Methodology Study Eco-design of Energy-using Products

Final Report

MEEUP

Project Report

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CONTENTS

SUMMARY MEEUP Project Report

1 Introduction .................................................................................................................................6

2 Selection of products ..................................................................................................................7

3 Contacts with stakeholders ........................................................................................................8
   3.1 Website ................................................................................................................................ 8
   3.2 Stakeholder experts ............................................................................................................... 8
       3.2.1 Expert Meetings ............................................................................................................ 8
       3.2.2 Participation in other workshops................................................................................... 9
       3.2.3 Commission Workshop ............................................................................................... 9
   3.3 Consultations in writing ........................................................................................................ 9
       3.3.1 Sectors ........................................................................................................................ 9
       3.3.2 LCA specialists ............................................................................................................ 10
       3.3.3 Industry LCA specialists ............................................................................................ 10
   3.4 Stakeholder websites .............................................................................................................11

4 Identification of Information Sources .....................................................................................12
   4.1 Introduction ........................................................................................................................ 12
   4.2 Overview per Task .............................................................................................................. 12
       4.2.1 Task 1: Environmental Impact Analysis ....................................................................... 13
       4.2.2 Task 2: Market Analysis ............................................................................................... 13
       4.2.3 Task 3: Improvement Potential ................................................................................... 14

5 Data Availability .......................................................................................................................15
   5.1 Absolute data gaps ............................................................................................................. 15
   5.2 Relative data gaps for products ........................................................................................... 15
       5.2.1 Refrigerators, Dishwashers ......................................................................................... 15
       5.2.2 Personal Computers ..................................................................................................... 16
       5.2.3 Vacuum Cleaners ........................................................................................................ 16
       5.2.4 Circulators .................................................................................................................... 16
       5.2.5 Street Lighting ............................................................................................................. 17
       5.2.6 CH Boilers .................................................................................................................... 17
       5.2.7 Room Air Conditioners ............................................................................................... 18
       5.2.8 Copiers ........................................................................................................................ 18
       5.2.9 Televisions .................................................................................................................... 18
   5.3 Relative data gaps on Unit Processes .................................................................................. 19
       5.3.1 Introduction ................................................................................................................... 19
       5.3.2 Too much information .................................................................................................. 20
       5.3.3 Too little information ................................................................................................... 20
       5.3.4 Incomplete information .............................................................................................. 21

6 Planning .....................................................................................................................................22
APPENDICES

Appendix I: Assignment VHK

Appendix II: Webstatistics & Project Website

Appendix III: Stakeholder Expert Meeting 26 Jan. 2005

Appendix IV: Stakeholder Expert Meeting 28 April 2005

Appendix V: Commission Workshop 3 Oct. 2005

Appendix VI: Reviews

Mark Goedkoop: 22.4.2005
David Pennington, 26.4.2005
Anna Braune (IKP) and Constantin Herrmann (PE-Europe), 4.5.2005
Gjalt Huppes et al. (CML), 9.5.2005
Rolf Frischknecht, 21.5.2005
Ferdinand Quella (Siemens), Reinhard Höhn (IBM), Constantin Herrmann (PE-Europe)
Hans van der Wel, Maarten ten Houten, Theo Schoenmakers (Philips)

Appendix VII: Example Double and Single Value Indicators

Appendix VIII Correspondence on metals Recycling

Between VHK and the European Aluminium Association, represented by Mr. Kurt Buxmann (Alcan)
Between VHK and Eurofer (steel industry), represented by Ms. Clare Broadbent (Eurofer IPP manager)

Appendix IX. Thank you
Summary

The aim of the underlying Methodology study for Ecodesign of Energy-using Products (MEEUP) is to contribute to the creation of a methodology allowing to evaluate whether and to which extent various energy-using products fulfil certain criteria that make them eligible for implementing measures under the Ecodesign of EuP Directive 2005/32/EC; these criteria are specified in Article 15 and Annexes I and II of the Directive.

Reporting on the study consists of three parts:

1. MEEUP Methodology Report, proposing the intended methodology for an information system that will assist the European Commission with the Consultation Forum to prepare for implementing measures.
2. MEEUP Product Cases Report, illustrating the methodology applied to 10 EuP product cases.
3. MEEUP Project Report, describing the process to arrive at the above results.

The underlying report is the MEEUP Project Report, serving an administrative purpose vis-à-vis the contract and providing more background on how the methodology came about and the Product Case reports were conceived.

This MEEUP Project Report answers to the contractual requirements of the service contract. It demonstrates that

- The selection of the representative Product Cases from the product categories listed in the tender has been accomplished in close consultation with the European Commission and stakeholders.
- There has been an extensive stakeholder consultation and intermediate results have been disseminated in an open and transparent way. Over the 10-12 month project period more than 150 stakeholder representatives have shown an interest through attending meetings/workshops or requesting information. Roughly half of them have also contributed pro-actively in the final result in one way or another. The stakeholder expert group that was set up with ca. 20 specialists identified as such by the sector organizations, has held two productive meetings in January and April and the Commission workshop in October was attended by around 80 persons. External reviewers with a background in Life Cycle Assessment and environmental databases were invited to react on the preliminary design of the methodology.
- In the period Jan.-Oct. 2005, the project website www.eupproject.org --containing the relevant project documents-- was visited 6600 times by approximately 3700 ‘unique visitors’. Currently the website --advertised only to stakeholders and experts--is visited on average 60 times per day during weekdays.
- Information sources for carrying out tasks 1-3 and possible information gaps have been identified and an approach developed to deal with this. Data retrieval has involved contributions from experts, product analysis and extensive literature search. Several thousands documents were retrieved, of which 700 key documents are in the reference list of the methodology report.
- Data analysis has involved the development of specific tools such as the ‘EuP EcoReport’. Although not explicitly required under the assignment, this tool in MS Excel was developed to make the methodology more accessible for the intended audience of policy makers, consultants and stakeholder experts involved in the preparatory stages of conceiving implementing measures/legislation under the 2005/32/EC Framework Directive.
- Reporting on the deliverables is comprehensive and comprises a Methodology Report (180 pages, including ca. 50 pages of appendices and ca. 55 tables), a Product Cases Report (ca. 470 pages, 300 tables and 100-150 figures,
divided over 10 Product Cases), the underlying Project Report (over 100 pages) and a CD-ROM containing also – apart from the documents-- the content of the project website and the ‘EuP EcoReport’ form. These final reports were preceded by a midterm interim reports informing the European Commission and stakeholders of progress and preliminary results.

- All tasks have been performed in time –according to the deadlines in the planning-- and in close collaboration with the European Commission.

In describing the above, the underlying Project Report also provides a host of information on data availability (as summarized in the Product Cases Report) and the presentations, the minutes of meetings/workshop as well as the full reviewer’s comments and our reaction to that give extensive background information as to the considerations that have led to the proposed methodology and product case reports.
1 INTRODUCTION

This MEEUP Project Report answers to the contractual requirements of the service contract. The full text of the assignment can be found in Appendix I. The assignment has requirements regarding

- the selection process for the final Product Cases (see Chapter 2)
- the stakeholder consultations, e.g. a consultation group of sector experts (see Chapter 3) and a Commission workshop.
- information dissemination through a website (also see Chapter 3)
- reporting on data availability (See Chapters 4 and 5, see also the Summary of the MEEUP Product Cases report for an overview of data availability).
- Reporting on the deliverables (methodology and product cases, interim and final reports)
- Planning and consultation with the European Commission (Chapter 6)

In describing the above, the underlying Project Report also provides a host of information on data availability (as summarized in the Product Cases Report) and the presentations, the minutes of meetings/workshop as well as the full reviewer’s comments and our reaction to that give extensive background information as to the considerations that have led to the proposed methodology and product case reports.
2 SELECTION OF PRODUCTS

The Commission states in its tender document that the product categories listed below will be addressed by the examination of at least one representative product to be selected by the contractor, unless specific products are named within a category, in which case they must be part of the analysis:

- Heating and water heating equipment
- Electric motors
- Lighting
- Domestic appliances (refrigerators, dishwashers, small household appliance(s))
- Office equipment (copier)
- Consumer electronics (PC’s- including portables)
- Ventilating/air conditioning equipment

Because a part of the input on PC’s will be delivered by the EPIC project (DG Research project by IKP et al.), it was decided to incorporate also the product group of “TV’s”, that is also subject to a parallel Eco-design study by AEAT for JRC Seville also delivering part of the input that should otherwise be retrieved by VHK.

In consultation with the Commission and stakeholder experts the following products groups were selected from the above list:

- **Gas- and oil-fired single central heating boilers** (category heating and water heating equipment)
- **Room Air Conditioners < 12 kW** (category Ventilating/air conditioning equipment)
- **Circulation pumps for domestic and small commercial central heating systems** (category electric motors)
- **Street lighting** (category lighting)
- **Refrigerators and freezers** (category domestic appliances)
- **Dishwashers** (category domestic appliances)
- **Vacuum cleaners** (category domestic appliances, specifically small household appliances)
- **Copiers** (category office equipment, subdivided in small and high volume copiers)
- **PC’s including portables** (category ICT & CE, information and communication technology/ consumer electronics)

The selected products are believed to be representative of the categories and sufficient data is expected to be available use these products as illustrations of the methodology to be developed.

The offer specifies that the efforts of VHK will be restricted by budget: The aim of the underlying study is to contribute to the creation of a methodology, not to perform an exhaustive research also on indicators that are not readily available.
3 CONTACTS WITH STAKEHOLDERS

So far, VHK has established contacts with stakeholders in several ways:

3.1 Website

For the duration of this project and for the benefit of all parties involved in this project, VHK has created a website www.eupproject.org where working documents, data sources and links can be downloaded. The website also features an e-mail address where stakeholders can send relevant documents to be incorporated on the site. The technical part of the website, featuring (also) original copyright protected material, will only be available to stakeholder experts for personal use. Passwords were obtainable from VHK for experts agreeing to honour copyright obligations for all material not publicly available. A copy of representative webpages from www.eupproject.org can be found in Appendix II.

In the period Jan.-Oct. 2005, the project website www.eupproject.org --containing the relevant project documents-- was visited 6600 times by approximately 3700 ‘unique visitors’. Currently the website --advertised only to stakeholders and experts—is visited on average 60 times per day during weekdays. A copy of the key webstatistics can also be found in Appendix II.

3.2 Stakeholder experts

3.2.1 Expert Meetings

VHK has organised an informal group of stakeholder experts that acts as sparring partners and possible contributors to the study. The group consists of experts from the relevant industry groups, consumer associations and other NGO’s and has met two times in Brussels. For industry experts the invitations to participate in this informal group have been established in co-ordination with the industry associations, but the experts participate on personal title. Consultations (incl. draft documents)

The minutes (including list of participants) and presentations of the meeting of 26 Jan. 2005 can be found in Appendix III. The minutes (including list of participants) and presentations of the meeting of 26 Jan. 2005 can be found in Appendix IV.

For the expert meetings VHK has supplied several consultation documents for the experts to react to:

- Draft chapters introducing the assignment and general approach
- Preliminary set of Bills-of Materials for product-cases
- Draft table and explanatory notes on Unit indicators for materials and energy
- Draft memo (to be completed into a chapter) explaining the Unit indicators.
- Draft Excel form “EcoReport” to make a complete life-cycle assessment of environmental impact using the Unit indicators

Almost all sector-experts have not only re-acted but also pro-actively collaborated in the study, supplying Bills of Materials (BOMs) and other relevant quantitative information for the case studies.
3.2.2 Participation in other workshops

Apart from the VHK stakeholder meetings, VHK has also participated in stakeholder meetings and workshops organised by contractors working on parallel studies or stakeholder meetings on specific subjects, such as

- Workshop organised by contractor AEAT in the context of the Television study of JRC Seville (Brussels, Q4 2004)
- Kick-off meeting (Brussels, Q4 2004) and workshop (Hannover, Q1 2005) organised by IKP/PE-Europe in the context of the EPIC ICT study on Personal Computers
- Meetings of stakeholder experts on EU Energy Star (Ispra Q4 2004, Q1 2005), discussing methodology for the revision on criteria for computers and copiers; two products that are part of the list and where test standards are very important.

Furthermore, VHK has engaged in several personal and telephone interviews with sector experts, mainly in the Brussels area, to acquire data and discuss specific technical subjects relevant to the study. One expert that has not been mentioned before is Robert Harrison on the subject of television test standards.

3.2.3 Commission Workshop

On the 3rd of October 2005 the European Commission organised a Workshop, visited by approx. 80 selected participants/stakeholders to discuss the findings in the first draft final MEEUP report. The morning session, chaired by Mr. Luis Montoya (EC DG ENTR, H5), was opened by the DG ENTR acting Director General Mr. Heinz Zourek. After that VHK presented the results of the MEEUP Methodology Report and the specific case of streetlighting was presented by ELC. The afternoon session, chaired by Ms. Spiliopoulou (EC DG ENTR, H5), consisted of a presentation of Product Cases. Written questions received beforehand were partly treated in the VHK presentation and partly in the remainder of the afternoon session. The last 90 minutes of the afternoon session there was an open discussion with stakeholders, the Commission officials and the consultant.

Minutes and presentations of the Workshop can be found in Appendix V of this report.

3.3 Consultations in writing

3.3.1 Sectors

Apart from the personal (bi-lateral) meetings, VHK has invited expert opinions in writing and has engaged in extensive electronic correspondence regarding specific technical subjects. The latter correspondence not only involved individual stakeholder experts but also experts speaking on behalf of interest groups such as the European semi-conductor industry on the topic of environmental impact of IC\(^1\)-production, which is one of the Unit Indicators needed for several product groups. Contacts with e.g. AMD and Sharp Corp. (Ms. Sharon Heymanns) have been very useful in this respect.

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\(^1\) Integrated Circuit
3.3.2 *LCA specialists*

A specific effort has been undertaken to receive feedback from the foremost LCA-experts on the proposed methodology. The following experts have collaborated in this and we are grateful for their comments:

- Gjalt Huppes, CML (Centrum voor Milieukunde, Centre for Environmental Technology), Leiden University, the Netherlands. CML is a scientific authority in the field of life cycle impact analysis (LCIA) worldwide. It provides the chair for the UNEP/SETAC Life Cycle Initiative and is presently engaged in the EIPRO study for the European Commission, looking at the use of Input-Output analysis for Integrated Product Policy (IPP).

- Rolf Frischknecht, ESU, expert for *Ecoinvent* database, Switzerland. *Ecoinvent* is an extensive and detailed LCI (Life Cycle Inventory) database, containing emission and resources consumption data of over 1000 unit processes. Ecoinvent is the latest product of the Swiss government engagement in LCA activities, starting more than 25 years ago with the BUWAL publications.

- Mark Goedkoop, Pré consultants, Amersfoort, the Netherlands. Pré is the developer and publisher of the SIMAPro 6 LCA software-tool. The tool accommodates both multiple LCI databases and multiple LCIA (weighting) methods and is distributed worldwide. Also, Pré has created the EcoIndicator95 and EcoIndicator99 method, which are single value indicators trying to incorporate all or most of the environmental impacts.

- David Pennington, JRC Ispra, Italy. Pennington is the author on several scientific publications in the field of Life Cycle Analysis and presently working for the European institutions in Ispra, Italy.

- Anna Braune, IKP Stuttgart, with the assistance of Constantin Herrmann (PE-Europe), developers resp. users of the Gabi 4 LCA software tool. Gabi 4 is a single LCI database tool with multiple LCIA (weighting) options. It is distributed worldwide (EU, Japan, US).

The full comments of the reviewers on an interim version of the methodology and the VHK response to the issues raised can be found in *Appendix VI*.

3.3.3 *Industry LCA specialists*

Apart from the above experts we also received feedback on the methodology from industry experts in the field of LCA:

- Ferdinand Quella (Siemens) in concurrence with Reinhard Höhn (IBM) and Constantin Herrmann (PE-Europe). PE-Europe is an environmental consultancy firm, originating from IKP and coordinating with IKP the EPIC ICT project.

- Hans van der Wel (Philips Environmental Services), Theo Schoenmakers, Maarten ten Houten (Philips Consumer Electronics).

The comments of the above experts are presented also in *Appendix VI* and our answer to these comments is used as a tool to summarize our considerations in proposing the methodology as we did.

Specifically in response to concerns of several reviewers that the indicators will be –incorrectly—used to compare the environmental impacts of products not only per indicator, but across indicators to arrive at single-value for the total environmental impact, we have given some guidance to this effect in *Appendix VII*, but more (an probably better) options for weighting amongst categories can be found in literature and LCA tools.

Furthtmore we would also like to point out the following
For the intent and purpose of the underlying MEEUP study we are not proposing to use a single or double value evaluation, because it will necessarily contain a degree of subjectivity that goes beyond the more robust legal basis that we have chosen for the single categories. Should one want to go down this route, further study and consultation is recommended.

There has been a correspondence with many stakeholder specialists. As an example, please find in Appendix VIII the correspondence on the complex subject of recycling between VHK and representatives of the European Aluminium Association and Eurofer.

3.4 Stakeholder websites

The Ecodesign of Energy-using Products (EuP) framework directive is in principle relevant for a very broad range of stakeholders, comprising not only the industry that produces and/or designs the EuP, but also the metal and plastics industry, component manufacturers, the energy industry, consumer associations, environmental NGOs, recyclers, etc. European representations and associations of these stakeholders are probably well over fifty. The national associations that are members of these European associations would amount to over a thousand, representing hundreds of thousands SMEs\(^2\), large corporations and millions of consumers. The large international companies that can afford to be an active part of the European discussion through their own environmental managers also amount to roughly over a thousand.

Furthermore, most of these stakeholders do not only influence the decision making process directly, but also indirectly through other bodies that have – in addition- also their own agendas: National governments, standardization bodies (CEN, ISO, etc.), research institutes and consultants, extra-EU industry representations (Japan, US, etc.) and international OECD, UN, etc. bodies.

It is of course not possible to approach each of these stakeholders or stakeholder groups actively within the framework of our study. However, as much as possible we have tried

a) to inform the stakeholders through the www.eupproject.org website (see paragraph earlier) and  
b) we have consulted websites of stakeholders giving relevant information and position papers on the topic.

In fact, the consultation of several thousands of stakeholder websites has been an important part of our data retrieval process. A special mention should be given to the increased availability of company Sustainability Reports. Over the last two years there has been a rapid development in this area towards more transparency that has been very helpful in the retrieval and checking of data.

It is outside the budgetary framework of our project to report on every single consultation in this respect, but the portals and references mentioned on the www.eupproject.org website give an impression of our efforts in this respect.

Furthermore, Appendix IX gives an overview of the persons that in one way or another have been involved in the project (copied also in the Methodology Report, Appendix IV)

\(^2\) Small and Medium-sized Enterprizes
4 IDENTIFICATION OF INFORMATION SOURCES

4.1 Introduction

Data sources were consulted as set out in the tender and our offer, i.e. through literature search, databases and software tools and stakeholder consultation. The stakeholder consultation has been described in detail above. Furthermore,

- Thousands of electronic documents were retrieved, ranging from extensive research reports of several hundreds of pages to simple two-page web-prints in pdf format. Roughly
  - 60% relate to the 10 product cases (tasks 1 to 3),
  - 30% relate to materials- and energy indicators and
  - 10% relate to methodology and policy studies (incl. legislation).

Some 700 key documents are included in the reference list of the MEEUP Methodology Report (see Appendix III of this report)

- For information sources like publications from EU consumer association tests (e.g. Stiftung Warentest) and similar (e.g. the computer magazine c’t), where the information is not available electronically but only in print, VHK has summarized the main information electronically (tables). Similarly, information from standards (EN, ISO) etc. that by definition cannot be published as such\(^3\) has been made accessible by summarizing the content that is relevant.

- Databases were consulted from Eurostat (trade), the EU Energy Star site (PCs) and SIMAPro 6 (Life Cycle Analysis). SIMAPro itself gives access to the > 10 unit process LCI data-bases – including Ecoinvent—and most current LCIA/weighting methods (Eco-indicator, CML, etc.)

- For products where no Bill-of-Materials (BOM) was available, VHK has disassembled and weighted 4 products at component level to generate an initial BOM. This was the case for PCs, Room Air Conditioners, Dishwashers and Copiers.

4.2 Overview per Task

The next sections give an overview of activities for each of the 3 tasks for the 10 product groups required by the contract.

\(^3\) All standards have to be purchased from standardisation bodies and are subject to copyright.
4.2.1 Task 1: Environmental Impact Analysis.

Prime focus of the data-retrieval has been on (primary sources used in) EU reports, notably those covering related Dossiers such as WEEE, RoHS, SAVE, Ecolabel, IPP, IPPC, etc.. Regarding the various Life Cycle Assessment methodologies (e.g. Eco-indicator 99, Ecopoints 97, CML 92, EPS 2000, LCI approach) a pragmatic approach was taken, based on the requirements of the tender, collating data at a low aggregation level. In other words, if sources do not reveal these lower aggregated data (material/emissions balance and energy balance) they were in principle disqualified as a primary source from our investigation unless it was the only data source available. The same goes for LCA’s not clearly indicating sources, basic assumptions and systems boundaries.

In case this led to data gaps for a specific ‘relevant product’, VHK has re-built the LCA from known material balances and energy balances, if possible using transparent and generally accepted databases\(^4\) and conversion factors\(^5\) of materials and energy sources to emission and consumption values.

Definitions and system boundaries were assessed on the basis of generally accepted principles\(^6\), being discussed with the Commission and the stakeholder group. The same is true for the question whether the product at hand really is representative of the ‘relevant product’ group.

4.2.2 Task 2: Market Analysis

VHK has collected market data on production, imports, exports and apparent consumption of relevant products from the official EU sources like Eurostat, at the most appropriate level that the PRODCOM classification allows. Eurostat has also been the main source for intra- and extra EU trade.

In order to achieve consensus on the consumption and market structure (including intra EU trade flows) with the stakeholders, VHK has also retrieved consumption and trade data from other sources, through publicly available

- market analyses from specialised market research firms (e.g. GfK, GBC)
- market data derived from stock models (e.g. VHK stock models for whitegoods and heating appliances)
- data from sector-specific databases, as supplied by stakeholders

In its Methodology and Product Cases Reports to the Commission, VHK has compared the additional economic data sources with Eurostat and discusses what is the most widely accepted approach by the stakeholders to determine ‘economic significance’ in the sense of Article 15 of the draft Ecodesign/EuP directive.

Apart from the assessment of the volumes of sales and trade (in physical and monetary units) in a recent year, a time series was established including some of the important reference years in the past (e.g. 1990 as a Kyoto reference year) and in the future (2010, 2020) if sufficient material was available. The time should relate to the volume of installed products (the ‘park’) over the 1990-2020 period.

\(^4\) e.g. SIMAPro

\(^5\) e.g. IPCC (Intergovernmental Panel on Climate Change) data for GHG impact or database tools like SIMAPro.

\(^6\) e.g. including all parts of the Life Cycle that contribute more than 10% of the total impact
4.2.3 Task 3: Improvement Potential

Primary data sources for the identification and validation of design options were:

- Product-specific SAVE reports (incl. subtask reports) and ECCP background documents
- Background reports for EU Ecolabel, national ecolabels and EPD III criteria
- Design options as specified in manufacturer’s environmental reports
- Design options as specified in publicly available LCA- and/or Ecodesign studies
- For TV’s and PC’s: Reports from parallel Ecodesign studies (JRC Sevilla, EPIC)

Secondary sources, mainly consulted if primary sources were unavailable for specific product groups, are

- Comparisons of ‘best’ and ‘worst’ cases in product databases (e.g. Homespeed, EU Energy Star, etc.)
- Manufacturer’s claims in commercial publications (to be verified)
- Scientific publications from research institutes and universities, claiming significant environmental improvements (to be verified).

Data sources for the ex-post impact analysis are Eurostat or national statistics offices, industry sector statistics and reports, manufacturer’s annual reports, etc..
5 DATA AVAILABILITY

5.1 Absolute data gaps

There are very few relevant subjects on which no data at all were available. This was only the case for Bills-of-Materials (BOMs) of some products. In those cases (PCs, RACs, copiers) VHK decided to produce its own data from disassembly of the products mentioned. This took around 1 to 1.5 man-day per product and was seen to be the most efficient way of data retrieval on this subject. In reaction, our information on BOMs for copiers, RACs and dishwashers was then completed by more recent information from the stakeholder experts. As a result we have now a fairly complete set of Bills-of-Materials for all products.

5.2 Relative data gaps for products

Apart from the few missing data as described above, it is not a matter of absolute availability of the data, but rather the accuracy and level of detail of available data. Below we discuss the situation regarding data availability in the different sectors. Beforehand, we would like to stress that we have gathered the data for illustrative purposes and obviously all data should be checked. Having said that, the effort in collecting data—even as an illustration—has been considerable as stakeholders are critical of using approximate values even for that purpose.

5.2.1 Refrigerators, Dishwashers

For instance, in the large domestic appliances sector (refrigerators and dishwashers) there is an experience of more than 10 years in dealing with the preparation of legislation in the field of energy efficiency.

Comprehensive studies were made e.g. in the context of the EU SAVE programme supplying a host of data that are known to industry sector-experts. Industry has participated pro-actively in these studies, is used to following similar discussions on broader eco-design related subjects (eco-labels), has set-up and financed relevant studies of its own is monitoring fleet energy use annually and reporting to the Commission. European test standards are regularly being updated and supplemented by industry associations’ best practice indications to ensure univocal data able to withstand legal scrutiny. The potential commercial benefit of certain environmental policy measures is recognized, meaning that there is an active interest of company commercial departments. Environmental managers are actively following political developments, but the main discussion partners for the European Commission at a technical level are heads of R&D –fully aware of the technical state-of-the-art today and on the long run-- with very short and direct communication with strategic management at EU-based CEO level. In short, although things can always be improved, there are no serious data gaps.

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7 E.g. on stock model
8 Very important for subsidy schemes
5.2.2 Personal Computers

On the other side of the spectrum we find a sector like Personal Computers where there is practically no experience with (preparation for) mandatory requirements, where no comprehensive EU studies exist, where voluntary Energy Star labels –despite the commercial incentive of preferred government procurement-- have only attracted 30% of the industry and where (attempts at) eco-labels have found no resonance with the industry. There are no EU voluntary agreements –except for ecodeclarations on individual products-- or unilateral commitments, fleet parameters are not monitored or reported. There are no harmonised European energy performance test standards. There is no evidence that potential commercial benefits –beyond perhaps government procurement—are perceived and an active support of EU energy policy goals is not very prominent. Discussions on technical issues with the European Commission are mostly the exclusive domain of environmental managers. There is little direct involvement of central R&D and Marketing departments in the discussions. Communication lines are long as strategic management is placed 80% outside the EU. In short, there are serious data gaps in terms of accurate and up-to-date information. In its case study VHK had to resort to anecdotal evidence, consumer association’s test, analogies with the US situation, etc. to fill these gaps even at the level of illustrations. It is clear that the preparatory studies for implementing measures will require a further major effort in this respect.

Data gaps with other products are somewhere in between these two extremes. For instance (not in any particular order):

5.2.3 Vacuum Cleaners

Small domestic appliances (product case: Vacuum Cleaners) profit from the industry association’s experience with large domestic appliances and the sector will therefore motivated to contribute. The main problem is that they have only recently become a subject in EU environmental policy. There has been no comprehensive SAVE study in this field and therefore much of the required data for e.g. the EU Ecolabel study, which usually is a secondary source, is lacking. Furthermore, there is a dispute on appropriate performance test standards on dust removal and re-deposition. A harmonised EN standard is in place, but it is not as yet at the level that would withstand legal scrutiny and general requirements regarding tolerances. VHK has retrieved information from the most recent consumer tests (e.g. Stiftung Warentest) and is collaborating with industry to investigate the problem of performance test standards. It is expected that the information will be sufficient for illustrative purposes, but may require study effort to arrive at implementing directives should this prove to be relevant.

5.2.4 Circulators

For central heating pumps (circulators) the situation is very close to the one described for large domestic appliances. The main difference is in the relative lack of experience of the sector with actual mandatory policy measures. The predominantly EU-based industry has been preparing policy measures for energy efficiency for over 5 years, initiated its own –SAVE sponsored—study preparing for mandatory policy measures (MEPS or Energy Labels). It has actively participated in the German Blue Angel eco-label, provides information in Type III Environmental product Declarations, has prepared a harmonised European energy performance test standard and has made a proposal for an Energy Label classification according to that standard. Apart from the considerable environmental benefit of policy measures, the sector has recognized the potential commercial benefit and there is an active involvement of R&D, Marketing and strategic management. What is lacking is the implementation. Despite the fact that circulators are (one of) the biggest electricity consumers in Middle and Northern European households and the tertiary sector, they are hardly visible, i.e. “hidden” in the heating installation. Furthermore, they are almost never consciously purchased by

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9 E.g. no registrations for the EU Eco Label.
the end-user; it is a “B2B” (Business-To-Business) market where the buyer is the boiler-manufacturer or the installer. Probably for these two reasons circulators are not on the shortlist of products for the EU Energy Labelling directive EC/92/75 and they have not been subject to any other mandatory measures.

To summarize: There are no serious data gaps as regards most of the VHK study on methodology. The biggest “data gap” will become only apparent in Task 3, namely what would be an acceptable level for an implementing directive considering the impact analysis, which for a B2B market may be different than for a typical consumer market.

### 5.2.5 Street Lighting

For street lighting the industry is a mix of a few global companies (Philips, Osram, Sylvania, etc.) making the light sources (“lamps”), represented by ELC, and hundreds of small and medium sized enterprises making the lighting fixtures, represented by CELMA. The manufacturers of the lamps and the necessary electronics (ballasts) have been dealing with promotional measures, energy labelling and MEPS for at least a few decades and are well prepared, well staffed and have a good knowledge of the market at EU level. So, basically an important part of the information that is needed for Tasks 1 to 3 has become available and the ELC is actively co-operating in the MEEUP study. On the other hand, as this is a joint action ELC-CELMA, especially regarding luminaries and gear, further effort will be needed in the preparatory studies.

### 5.2.6 CH Boilers

The sector of CH boilers is clearly in a transition phase on several counts. Through mergers and joint ventures the number of EU manufacturers has been drastically reduced over the last 15 years. Manufacturers that traditionally were active on a national scale are now part of larger industry groups that manifest themselves as European. One of the consequences is that there is a risk that official statistics reveal proprietary marketing data of single manufacturers. Another consequence is that systematic marketing and environmental data retrieval on an EU scale, which is reality for many other sectors, is only now starting to become a subject of discussion, but that there is a serious data gap. Fortunately some work has been done during the SAVE boiler study, where VHK developed on the basis of its own material and inputs from others like CGB a stock model. The accuracy of this stock model and the level of detail on product-features should not be over-estimated, but at the moment it is the only way to deal with the data gap for Task 1 and 2. For further steps, however, it is recommended that a much more detailed study on EU scale is done.

This transition from a national scale to an EU scale is also happening in the legislation and test standards. Until recently national energy policy measures in the field of boilers were typically national and strongly linked to national building regulations and national energy performance standards of buildings. Germany has its EnEV (Energie Einspar Verordnung), the UK has measures in place to make condensing boilers mandatory by the end of this year, the Netherlands has its Energy Performance Coefficient (EPC), the Danish have their Energy certificate and building label, the French have the new Réglementation Thermique (RT), etc..

The result is a host of regulations, subsidy schemes, etc. that—in each in its own way—is promoting boiler energy efficiency. The harmonised EN boiler test standard is still a basis for all or most of these regulations, but the way its results are being used in the framework of the building code is different. Now, with the EU Energy Performance of Buildings Directive (EPBD) this is bound to change. Various technical committees (TCs) of CEN are now working on over 40 harmonised standards that will put the EPBD in place. Some of this information is already public, other drafts are still in various stages of consultation but there will be a data gap regarding information that is relevant for the impact analysis (Task 3).

On the potential commercial benefit of EU environmental policy measures industry and governments seem divided. Some are clinging to national legislation and measures whereas others see the benefit of a harmonised internal market
with EU-wide environmental measures. In terms of data availability this means that there can be significant
differences in transparency between companies and between Member States. In terms of European representation in
the political discussion the picture is also diverse. Much more than with the other sectors the boiler sector heavily
relies for its technical regulatory know-how on national test- and research institutes. Very often they are the ones to
take the lead in setting up new test standards and gathering data. EU manufacturer’s R&D departments are not always
directly involved. The environmental manager, actively following EU politics for a single company, is also rare.
Often in the political discussions upper management is involved directly.

VHK has a long-standing technical experience in the sector and good contacts with the relevant research institutes.
Also the European heating industry association EHI plays an active role in the MEEUP study providing for instance
Bills-of-Materials. Yet, as a consequence of the above-described situation with a lack of systematic EU, some
information will be anecdotal and a major effort in the preparatory study can be expected.

5.2.7 Room Air Conditioners

RACs are a product group where a SAVE study was performed, an EU Energy Label was recently introduced and in
general -because of both the energy and CFC problems- it is a product sector that is well prepared in the
environmental policy field. Most information stems from the manufacturers (Daikin, De’Longhi), who are actively
collaborating in this study, but the possibilities for verification through third party research are limited. For the the
underlying study we retrieved sufficient material for our purpose. To be continued in the preparatory studies…

5.2.8 Copiers

Copiers are a global business, mostly in the hands of around 10 major manufacturers. There is one major EU
manufacturer of volume copiers (Océ), a few in the US (e.g. Rank Xerox, HP) and the rest has its head-office and
R&D mainly in Japan (Canon, Epson, Konica-Minolta, Ricoh, etc.). Having a very visible environmental impact
(paper, toner, energy), the office copier has been a popular subject of energy and eco-design studies. It has been
incorporated in Energy Star since the beginning of the 1990s and more recently it has been subject of a new Blue
Angel label. Furthermore, as the copier is a typical subject of green government procurement and the commercial
benefit is obvious, the sector has reacted very actively to the call for green copiers. Through the Sustainability
Reports of the manufacturers there is no lack of information on new, environmentally friendly technical options,
relevant for Task 3. What is more difficult is to obtain price information on specific models and market information
with a certain level of detail. In order to fill these data gaps VHK has to work with estimates and publicly available
information. Furthermore, by explicitly distinguishing large and small volume copiers and multi-functional devices
(MFD) we hope at least to give an impression of the market and the environmental impact that is sufficient to
determine whether copiers would be eligible under the Ecodesign directive. Finally, to remedy the lack of design
detail in the publications we have disassembled a small office copier, which in turn also triggered the copier industry
to reveal more detail in its Bills-of Materials.

What remains is that copiers are a highly complex technical product, requiring the inputs from many different
disciplines (electronics, chemistry, physics, paper technology, mechanics, etc.). Therefore it will be extremely
difficult to indicate design options (Best Available Technology, BAT) beyond what the industry itself is planning and
–because of the secrecy between a group of only a handful suppliers—probably even more difficult to pinpoint an
exact Least Life Cycle Cost solution. In short, Task 3 will require some extra effort in the preparatory study.

5.2.9 Televisions

The market structure with televisions is not dissimilar from the one with copiers: Less than a dozen global players
and limited EU production/ R&D facilities. Still, being a mass-produced consumer product with a specific interest
from consumer’s associations and specialised magazines, already much more information is publicly available. Furthermore, televisions have been the subject of larger SAVE studies, resulting indirectly not only in a voluntary industry agreement on standby losses in 1997 but also more recently in a European energy efficiency formula for the TV on-mode that has been adopted by countries worldwide. The AEAT study for JRC Seville has updated some market aspects of the 1997-1998 SAVE studies and in general there is some information. However, the environmental impact of the TV production and use has required considerable extra VHK-efforts, not only in establishing Bills-of-Materials derived from computer display data but also in establishing the actual energy consumption of televisions. For the latter we had to resort to anecdotal information from consumer associations tests and try to interpret the data from different test standards and real-life.

For Task 3, the assessment of design options poses some special difficulties. At this moment there are almost a dozen different display technologies on the market or under development. This may make for exciting reading, but at the moment nobody—especially not the industry—knows which technologies will prevail. Also the assessment of Least Life Cycle Cost options is a rather academic discussion in a market where consumers are prepared to pay three to ten times more money for a TV that has a more shallow form factor.

Therefore, rather than focusing on the technical differences between these technologies and smaller differences in environmental impact we have looked for similarities in order to assess how they could be treated as a group by policy makers that are concerned over the environmental impact of the rapidly growing number and size of televisions. Again this will be a sector where considerable work will be required in the preparatory study.

5.3 Relative data gaps on Unit Processes

5.3.1 Introduction

A practical methodology needs data. Moreover, to a large extent the data availability determines the methodology. As the methodology for the Ecodesign of EuP Directive needs to be applied within the next year, it is no use to propose a methodology that would require an extensive data search before it can start.

For the methodology the so-called Unit Indicators (see Chapter 5 of the Methodology Report), i.e. the environmental impact per kg material produced or unit of energy resources consumed, are an important building block. The development of a first data set of unit indicators has not been easy. Contrary to what is said in the JRC Seville study on Eco-design (Tukker et al. 2000) we found no consistent set of impact data. The differences between the data are very often considerable: differences of factor 2 to 3 are no exception. With a single exception, i.e. the LCI data for plastics processing by PlasticsEurope, no data-set existed on which more or less everybody agrees.

An extra problem was created by the fact that many data from ecologists are now packaged in commercial databases, i.e. it is copyrighted information that cannot be published in a report that is by definition public.

Much more than any data gaps with the product-cases this particular “data-gap” created not only methodological problems and choices, which are described in detail in the Methodology Report, but also the very practical problem that we could not propose a methodology without at least halfway robust data, i.e. acceptable to all stakeholders.
At this point we could have reported this to the European Commission and conclude that it was simply impossible to make a quantitative environmental impact assessment at the level that the European Commission required. However, truth be told, this would have been incorrect.

Over the last 2 to 5 years, following sector agreements on end-of-pipe measures (e.g. IPPC), following RoHS obligations and following industry actions in the field of publishing transparent Sustainability Reports, most of the information is out there. It is just not in the right form.

This forced us to do something that we hadn’t anticipated: Spend an unbudgeted 3 to 4 man-months extra in composing a harmonised set of Unit Indicators to show a) that it can be done, and b) to have a first set of unit indicators to work with.

That it “can be done” doesn’t mean that there are no problems. Essentially, with the unit indicators we encountered three problems:

- Too much information
- Too little information and
- Incomplete information

5.3.2 Too much information

The oldest materials on which environmental information was gathered are packaging materials. Already since the early 1970s researchers have looked at the environmental impact of producing and disposal of bulk plastics, steel, aluminium, cardboard and glass. In the beginning this was often limited to energy requirement, resources depletion and waste. But since the BUWAL publication in the beginning of the 1980s also toxicity of water- and air emissions became part of the equation. As a consequence, there are many different values that can be found for the environmental impact of these materials, measured and interpreted according to many different methodologies.

After discarding the ones that were clearly out-of-date, wrong or incomplete on the basis of the methodology employed or a selective understanding of the industrial processes involved, we chose those where we could count on the largest stakeholder support, e.g. sectors that had a vested interest, and then checked whether these values were close enough to values found by neutral sources. In 9 out of 10 cases we found that the impact assessed by the stakeholders was at least as high as what was found by the neutral sources e.g. in SIMAPro databases (sic!).

5.3.3 Too little information

Semi-conductors in all their forms (LCD, LED, IC, etc.) and other electronics components are relatively new materials produced by a sector that is highly competitive and changing rapidly. For these materials it was very hard to find publicly available, complete, well-documented Life Cycle Inventory data. Average values are mentioned, but never in a detailed or well-defined format. In those cases we had to combine data sources to make an estimate and then feed back the information to the component industry to obtain information on which there was some form of consensus.
Another form of “too little information” is when for instance small quantities of exotic materials are used. For instance, the glow-wires lamps can contain very small quantities of tungsten, zirconium and gallium. For these materials we have some idea of e.g. the mining emissions (ore concentration, surface or underground mining, location) and we have some idea of the energy requirement of the processing. In order to arrive then at a complete emissions profile we had to make an estimate based on analogies with similar materials.

5.3.4 Incomplete information

A situation with incomplete information is not identical to “too little information”. It means that detailed information is available, but covers only a part of what is needed to make a complete assessment of the environmental impact. Basically, the situation of incomplete information is the normal starting point for a process-based LCA. The problem used to be that this process information was confidential. But this is now changing.

As mentioned before, over the last years (2002-2005) we have seen many Annual Sustainability Reports of individual companies in the materials and manufacturing sector, publishing key process parameters. The IPPC BREFs that were drawn up by large groups of sector-experts also published many process parameters. And in the electronics industry, the RoHS directive as well as the EIA and ECMA recommendations on lists of “Materials of Interest” and Environmental Product Declarations prompted many suppliers to supply detailed information.

However, the environmental impact of materials and energy inputs outside the factory walls is usually not given. E.g. electricity consumption is given kWh electric energy and the efficiency of power generation to indicate the primary energy and power generator emissions were not reported. The emissions and energy requirement for material-inputs are not given. In those cases we completed the impact assessment with materials- and energy-impacts we knew from other sources.

In the case those impacts of inputs were also not complete, we estimated them from known energy analysis values and analogies in e.g. mining technology and ore concentration. This was the case for instance with exotic metals, such as precious metals and various coating and plating processes.

Needless to say that we recommend further research to firm up, document and expand the set of unit indicators. Especially in terms of reporting, we definitely did not have the budget to make a full documentation: In the underlying study we had to limit ourselves to publishing the results in the form of a table, indicate publicly accessible sources used and describe the main considerations in the explanatory notes.

A full documentation of our close to 100 unit indicators would probably require a full chapter for each indicator, which is definitely outside any requirements of our contract.
6 PLANNING

The table below gives the original project planning. Mainly because of the extra effort to establish the unit indicators and the extra effort to provide very detailed data for some product sectors, VHK was behind in the product reports for task 1 and 2 at midterm. Also, these interim reports could not be completed before end of June. Later on, limiting—in agreement with the European Commission—our efforts on the sections of the Improvement Potential for the Product Cases, we could recuperate some of the time lost. The final draft reports could be delivered as planned.

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APPENDICES
## APPENDIX I: ASSIGNMENT VHK

### Contents:

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<td>8.5</td>
<td>Workshop</td>
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<td>9</td>
<td>Time table</td>
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</table>
1 BACKGROUND

It is generally acknowledged that the production, distribution, use and end of life management of energy-using products (hereafter EuP) is associated with a considerable number of important impacts on the environment such as climate change linked to energy consumption, consumption of other materials and natural resources such as water, waste generation and release of hazardous substances to the environment. In response to this situation and also for contributing to security of energy supply while preventing potential barriers to trade because of diverging requirements, the Commission has recently published a proposal for a harmonized framework for setting eco-design requirements of energy-using product.

This proposal foresees that once the Council and EP adopt the framework Directive, the Commission in co-operation with the Member States will have the possibility to establish legal obligations (implementing measures) concerning environmental aspects of energy-using products. The proposed framework Directive is in principle applicable to any product using energy to perform the function for which it was designed, manufactured and put on the market. All energy sources are covered, although it is likely that only products using electricity, solid, liquid and gaseous fuels will be the subject of implementing measures.

Only products fulfilling certain criteria can be the subject of implementing measures; these criteria are specified in Article 12 (1) of the draft Directive proposed by the Commission and include the relevance of the product for the internal market and the environment as well as the potential for improvement.

2 AIM

The aim of this study is to contribute to the creation of a methodology allowing to evaluate whether and to which extent various energy-using products fulfil the above mentioned criteria. Such a methodology will be applied to products that have already been identified as relevant for certain environmental aspects and/or the volume of trade in the internal market in the context of other Community initiatives or policies such as the ECCP and the Eco-label.

3 TASKS

As a minimum, each of the product categories listed below will be addressed by the examination of at least one representative product to be selected by the contractor, unless specific products are named within a category, in which case they must be part of the analysis:

- Heating and water heating equipment
- Electric motors
- Lighting
- Domestic appliances (refrigerators, dishwashers, small household appliance(s))
- Office equipment (copier)
- Consumer electronics (PCs- including portables)

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10 This chapter combines texts from the Call for Tender, ENTR/03/96 “Study on the Eco-design of Energy-using Products”, EC DG ENTR, April 2004 and the VHK Proposal for ENTR/03/96, May 2004.

11 COM(2003)453final
Ventilating/air conditioning equipment

Because a part of the input on PCs will be delivered by the EPIC project (DG Research project by IKP et al.), it was decided to incorporate also the product group of “TVs”, that is also subject to a parallel Eco-design study by AEAT for JRC Sevilla also delivering part of the input that should otherwise be retrieved by VHK.

For each of the above products three main tasks are formulated: Environmental analysis, Market analysis and Assessment of Improvement Potential

4 ENVIRONMENTAL ANALYSIS (TASK 1)

4.1 Tender requirements

Product characteristics that are associated with significant environmental impacts will be identified and the potential contribution to these impacts quantified, on the basis of an appropriate functional unit.

For each product on the basis of information collated/processed/created during the project the following data should be provided.

4.2 Subtasks (VHK)

- **Data retrieval**, through literature search, databases and software tools, stakeholder consultation
- **Data analysis**, including harmonisation of data quality, system boundaries, basic assumptions, etc., identifying and —within reason— trying to fill in data gaps.
- **Reporting on products**: data analysis aspects and completing the required tables at the level of materials and energy flows as well as at the higher aggregated level of environmental impacts as required in the Call for Tender.
- **Reporting on methodology**: A special report on the conclusions regarding methodology: Discussing the most widely used and accepted forms of LCAs, and the most widely used/accepted product classifications; with pros and cons. [part of final report]

4.3 Data retrieval & analysis (VHK)

Prime focus of the data-retrieval will be on (primary sources used in) EU reports, notably those covering related Dossiers such as WEEE, RoHS, SAVE, Ecolabel, IPP, IPPC, etc.. Regarding the various Life Cycle Assessment methodologies (e.g. Eco-indicator 99, Ecopoints 97, CML 92, EPS 2000, LCI approach) we will take a pragmatic approach based on the requirements of the tender, collating data at a low aggregation level. In other words, if sources do not reveal these lower aggregated data (material/emissions balance and energy balance) they will be disqualified as a primary source from our investigation. The same goes for LCAs not clearly indicating sources, basic assumptions and systems boundaries.
Table: Proposed selection of impacts, related to the environmental priorities as listed in (the table of) the Call for Tender

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<tr>
<th></th>
<th>raw material acquisition</th>
<th>manufacturing</th>
<th>distribution</th>
<th>use (incl. installation and maintenance)</th>
<th>end-of-life</th>
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<td>Energy consumption</td>
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<td>Material use (in kg), incl. recycling credits</td>
<td>Metals (Si, Al, Cu)</td>
<td>Bulkpolymers (PE, PP, PS, etc.)</td>
<td>Technical plastics (PA, PC, etc.)</td>
<td>Others (glass, electronics, etc.)</td>
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<td>Waste generation</td>
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<td>to incinerator</td>
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<td>non-RoHS substances (to be specified)</td>
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Should this lead to data gaps for a specific ‘relevant product’, VHK will re-build the LCA from known material balances and energy balances, using transparent and generally accepted databases\(^{12}\) and conversion factors\(^{13}\) of materials and energy sources to emission and consumption values.

Definitions and system boundaries will be assessed on the basis of generally accepted principles\(^{14}\), to be discussed with the Commission and the stakeholder group. The same goes for the question whether the product at hand really is representative of the ‘relevant product’ group.

### 4.4 Deliverables (VHK)

The final result of task 1 will be

- a discussion of data availability and methodological problems encountered,
- a completed LCA table as required in the Call for Tender (shown par. 1.4.1) for each of the relevant products,
- a proposal for a generally applicable methodology in making the LCA of energy-using products

\(^{12}\) e.g. SIMAPro

\(^{13}\) e.g. IPCC (Intergovernmental Panel on Climate Change) data for GHG impact or database tools like SIMAPro.

\(^{14}\) e.g. including all parts of the Life Cycle that contribute more than 10% of the total impact
5 MARKET ANALYSIS (TASK 2)

5.1 Tender requirements

This analysis entails the identification of product (groups) in question, (including assessment of need for identifying subgroups) for the EU market as well as retrieval of data on consumption (taking into account production/imports/exports) and of market structure in the EU (including intra-EU trade flows). Any particular characteristics in the market structure at Member State level, including policy measures affecting the design of products for environmental reasons will be mentioned.

Functional characteristics (in case of important variations across brands/models) and consumer behaviour (where applicable and relevant for the resulting environmental impact of the product) will also be considered.

Possible additional indicators for the relevance of the product for the internal market will be elaborated.

Any additional indicators proposed will be simple (easy to be computed and used, understandable for non-experts) and based on data which are relatively easily available (meaning accessible to all interested parties, from public sources, ideally, or, in any case, at low cost and in comparatively short time).

5.2 Subtasks (VHK)

- Data retrieval, through literature search, databases and software tools, stakeholder consultation
- Data analysis, including consistency of data and selection of final data
- Reporting Results per relevant product
- Reporting on Methodology. A special report on the conclusions regarding methodology: Discussing the most widely used and accepted forms of market analysis and the most widely used/accepted product classifications; with pros and cons.

5.3 Data retrieval and analysis

VHK will collect market data on production, imports, exports and apparent consumption of relevant products from the official EU sources like Eurostat, at the most appropriate level that the PRODCOM classification allows. Eurostat will also be the main source for intra- and extra EU trade.

In order to achieve consensus on the consumption and market structure (including intra EU trade flows) with the stakeholders, VHK will retrieve consumption and trade data from other sources, through publicly available

- market analyses from specialised market research firms (e.g. GfK, GBC)
- market data derived from stock models (e.g. VHK stock models for whitegoods and heating appliances)
- data from sector-specific databases, as supplied by stakeholders

In its reports to the Commission, VHK will compare the additional economic data sources with Eurostat and discuss in its report to the Commission what is the most widely accepted approach by the stakeholders to determine 'economic significance' in the sense of Article 12 of the draft Ecodesign/EuP directive.

Apart from the assessment of the volumes of sales and trade (in physical and monetary units) in a recent year (compare Art. 12.1 (a) (i) of the draft Eco-design/EuP directive), a time series needs to be established including some of the important reference years in the past (e.g. 1990 as a Kyoto reference year) and in the future (2010, 2020). The time should relate to the volume of installed products (the ‘park’) over the 1990-2020 period.
5.4 Deliverables (VHK)

The final result of task 2 will be

- a discussion of data availability and methodological problems encountered,
- a complete overview of market data and indicators as described above for each of the relevant products,
- a proposal for a generally applicable methodology in making the market analysis of energy-using products

6 ASSESSMENT OF IMPROVEMENT POTENTIAL (TASK 3)

6.1 Tender requirements

The analysis should consider the theoretical (technical) potential and the industrial/ economic/social feasibility for improvements in the main environmental aspects (among those listed in the above-mentioned table) taking into account Article 12(1)(b) of the Directive proposal 6.

To the extent possible, consideration of economic feasibility will include quantification of the cost implications of environmental improvements, to ensure that these do not entail excessive costs, in accordance with Article 12(1)(a)(iii) of the Directive proposal 6.

Existing legislation at EU level and voluntary initiatives (covering a large share of the market and with adequate monitoring and verification mechanisms) will be considered.

6.2 Subtasks (VHK)

- Data retrieval, through literature search, databases and software tools, stakeholder consultation
- Data analysis, including evaluation of data quality, harmonisation and sorting of data according to LCC-approach (see below)
- Reporting Results per relevant product
- Reporting on Methodology. A special report on the conclusions regarding methodology: Discussing the most widely used and accepted forms of market analysis and the most widely used/accepted product classifications; with pros and cons.

6.3 Data retrieval & analysis (VHK)

Primary data sources for the identification and validation of design options are:

- Product-specific SAVE reports (incl. subtask reports) and ECCP background documents
- Background reports for EU Ecolabel, national ecolabels and EPD III criteria
- Design options as specified in manufacturer’s environmental reports
- Design options as specified in publicly available LCA- and/or Ecodesign studies
- For TVs and PCs: Reports from parallel Ecodesign studies (JRC Sevilla, EPIC)

Secondary sources, mainly to be consulted if primary sources are unavailable for specific product groups, are

- Comparisons of ‘best’ and ‘worst’ cases in product databases (e.g. Homespeed, EU Energy Star, etc.)
- Manufacturer’s claims in commercial publications (to be verified)
- Scientific publications from research institutes and universities, claiming significant environmental improvements (to be verified).
Data sources for the ex-post impact analysis will be Eurostat or national statistics offices, industry sector statistics and reports, manufacturer’s annual reports, etc..

6.4 Deliverables (VHK)

The final result of task 3 will be:

- a discussion of data availability and methodological problems encountered,
- a complete overview of LCC data, scenarios and indicators as described above for each of the relevant products,
- a proposal for a generally applicable methodology for an analysis leading up to an estimate of the environmental improvement potential.

7 FINAL REMARKS ON TASKS 1 TO 3

Although the above description of the three tasks may seem fairly comprehensive, it is obvious that this approach will need to be refined and adjusted in light of the requirements of the new Eco-design directive. For each of the products specific additional environmental indicators apply and each of the products will have its own methodological pitfalls for which a solution must be found. As regards these additional indicators, VHK will take great care in ensuring that they are easy to be computed and used, understandable and based on data that is relatively easily available (from public sources or attainable at low cost and in a comparatively short time). It must be clear that the efforts of VHK will be restricted by budget: The aim of the underlying study is to contribute to the creation of a methodology, not to perform an exhaustive research also on indicators that are not readily available.

VHK expects —with the already vast amount of data that will be available— to make a major contribution to the methodology, but at a certain point ‘data gaps’ will have to be indicated that need to be filled with preliminary estimates and that will probably require additional research outside the scope of the underlying study. Especially with regards to data concerning new EU Member States we anticipate that on several counts we will not find adequate data.

As mentioned, the aim of the underlying study is to contribute to the creation of a methodology allowing to evaluate whether and to which extent various energy-using products fulfil important environmental criteria. VHK believes that the approach offered here, will do just that. In accordance with Article 12 1. (a) ‘with regard to the selection of the EuP to be covered’

- Task 2 (Market Analysis) and the considerations regarding the product category definition will provide an answer to the question whether the EuP represents a significant volume of sales and trade (Art. 12. 1 (a)(i)). This answer will not only come from the determined sales and trade volume of each of the individual relevant products, but also from a comparison between those products and a comparison of parameters for the EU as a whole.
- Task 1 (Environmental Analysis) and -again- the considerations regarding the product categorisation will provide an answer to the question whether the EuP represents a significant environmental impact (Art. 12. 1 (a)(ii)). Again, the answer will probably come not only from the established absolute values, but also from the relative value with respect of the other products studies and -to the extent that data are available- the EU as a whole.
- Task 3, together with the baseline inputs from Task 2, will provide an answer to the question whether the EuP presents a significant potential for improvements of the environmental impact (Art. 12. 1 (a)(iii)).
- All three tasks will provide input into the question how Eco-design measures would fit in with the Community environmental priorities. (Art. 12. 1 (a)(iv)).
Decision No. 1600/2002/EC (Sixth Community Environment Action Programme) mentions as the key environmental priorities:

- Climate change
- Nature and biodiversity
- Environment and health and quality of life
- Natural resources and wastes

VHK will make an effort to show how the improvement in environmental impact of the products studied can methodologically be tied in with these priorities. Furthermore, in the discussion of the LCC-approach (Chapter 4), it is clear that the underlying study works within the criteria set in Art. 12.1 (b) of the draft Eco-design/EuP directive.

8 REPORTS & COMMUNICATION

8.1 Main Report

After this introductory chapter, the underlying main report features 4 chapters defining the scope, system boundaries and methodological approach regarding the Eco-design target group (chapter 2) and the 3 main tasks (Chapters 3-5).

Chapter 6 will deal with data availability and some methodological problems encountered when applying the approach.

After that, there are three chapters summarizing the main results per task (environmental, market, improvement potential) for all the product groups.

The final chapters deal with conclusions and recommendations presenting a methodology for product evaluation in the framework of the Eco-design of EuP Directive.

Appendices to the report are a list of literature references, an overview of Eco-design history 1950-now and a preliminary list of examples of how the implementing directives for each of the product groups could look like.

Deadline for the interim report is May 2005. The selection of the representative products from the product categories listed will have been accomplished. Contacts with relevant stakeholders will have been established. Information sources for carrying out tasks 1-3 and possible information gaps will have been identified, as well as reliable ways for complementing these gaps. The methodological approach must be well developed.

On receipt, the Commission shall have twenty days to approve or reject the report, and the Contractor shall have twenty days in which to submit additional information or a new report.

The final report is due by mid November 2005. The final report, which is considered the outcome and main deliverable of the contract, will cover fully all the requirements of the technical specifications and propose a methodology, applicable in principle to any energy-using product, for determining whether and to which extent it fulfils the criteria of Article 12(1) of the EuP Commission proposal.

On receipt, the Commission shall have forty-five days to approve or reject the report, and the Contractor shall have forty-five days in which to submit additional information or a new report.

The final version of the final report shall be available in two paper copies and in electronic format (so that it can be directly placed in the internet) before the end of the contract duration.
8.2 Product Background Reports

The project will generate detailed product reports, containing detailed information concerning the results of the three tasks. Deadlines for final and interim versions are the same as for the main report.

8.3 Website

For the duration of this project and for the benefit of all parties involved in this project, VHK has created a website www.eupproject.org where working documents, data sources and links can be downloaded. The website also features an e-mail address where stakeholders can send relevant documents to be incorporated on the site. The technical part of the website, featuring (also) original copyright protected material, will only be available to stakeholder experts for personal use. Passwords can be obtained from VHK for experts agreeing to honour copyright obligations for all material not publicly available.

8.4 Stakeholder experts

VHK has organised an informal group of stakeholder experts who will act as sparring partners and possible contributors to the study. The group consists of experts from the relevant industry groups, consumer associations and other NGOs and will meet approximately 2 or 3 times during the project.

8.5 Workshop

When an early version of the draft final report is available, and in any case no later than the 10th project month, VHK will present the accomplished work in a workshop with experts organized by the Commission. Feedback received will be processed and, as appropriate, incorporated in the draft final report to be submitted to the Commission towards the end of the 10th project month.
## 9 TIME TABLE

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APPENDIX II: WEBSTATISTICS & PROJECT WEBSITE
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Eco-design of EuP methodology

This is the website of the "Eco-design of Energy-using Products Methodology" study for the European Commission, DG Enterprise. The project is conducted by Van Holsteijn en Kemna and runs from 17.11.2004 until 17.12.2005.

The aim of the website is to create an information platform, providing to stakeholders all necessary information about progress of the project and the opportunity for a timely and appropriate contribution. It contains relevant literature, background information and working documents. Access to part of it is limited to selected stakeholder experts for copyright reasons.

- General information about this project
- More information about this website: webmaster@vhk.nl
- Log in (for participants)

Note:
PDFs require Acrobat Reader 6 or higher. Should you experience difficulties opening the above PDF documents, please download the latest Acrobat Reader software at www.adobe.com (free).

European Commission Workshop - 3.10.2005 :::: NEW ::::
Presentations
- VHK_Presentation Draft Final Report - PDF 0.3 MB
- ELC Presentation Case Street Lighting - PDF 1.5 MB
- VHK Presentation Methodology Special Topics - PDF 0.1 MB
- VHK Presentation Illustration Product Cases - PDF 2.5 MB
- Minutes 3 October MEEUP Workshop - PDF 0.17 MB — issued 28.10.2005

Draft Final Reports - 23.09.2005
- Methodology report, Appendix 1 - 1st Draft Final report, rev. - PDF 1.5 MB
- Product cases report, Appendix 2 - 1st Draft Final report, rev. - PDF 5.6 MB
- EUP EcoReport v4 (extended version) - Excel 2 MB — issued 23.09.2005

Interim report - 01.07.2005
- Interim report - PDF 120 kB
- Interim report Appendix 1: Methodology - PDF 1 MB
- Interim report Appendix 2: Product cases - PDF 4.6 MB

If you have problems with the above PDFs, you can download the PDFs below which are compatible with the older Acrobat version 4 (however, these are larger files):
- Interim report (Acrobat 4) - PDF 145 kB
- Interim report Appendix 1: Methodology (Acrobat 4) - PDF 1.5 MB
- Interim report Appendix 2: Product cases (Acrobat 4) - PDF 11.5 MB
Expert meeting April 28, 2005 - Brussels
- Minutes of 2nd MEEUP meeting - PDF 35 kB
- MEEUP presentation by VHK - PDF 1.2 MB
- ELC Street Lighting - PowerPoint 1.04 MB
- Ceced Cold - PowerPoint 77 kB
- Ceced Dishwashers - PowerPoint 61 kB
- Ceced Vacuum cleaners - PowerPoint 58 kB

Expert meeting January 26, 2005 - Brussels
- Minutes of 1st MEEUP meeting - PDF 36 kB
- Bosch Siemens Hausgeräte presentation - PDF 137 kB
- Canon presentation - PDF 292 kB
- CECED presentation - PDF 32 kB
- Daikin presentation - PDF 288 kB
- ELC presentation - PDF 229 kB
- Océ presentation - PDF 333 kB
- VHK presentation - PDF 85 kB

General information
- EuP draft directive COM(2003) 453 final, 01/08/2003 - PDF 351 kB
- Call for tender ENTR/03/96, 24/04/2004 - PDF 193 kB
- Updated Work Program, 10/12/2004 - PDF 77 kB
- Updated Time Table, 10/12/2004 - PDF 27 kB

Links
EU portals
- DG ENTR environment portal
- DG TREN energy demand portal
- EEA
EU selected shortcuts
- 6th EAP
- Air Quality
- Batteries
- ECCP

stakeholders’ links
- BEUC
- CECED
- CELMA
- EEB
- EHI
- EICTA
- ELC
- Europump
- Eurovent-Decofam
- Orgalime
- UEAPME
- WWF

LCA portals and sources
- APME
- Blue Angel
- CEN
- Cenelec
- CISO
- CML (CMLCA)
- DfS Delft
- Ecobilan (Team)
- EcoInvent
- EAA
- EMPA
- ENEA (eLCA)
- EPA NRMRL
- Eurelectric
- ETSI
- FEFCO
- IDEMAT
- ifeu (Umberto)
- IISI
- IKP (Gabi)
- ISO
- ISO14000
- KCL-ECO
- MST (EDIP)
- NIDI
- Nordic Swan
- Öko-institut (PROSA)
- Pré (SimaPro)
- UNEP/SETAC

Technical literature
The following categories contain lists of literature references. If the information is available in electronic format, it can either be downloaded directly or there is a reference to the source website.

Note that these literature references are part of the MEEuP project source material. Not included here are other technical sources, i.e. those that are:
- readily available through the links on this website's home page (EU links to legislation and background reports, stakeholders websites and general LCA websites)
- part of the references of VHK-reports on the various subjects and thereby already summarized in those VHK-reports
- not available in electronic format, e.g. books and magazines
- strictly confidential, but where permission is granted to use specific data or to use these confidential sources to check public data
- software and database tools, e.g. proprietary VHK-tools for energy analysis, stock modelling, etc. as well as tools licensed to VHK.

Literature may be copyright protected and therefore access is restricted. Password holders declare to use the literature sources strictly for personal use and not to re-distribute the material, unless it concerns material from public sources.

Documents
Below is an overview of the literature with direct links. You can use your browser's BACK button to return to this page.

Methodology
LCA Methodology
- LCA methodology articles
- LCA policy reports
- Manuals & software
- Standards

Eco-design Methodology & indicators
- Energy
- Material resources
- Methodology & Misc.
- Toxicity

Eco-design History

Product information
1. Heating and water heating equipment
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

2. Ventilation / Air-conditioning
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

3. Electric motors: CH Pumps
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

4. Lighting products
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

5. Refrigerators & Freezers
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

6. Dishwashers
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

7. Small domestic appliances
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

8. Copiers
- Environmental analysis
- Market analysis and product definition
- Design-options, costs and LCC calculations
- Impact analysis

9. PCs
- Environmental analysis
- Market analysis and product definition
APPENDIX III: STAKEHOLDER EXPERT MEETING 26 JAN. 2005

- Minutes (9 pages)
- Presentations (19 print pages)
  - VHK
  - BSHG (dishwashers)
  - Canon (copiers)
  - CECED (refrigerators)
  - Daikin (room air conditioners)
  - ELC (street lighting)
  - Océ (copiers)
Minutes 1st MEEUP Meeting

Place: European Commission, DG ENTR building, Rue de la Science 15, Room 0/25
Time: 26.1.2005, 9.30h – 17.00h
Language: English
Organisation: VHK (service contract to the European Commission, DG ENTR)
Documents: www.eupproject.org

Participants

<table>
<thead>
<tr>
<th>Organisation</th>
<th>Name</th>
<th>Role</th>
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<tr>
<td>European Commission</td>
<td>Michael Papadoyanakis</td>
<td>DG ENTR</td>
</tr>
<tr>
<td></td>
<td>Mrs. Orsolya</td>
<td>DG ENV (observer)</td>
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<td>Project team</td>
<td>René Kemna (pl)</td>
<td>VHK</td>
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<td>Martijn van Elburg</td>
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<td>Central Heating</td>
<td>Felix van Eyken</td>
<td>EHI</td>
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<td>Boilers</td>
<td>Jan Cluyse</td>
<td>Daikin Europe</td>
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<td>Airconditioning</td>
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<td>Berno Ram</td>
<td>Philips Lighting</td>
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<td>Henk Douven</td>
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<td>Christer Persson</td>
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<td>IBM Deutschland</td>
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<td>Jean-Philippe Denruyter</td>
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Draft Agenda:

1. Opening
2. Tour de table: Introduction experts, incl. background & interest regarding the subject (All) [9.30h]
3. Presentation Work Programme (VHK & questions) [10.00h]
4. Data retrieval per product group (short VHK status report, identification of needs per product group, tour de table amongst experts), [11.30h, break 12.30 – 13.30h]
Minutes of 1st MEEUP Meeting, Brussels, 26-1-2005

5. Selected methodological issues (concerning approach Chapters 1-5), exploratory discussion [15.30h]
6. Any other Business, incl. date next meeting in May. [16.45h]

Point 1: Opening
The participants are welcomed by project leader René Kemna (RK). The agenda is agreed. André Brisaer (EC, DG TREN), who would have liked to attend, is excused because of illness. Due to early absence of Bidstrup airconditioning is put forward on the list of product groups to cover.

Point 2: Tour de table
During the tour-de-table Reinhard Höhn (RH) asks:
1. whether he is asked as EICTA or IBM representative. RK replies that his invitation is co-ordinated with the chairman of the EICTA Environmental Committee (J-W. Scheijgrond), but he should feel free to make remarks on behalf of IBM or personal title. The meeting is informal;
2. whether documents supplied are confidential. RK replies that all data on the web and in the meeting is principally open for access by stakeholders. But stakeholders should realize that VHK reports are drafts and may be subject to change. Furthermore, if there is no other way in view of competition, it is possible for stakeholders to supply confidential data, e.g. data input that would help VHK to correct/amend older public data e.g. in BOM’s (Bill-of-Material) but would not show up on the website and meeting documents and would only appear in an aggregated form—agreed by the supplier of the data—in the VHK draft reports. In that case the data should be clearly marked as confidential.

Answering a question of Theo Schoenmakers (TS): The password-protection of part of the documents on the web is intended to stay in line with copyright requirements and not for any reasons of confidentiality. As far as RK is aware, it is OK for password-holders to send a downloaded document to specific persons for personal use.

TS also asks whether the methodology documents will be on the public or protected part of the website. RK replies that (draft)reports shall be put in the public part if possible.

Point 3: Presentation of work programme
RK proceeds with a presentation outlining the work programme. This presentation can be found on the EUP project website. Below are listed some remarks and comments during the presentation.

on the subject of PC’s and laptops
RH feels the categorisation of ‘PC’s and laptops’ as ‘consumer electronics’ is confusing. They are usually listed as ‘office’ or ‘ICT equipment’. MP replies that the definition of consumer electronics is loose and covers PC’s and laptops used in a home situation. RH asks to consider in any case the differences between average office and home PC’s. RK will change the category name to “consumer electronics & ICT equipment” in the version for the website and in the report.

on the subject of airconditioning
RK explains that VHK’s preference for airconditioning equipment over ventilating equipment is mainly for reasons of availability of data and a wish to simplify the
necessary research – not that airconditioning is a more prone candidate for legislation. Michael Papadoyanaki (MP) confirms the product groups listed are just test-cases.

on the subject of TV’s
RK informs the group that TV’s were added to the list to increase the level of consistency and awareness of the different studies going on for this product group.

on the subject of using the existing legislative framework (for assessment of) emissions data
RK informs the group that this method should enhance consistency with the legislative framework and therefore may be more adequate for describing future situations than other sources.

on the subject of RoHS
RK points out that the RoHS ‘impact category’ in the Commission list will deal primarily with the exceptions in the directive (not with the materials banned, because they should no longer exist). The “Non-RoHS” category will deal with what is called “materials of concern” mentioned in e.g. voluntary lists of certain industry associations (EICTA) and manufacturers (e.g. Electrolux).

RK replies that as regards the presence of hazardous substances in the product the RoHS Directive is the relevant legislation. As regards emissions of hazardous substances in other phases in the life cycle other Directives (Air- and Water Quality, Waste Incineration, LCP, etc.) are more relevant. MP adds that the environmental analysis in the context of this study should, to the extent possible, take into account emissions of hazardous waste during the whole lifecycle.

RH adds that the EICTA-list contains substances that are not-toxic but have been added for practical reasons (such as effects on recycling, or resource values, etc. Gold and silver are non-toxic, Beryllium creates problems in the recycling stage of copper). MP adds that toxicity is not the only reason for a waste to be characterized as hazardous. There are other criteria (e.g. flammability etc) which are defined in relevant legislation (hazardous waste Directive) Melissa Shinn (MS) adds that hazardous substances not only play a role in the EOL of a product, but also during the production phase.

Point 4: Data retrieval per product group
Jean-Philippe Denruyter (JD) asks why energy isn’t mentioned in the specific questions raised by VHK. RK replies that for energy there is a lot of data readily available, the specific questions are aimed at possible gaps in data.
The meeting proceeds with presentations by the stakeholders. These can be found in the annex. The following minutes focus on specific issues and questions raised during the presentations.

**Circulators:** Niels Bidstrup (NB) informs the group that Europump has worked on a voluntary energy labelling scheme, which is close to finalisation. “A-class” (index <40) can be obtained by variable speed drive circulators with permanent magnet motors (variable speed represents 20% of stock, with permanent magnet they can save up to 80% of energy consumption). The average circulator in stock would be “D” (Inex 100). RH informs about the environmental burden of electronics added. Niels Bidstrup will make the BOM available and supply the economic data (price, running costs, latest projections on installed /sold for EU-25).

**Boilers:** Felix van Eyken (FvE) sets out to explain that the performance of boilers is difficult to assess without the heating system it forms part of (radiators, piping, controls). There is a huge potential there and the boiler is just one specific item. Also he points out that there are methodological problems. The Building Directive seems to have solved the issue of the heating value unit (lower calorific, RK), but there are more local differences e.g. in the heating values of the fuel.

Having said that, he is willing to supply emission and energy data for oil- and gasfired boilers, both atmosferic and condensing, and will try to retrieve BOMs for also oil-fired and floor-standing boilers (though data are more scarce than for gas-fired). Agrees with approach in the SAVE Heating Study.

RK asks why, as the manufacturers of the largest residential CO2-emitters, there have been no initiatives from the industry to ban atmospheric boilers and only go for condensing boilers. FvE replies that the industry sees little problems in using condensing boilers for newly built, but 80% is replacement market. The dimensioning of heating installations, appropriate chimneys, controls and the training of installers are seen as major barriers. RK promises he will focus on these issues in the study.

FvE asks RK why the focus only lies at heating only boiler. RK replies that for reasons of budget, data availability, large market segment and the urgently needed update of the Boiler Directive the heating only boiler has been chosen for a full analysis. But where more data on the whole product group of boilers/ combis/ water-heaters is easily available it will be mentioned.

RK asks if there are any new developments in CEN/Cenelec regarding realistic (duty cycle or BRE seasonal efficiency, modulating burners) efficiency measurement standards. FvE is not aware of that. At the moment efficiency is tested at 30 and 100% The BRE standard is considered to be applicable only to the UK, but not other countries. Difficulties in research lie in lack of funding and many diverging installation practices.

NB mentions the SAVELEC study, which focuses on electricity consumption by boilers (in most cases determined by the boiler control). He will send more information to VHK. RK promises he will focus on these issues in the study.

**Lighting:** GSs’ presentation illustrates the cooperative attitude of the ELC in achieving savings of 24 Mt. Especially for street lighting ELC sees an opportunity for future EUP Legislation to replace blended and mixed high-pressure mercury lamps by sodium (SOX). They propose street lamps as a case for this study. BOMs are available, although not in LCA format. ELC has noticed that in detailed LCA there are data gaps for some materials.
RK is OK with the subject (even LCA of street poles available) but mentions a list of other potential lighting-subjects he will send to ELC for a reaction. MS asks why there is only a focus on energy and not e.g. the status of mercury-free CFL’s. RK points out that —although not explicitly discussed—the chosen subjects do involve also many other subjects. E.g. street lighting is also about mercury substitution, resources consumption, ‘light pollution’, etc. GS replies that mercury-free technology is available, but at the price of increased electricity consumption (which indirectly increases mercury emissions). RH confirms the relevance for LCD monitors. Phil Dolley (PD) asks RK if the range in CFL performance will be addressed. RK replies that the study will not be able to cover all lighting subjects and has to limit its resources to one or two cases: If street lighting is chosen, CFLs have to be treated elsewhere. MP enquires about the representativeness of street lighting. GS replies that it is a very important product group with enough volume that exceeds the quantities stipulated in article 12 of the EUP framework directive, high total energy consumption and interesting improvement potential.

Copiers: The presentation by Henk Douven (HD) illustrates the environmental aspects of big volume copiers and the drives to address these issues (labels, customers and competition). Duplex is default. As one of the improvements ‘reduced servicing’ is mentioned, since a large format copier may require service visits every month. Carcinogenic substances are banned just as other suspected substances (provided alternatives are available). He will try to supply BOMs and specific LCA data (confidentiality?). Regarding paper use by copiers Constatin Hermann (CH) makes a remark that this is an educational issue (user behaviour). RK asks about lighter paper (e.g. 50 g/m2). HD mentions that the Océ machines can handle 50 g/m2 paper, but it is ‘not nice’ and less suited for duplexing. HD adds that also recycled paper can be used, but it comes with higher maintenance (environment: car km) costs to clean the dust particles from this type of paper.

Christer Persson (CP) presents the achievements of Canon for copiers and printers. RK asks which duty cycle was used for the presented Energy consumption comparison, and BOM. CP will check and will try to supply more detailed BOM and Energy consumption study condition. RH informs about the “DC/DC converter” in Energy reduction comparison. Follows a discussion about paper use, Yoshinobu Kuriyama (YK) says Duplex is default function for higher speed coping machine, but it is also important to consider software function, such as 2(pages print) into 1(page) function for different customer needs’ printers (such as lower speed simple hardware printer). RK asks for substance list and LCA methodology applied. CP replies there is a general list available. RK: This is better, because more transparent. YK says LCI studies are organized by various bodies and conducted it is useful tool for in-house improvements but difficulties lie to apply to it in general due to differences of consideration of boundary and/or depth of study etc. that, for in-house study, can be unify those conditions and can neglect such redundant part’s study. This needs to be considered very carefully and that can be discussed in more detail bilaterally.

Room airconditioners (RAC). The presentation lists the market (2003: 5 mio units, 2010: 8 mio units expected for “enlarged EU”), the energy consumption 15.000 GWh, the average efficiency (EER 2.4), the growth markets (F, ES and IT, mainly in households and hotels), the main systems (direct expansion), energy-labelling scheme and improvement potential (EER of 4.5 is already on the market= far above the energy label “A” scale). Jan Cluyse informs that Daikin has quite a lot of data available (through eco-design projects with universities) it would like to share
RK informs about the use of HFCs and HCs in RACs. Cluyse replies that HFCs are the refrigerants of choice. HCs are no viable alternative for safety reasons: an RAC system may hold 500 to 1000 grs of refrigerant (compared to 10 to 50 grs for refrigerator). If EOL is correct than no leakage will occur at this stage. To avoid leakage at installation the industry is looking at mechanical connections for RAC systems (instead of man-made connections).

**Televisions:** (no powerpoint presentation). RK informs about the role of gold in the materials-loop of TV’s and the current BAT for recycling of TV’s. TS replies first by describing the rapid developments for new flatpanel TV’s: LCD achieve 30% savings for each generation (1 tot 1.5 years), also for larger types of LCD. This is a very rapid development. He continues that Philips is willing to share information on BOMs, LCA and precious metals in TV’s. The (often made) comparison with mobile phones is not adequate (these have much higher content of precious metals per gr of product).

As regards backlighting of LCD screens, most still use CCFL type of light, but LED is making progress (2007-2008). Also OLED is an emerging technology. Philips has BOMs on these new technologies. TS will look into availability for this study. For now TS mentions the background study for the Ecolabel is outdated and should not be used anymore.

As regards recycling technology Philips is using shredding without prior disassembly with excellent results (as opposed to projects by IBM with prior disassembly). Philips claims recovery of precious metals of over 95-98% is possible. More data can be found in the thesis by Jacco Huisman.

**PC’s and laptops:** (no .ppt presentation) RH needs time to gather BOM data. LCA, ecolabel and EPD data --from Eddy Roelants, FSC-- is already available. (note: EPD are downloadable from web sites of other IT companies) RK asks whether FSC (Fujitsu-Siemens Computers), who is one of the few OEMs left in the EU e.g. for main-boards, could supply BOM and LCA data. RH continues: Recycling technology is usually manual disassembly, with reclaiming of precious metal content of electronics as profitable practice. Recycled plastics will not be put to use in new PC’s generally speaking, however IBM uses around 4% recycled plastics world wide in new products (note: IBM was the first computer company to market a computer with 100% recycling plastic for all major plastic parts). RH mentions the difference in recycling of leaded glass: at IBM, CRT glass is sent to glass company, where they cut off the leaded glass part for specific recycling routes. Generally at IBM they expect PC’s from private households after WEEE implementation to end up in Municipal managed Waste stream.

As regards energy there are some initiatives for reducing electricity consumption in on-mode: these will continue with or without EuP context. Drivers for this are companies environmental programs, need for reducing heat dissipation, Intel design specs, performance aspects, etc. Other non-energy-related measures are through market drivers, for example the phase-out of PVC for computer cases took place mainly because of public pressure. CH informs that the main difficulty for PC producers to supply a good BOM is the dependence on suppliers who need to supply the data – is not always possible. Data for IC’s (e.g. graphic cards) is easier than for hardware (e.g. disk drives). MP is curious how these manufacturers then fulfil the requirements of RoHS. RH informs that this is ensured through legal contracts with suppliers.

**Small appliances.** Matteo Rambaldi (MR, CECED) proposes to select vacuum cleaners as test-case. There is data available, which will be supplied by Mr. Renaudin. MR: The rationale for selecting vacuum cleaners is consistent with the text of the EuP proposal (significant
market, significant energy consumption and improvement potential). Follows a discussion on methodology.

Mr Rambaldi suggests that a **multiple hurdles approach** should be integrated in the methodology. Following such an approach the legislator should evaluate whether a product category should be targeted by an implementing measure. He should assess: - whether the product is relevant in the EU market (first hurdle); - whether energy is a concern for that product (second hurdle - Energy is the focus of this legislative measure. Art. 1 says that the directive "contributes to sustainable development by increasing security of energy supply"); **and Kyoto represents today the environmental priority number one**; - whether there is any scope for improvement (third hurdle); - whether the market is not delivering results (fourth hurdle).

MP stresses that EuP not only considers energy, but a broad environmental spectrum. Furthermore, the selected product cases in the underlying study are not necessarily to be selected at a later stage. There was some surprise with CECED that battery-operated devices could also fall in the scope. Franco Moretti (FM) assumed that battery-operated devices are dealt with in the Battery Directive. MP replies that EuP scope covers all energy-using equipment (battery or grid, oil or gas, all are included) and repeats that the main hurdle for selecting equipment is for them to fulfill the criteria as mentioned.

**Dishwashers.** The presentation by Hans Beer (HB) revolves around four headlines:

Handwash vs machine wash: On the average the machine uses less water and energy to do a certain amount of dishes than hand wash (however there are large variation across Europe) with better results (study UniBonn).

The environmental impacts are centred in the use phase, where continuous improvement is taking place through the voluntary agreement. By 2008 some 40% energy reduction compared to 1996 will be established. Other improvements relate to reducing temperature of last rinse by better rinse aids.

MP asks whether water, noise and detergent are considered in the next VA. HB replies that for water this is linked to energy consumption (so it is covered indirectly). Noise is mainly a performance issue, with drawbacks on energy use and material use. It is not explicitly covered in the agreement, but is a market aspect. No comment on detergents.

FvE responds to noise as an environmental issue and recommends it not be covered for boilers. RK replies that noise is not mentioned in the tender as environmental aspects and – it being a highly complex subject to treat in general terms-- will not be considered explicitly for all products. However, this does not preclude that for specific products, like dishwashers, where the measurement standard is adequate and it is a competitive issue it should not be included in a voluntary agreement.

**Refrigerators:** FM presents general LCA results for refrigerator (average now 290-300 ltrs). Some questions remain about the emissions to water in the use phase water-cooling in thermoelectric power generation. The presentation shows increased energy efficiency throughout the years. As regards recovery of refrigerants, emissions can be avoided if recovery is correct. Nowadays a recovery of 98% (of collected refrigerators) is achieved. Since illegal dumping is not recommended by manufacturer this should not be calculated in the LCA. RK replies it will be treated as risk, not as factual emission.

RK asks about the use of HFC 134a. FM claims this is only the refrigerant of choice for large US-style double door combined fridge-freezers. This is a market niche of a few 100,000 units
sold per year on a total of ca. 16 million cold appliances that are using HC’s. The reason is not related to technological problems, but due to US safety requirements regarding flammable refrigerants use ban in manufacture. Moretti mentions a safety threshold for domestic refrigerating appliances of a HC charge 150 grs. In case of air conditioners, the trend in the safety standardization committee is to fix a HC threshold at about 300 grs. FM will try to supply BOMs of average appliances.

**Point 5: selected methodological issues** (concerning approach in chapter 1-5)

RK proceeds with presentation regarding chapter 2 (scope).

Remarks are made concerning:

*EuP differences with non-EuP*

trade-off purchase price vs running costs. Maybe true for most large EuP, but not so for small battery operated equipment.

*EuP boundaries of influence*

TS and RH ask the picture to be changed reflecting the small influence of producers in the area of materials production and distribution. Also packaging-decisions are not fully responsibility of producer. RK replies that as regards distribution this will be accounted for on a volume or weight basis. He will change the rectangle in the picture.

*Eco-design decisions*

TS informs about the responsibility of the designer regarding user interfaces and modes. RK replies these are covered by the 4 point mentioned under tactical.

RK proceeds with presentation regarding chapter 3 (environmental analysis).

Remarks are made concerning:

*LCA emission sources*

RK proposes to use BREF (BAT Reference document) for relevant processes whenever possible. CH agrees in principle but warns this will not completely solve the problem of different emission datasets, since many BREFs give not single values but ranges. RK agrees that in those cases he will have to use the median value, but even in those cases BREFs are a more transparent reference for a legislator.

*Recycling*

The value of 90% recycling of metals is considered too low by many. The value of 90% is considered too high in the case of CRT-glass since most of it ends up in landfill according to PhilDolley. RH replies landfill will be prohibited in the future, so the CRT waste will end up somewhere else, as today for example in ceramics (but not 90%). Nowadays some 25-20% of old CRT is recycled and used for new CRT.

The two shredders streams option proposed by RK is not relevant in the case of products which already are electronics-rich and where a single shredder would already extract e.g. the precious metals according to TS. FM states that shredding options are limited by waste technology development, not by ecodesign measures.. RK: Precisely our point. In our study we should look at the dominant recycling technology in 2010-2020. If already now there is a single-product shredder-based recycling technology that has a higher yield of recycled
materials that a Design-for-Disassembly recycling route, than we will expect that (which is
now only one plant) to be the dominant recycling technology for EuP in 5-15 years. In other
words, we will give no quantitative credits for Design-for-Disassembly measures in EuP.
However, there is one exception: we only know the best and most economic recycling
practice for electronics-rich products like PC’s and TV’s. For EuP with a relatively low
fraction of electronics, like most whitegoods, we don’t know this and therefore we propose
the 2-stream shredder route and to give credits for those ‘low-electronics’ products where the
waste can be easily separated into ‘electronics-rich’ and ‘electronics-poor’.

Product life

Moderate credits for product life extension do not fit well in the case of lamps where progress
is slow (“in the case of incandescent lamps doubling life does reduce resource input, without
detrimental effects on energy consumption during use”). RK replies that he is interested in
any written information on this subject and –in view of the time-- will gladly discuss the case
of lamps bilaterally.

RK proceeds with presentation regarding chapter 4 (market analysis).

RK informs the complications of using ICT market data from EITO (www.eito.org), which
VHK is not allowed to disclose, whereas part of the study is financed by industry and the
Commission (incl. DG ENTR). MP will check with colleagues regarding this issue.

Point 6: any other business

There are no items put forward under ‘any other business’. RK thanks all for joining and
participating and looks forward to a fruitful collaboration in the following stages of the study.
RK also asks the attendees to send their Powerpoint presentations, check their agenda’s for
the next meeting in the second half of April which will be communicated ASAP.

Closure at 17.05

MvE/ RK
VHK
Agenda (draft) MEEUP Stakeholder Expert Meeting 26 Jan. BXL

1. Opening [9.30h]
2. Tour de table: Introduction experts, incl. background & interest regarding the subject (All) [ 9.30h ]
3. Presentation Work Programme (VHK & questions) [ 10.00h ]
4. Data retrieval per product group (short VHK status report, identification of needs per product group, tour de table amongst experts), [11.30h, break 12.30 – 13.30h]
5. Selected methodological issues (concerning approach Chapters 1-5), exploratory discussion [ 15.30h ]
6. Any other Business, incl. date next meeting in May. [ 16.45h ]

Participants 26 Jan.
CH Pumps: Niels Biddstrup (Grundfos)
Heating appliances: Felix van Eyken (EHI)
Lighting: Berto Ram (CELMa/Philips), Gerald Strickland (ELC)
Copiers: Christer Persson, Yoshihito Kuriyama (Canon/ EICTA), Henk Douven (Océ)
PC’s: Reinhard Hoehn (IBM/ EICTA), Eddy Roelants (Siemens), Constantin Herrmann (PE-Europe, EPIC project)
TV’s: Theo Schoenmakers (Philips/ EICTA),
Small Domestic Appliances : Matteo Rambaldi (CECED))
Dishwashers: Hans Beer (BSV/ CECED)
Refrigerators: Franco Moretti (Whirlpool/ CECED)
Room Air Conditioners: Jan Cluyse (Daikin/ Eurovent)
NGO’s: Jean-Philippe Denruyter, Mariangela Fabbri (WWF),
Melissa Shinn, Grazia Ceci (EEB)

Point 4. Specific Questions meeting 26 Jan.
1. Lighting and Small Domestic Appliances: Proposal for a suitable product case to be used in our study (representative and data available)
2. Refrigerators and Room Air Conditioners: Methodology / data on refrigerants
3. Copiers : Two typical products: Small (MFD type) and big (analog) copiers. Methodology/ data on paper use (duplex, e-paper) and toner (RoHS etc.).
4. Dishwashers: Methodology/ data on detergent use. Comparison to hand wash.
6. TV’s and PC’s: Methodology/data on recycling of scarce metals (gold, silver, etc.)
7. CH Pumps: To what extent can this product be exemplary for the larger group of ‘Electric Motors’ (design options VSD and environmental problems (Cu in motors, etc.)).

Eco-design of Energy-using Products

Methodology Study
Work Programme (Ch. 1)

Van Holsteijn en Kemna BV (VHK)
Rene Kemna (p.l.)
Martijn van Elburg

The aim of this study (tender doc.)
.....is to contribute to the creation of a methodology allowing to evaluate whether and to which extent various energy-using products fulfil the above mentioned criteria.*

Selected Products (tender doc.)
- Heating and water heating equipment (CH-boiler)
- Electric motors (CH Pump)
- Lighting (product to discuss)
- Domestic appliances
  - Refrigerators
  - Dishwashers
- Small household appliance(s) (product to discuss)
- Office equipment (copier)
- Consumer electronics & ICT equipment (PC’s- including portables, input EPIC)
- Ventilating/air conditioning equipment (RAC)
- TV’s (input from IRC TV)

* = Such a methodology will be applied to products that have already been identified as relevant for various environmental aspects and/or the volume of trade in the internal market in the context of other Community initiatives or policies such as the EEUP and the Eco-label.
Tasks (tender doc.)

1. Environmental Analysis
2. Market Analysis
3. Assessment Improvement Potential

1. Environmental Analysis Approach (tender/offer)
   - 'Cradle-to-grave': Production, distribution, use, end-of-life phases
   - Simplified LCA, principles ISO 14040 series
   - Impact categories proposed by the Commission
   - Subtasks: Data retrieval, data analysis, reporting on data availability and methodology
   - Primary data sources used are EU dossiers such as WEEE, RoHS, SAVE, Ecolabel, IPP, IPPC, etc.
   - Consistency with legislation

1. Environmental Impacts, Resources
   - Energy consumption
     - primary Gross Energy Requirement in MJ
   - Water consumption in m3
   - Material use (in kg), incl. recycling credits
     - Metals (St, Al, Cu)
     - Plastics (PE, PP, PS, etc.)
     - Others (glass, electronics, etc.)
   - Waste generation
     - to landfill
     - to incinerator
   - Hazardous waste generation
     - ROHS (exceptions)
     - non-ROHS (voluntary lists)

1. Environmental Impacts, Emissions
   - Emissions to air
     - greenhouse gases (GHG, CO2-eq.)
     - acidifying agents (SO2-eq., incl. NOx, also eutroph. NH3)
     - volatile organic compounds (VOC)
     - ozone depleting substances (ODP, CFC-11 eq.)
     - persistent organic pollutants (POD, e.g. PCB’s, dioxins)
     - heavy metals (As, Cd, Hg, Ni, Pb; also PAHs)
     - particulate matter (PM)
   - Emissions to water
     - heavy metals (Cd, Hg, etc.)
     - substances affecting oxygen balance (P, N, BOD, COD)
     - persistent organic pollutants (List I substances)
   - Other product specific

2. Market Analysis Approach (tender/offer)
   - Identification/classification of appropriate product groups (standards, statistics, EU legislation)
   - EU production, intra/extra-EU trade, consumption
   - Subtasks: Data retrieval, data analysis, reporting on data availability and methodology
   - Primary data sources: Eurostat and publicly available market data sources

3. Improvement Potential Approach (tender/offer)
   - Theoretical best potential (BAT, ‘Best Available Technology’)
   - Economic/social/etc. feasible potential:
     - LLCC approach (‘Least Life Cycle Costs’) or comparable
     - Manufacturer and consumer impact analysis
   - Focus: 2007-2008
   - Primary data sources: LCA-studies, SAVE studies, manufacturer publications, VHK engineering expertise.
Project Results Communication (tender/offer)

- Stakeholder experts: meetings (Jan., Apr.-May) and Commission workshop (Sept.-Oct.)
- Website ([www.eupproject.org](http://www.eupproject.org)): source material and drafts
- Interim Report (May 2005)
- Final Report (Nov. 2005)

Project Planning 2005 (tender/offer)

- Stakeholder expert meeting Jan. (environmental/market)
- Stakeholder expert meeting April (improvement potential)
- Interim Report May (tasks 1 and 2)
- Commission workshop Sept.-Oct. (draft results)
- Final report Nov.-Dec.

Eco-design of Energy-using Products

Methodology Study

*Eco-design scope (Ch. 2)*

Van Holstein en Kemna BV (VHK)
René Kemna (p.l.)
Martijn van Elburg

Product features (not production, sales, finance)

EuP Interface with other products
EuP differences with non-EuP

- Trade-off Purchase price vs. Running costs (LCC)
- Large number of components (100-2000), materials fractions (20+)
- Functionally complex: interface with energy source (safety), traction/heat/light/data energy transformation, control unit
- Combustion emissions (CO2, CO, CH4, SO2, Nox, etc.) dominant. Heavy metals less influence
- Use phase dominant. With non-EuP more production/disposal
- Medium-long Product Life (5-20 years). Most non-EuP have shorter life (<1-5 years), buildings much longer (>100 yrs.). Product life maximization may be sub-optimizing.
- Important influence consumer behaviour on env. Impact of EuP

EuP – industry: boundaries of influence

Eco-design decisions

At company policy level:
The product developer assumes shared responsibility --with production and market developers—for the product policy and the definition of new product/market combinations

At tactical level:
The product developer is responsible for
- Selection of materials
- Design of the geometry
- Selection of the type of production processes to realize the geometry
- Prescription of the way that the product should be used.

Eco-analysis tool in design-loop

Easy and understandable indicators for industrial product developers

- refer to a clearly defined functional product category
- be numerical or Boolean (yes/no)
- be up-to-date (e.g. not relating to legacy parameters)

- when numerical they should
  - preferably be absolute rather than relative
  - preferably relating to physical/chemical parameters
  - have clearly defined tolerances (with respect of a threshold value)

- relate to measurement standards that are
  - accurate (using clear unequivocal definitions, permitting small tolerances on measurement of all relevant parameters)
  - reproducible (complete/comprehensive --> comprising all relevant parameters)
  - realistic (e.g. duty cycle rather nominal)
  - economic (acceptable testing/procedural costs)
  - harmonized (e.g. EN/ISO standards, etc.)

Eco-design of Energy-using Products

Methodology Study

Environmental Analysis & Data (Ch. 3)

Van Holsteijn en Kemna BV (VHK)
René Kemna (p.l.)
Martijn van Elburg
ISO 14040 Approach

- **Scope & functional parameter**
- **LCI**: Life Cycle Inventory of
  - design parameters (e.g. in kg)
  - unitary process parameters (e.g. in resources or emissions per kg).
- **LCIA**: Life Cycle Impact Assessment: weighing factors to add different types emissions per category (e.g. emissions → GHG, acid., etc. impact)
- **Interpretation**: e.g. comparison with EU totals to conclude to eligibility criteria

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Data Required per Life Cycle Phase

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<tr>
<th>Phase</th>
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<th>LCI-unit processes</th>
<th>LCA-weighting</th>
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<td>[Substance]</td>
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Data Sources

- **Full LCA tools** (SimaPro 6, Gabi 4, etc.), databases (EcoInvent 2003, Idemat 2001, BUWAL-250, Gabi 4, etc.) and weighting methodologies (Eco-Indicator 99, CML 2000, EDIP '97, etc.)
- **Simplified LCA tools**, (Eco-It, EcoScan, EIME, KEPI)
- **Legislation** and background reports from EU environmental and energy-related legislation. (IPPC BREFs and SAVE)
- **Industry associations** (APME, IISI, EuroCopper, Eurelectric, etc.. for production. EICTA, CECED, EHA, Eurelectric etc.. for consumption).
- **Other literature** sources (EU Ecolabel, Blue Angel and Nordic Swan), product-LCA studies, etc.
- **Physical VHK** product-analysis, disassembly for ‘BOM’
- **Experts**, both inside and outside the EuP stakeholder expert group

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Full LCA emissions comparison from various sources 1

<table>
<thead>
<tr>
<th>Substance</th>
<th>unit per kg</th>
<th>BREF</th>
<th>IPCC, St Ecoinvent system, Fe</th>
<th>Ecoinvent (at plant), Fe</th>
<th>Ecoinvent (Fe), ETH-ESU 96, Fe</th>
<th>Edip 97, Fe vdBergh &amp; Jurgens, Fe</th>
<th>Ecoinvent (plant), Fe</th>
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<td>Carbon dioxide</td>
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<td>0.43</td>
<td>1.86</td>
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<td>275.00</td>
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Full LCA emissions comparison from various sources 2

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</table>
Special subject: Recycling

- **Ferro, non-ferro metals, glass** recycling: close to 90% (shredder-based), esp. with WEEE. Credits in virgin material.
- **Electronics/precious metals**. Credits for recycling design measures (2nd shredder route)
- **Plastics**. Equal (high) credits for recycling and incineration with heat recovery. Displacing fossil fuels.

Special subject: Product Life

- **Large EuP** with dominant use phase. No credits for product life extension
- **Small EuP** with dominant materials production/disposal phase. Moderate credits for product life extension
- **All**: Reparability and maintenance to reach nominal product life remain very important

Eco-design of Energy-using Products

Methodology Study

*Market Analysis & Data (Ch. 4)*

Van Holsteijn en Kemna BV (VHK)
René Kemna (p.l.)
Martijn van Elburg

Main data sources market (excl. Eurostat)

- Heating systems
- Airconditioning
- Circulators
- Lighting
- Refrigerators
- Dishwashers
- Small hh.
- Copier
- PC / laptop
- Television
- SAVE study 2002 (CH Boilers)
- SAVE study EERAC 1999
- SAVE study 2002 (max. 250 W)
- ELCled website (current)
- DELight 1998
- SAVE: Green Light 1999
- SAVE studies 1995/2000 (GEA)
- SAVE studies 1995 (GEA) and updates
- EU Ecolabel study 2001
- (need to be specific)
- Energy Star
- Energy Star (EU site and EPIC study)
- (AEAT study)

BOM's available 26.1.2005

- CH-Pump UPS 25-40
- CH-boiler, gasfired, Nefit Turbo 90, single, 21 kW
- Refrigerator, table-top, no freezer comp.
- Dishwasher, Bosch Day&Night 56M22B
- TV B&O Beovision LX550
- PC Dell 2.8 GHz P4 with CD/40 Gb HB/FD/17”FPD
- PC Displays: NEC 17” CRT, Cannon 15” LCD
- Copier Rank Xerox XCB55, table-top B&W analog, 8cpm
- RAC Amcor AC 7200 M, 2120 W cooling cap. (& Hitachi)
- Lamps misc. (general), D1-35W (detail), Ballast car
1. Study manual vs. machine dishwashing

2. What are the biggest relevant environmental impacts on a dishwasher?

3. What improvements are already achieved regarding to environmental impacts?

4. What further improvements are arranged (CECED, WG-WET)?
   4.1. industry agreement to eliminate DW with energy efficiency class:
       - \( C \text{ for } \geq 10 \text{ ps} \text{ and } D \text{ for } < 10 \text{ ps} \)
       by 31 Dec 2006
   4.2. industry commitment to achieve an energy saving of 40 % compared to the base case by 2008 in the market
   4.3. industry commitment to study ways achieving further energy savings after 2010 (e.g. rinse aid project)
   4.4. Commitments shall last up to a new energy label on dishwashers enforced by latest 31.12.2009
### Section Household and Appliance Technology

Dr. rer. nat. Rainer Stamminger  
Professor für Haushalts- und Verfahrenstechnik  
am  
Institut für Landtechnik

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Environmental impact during the product lifecycle

Row materials
(Non-ferrous metals, steel, synthetics, glass, others)

Disposal
(Energy consumption)

Usage
(Consumption of water, energy and chemicals)

Distribution
(Energy consumption and harmful emissions)

Production
(Consumption of raw materials)

Environmental impact during the product lifecycle of home appliances

Around 90% of the environmental impact attributable to the typical home appliance occurs during the use phase. Therefore our most important contribution for a sane environment is to develop resource-friendly products.


More than 90% of the environmental impacts during the usage phase
Ecological profile of a dishwasher

Realisation: LCS Life Cycle Simulation GmbH, Germany, Nov 2004

System definition and boundaries:

impact on the environment

dishwasher production  transport to the customer  usage  disposal, recycling

energy supply  preliminary products

material-input  transportation needs
energy use BSH
energy use supplier

means of transport
load
distance

water
power
chemicals

recovery system

BSH BOSCH UND SIEMENS HAUSGERÄTE GMBH

LCS, Nov. 2004, chart 3
Some landmarks in Canon’s product development

- 1993 Lead-free optical glass
- 1995 The elimination of PBB and PBDE in covers for all products
- 1996 The energy efficient on-demand printing technology
- 2002 Introduction of recycled materials in covers
- 2004 the introduction of the first RoHS compliant copier – iRC 6800
- 2004 New iR-Generation with On-Demand-technology up to 45 ppm
- 2004 New iR-Generation with sleep mode of 1.5 Watt

On-Demand & IH Fixing Technology

- On-Demand Energy-Efficient Technology
- IH Fixing Technology (Utilized since 2002)

In this technology, a ceramic heater localizes the heating to a specific area through a fixing film during printing. Surplus energy consumption is avoided and energy efficiency realized.

This technology employs an electromagnetic induction heater in which an eddy current is generated when the magnetic field passes through metal coils, directly heating the fixing sleeve. Efficiency results because heating is unnecessary during standby time.

Energy Efficiency

- Benefits from Products Employing On-Demand Energy-Efficient Technology

Customer Benefits (benefit based on cumulative unit sales* as of 2003)
- Reduction of environmental burden
- CO₂ emissions reduced by 1.73 million tons
- Economic effect (energy cost savings) 117.3 billion yen

Energy Consumption Comparison with Previous Model as Base 100

- No warming up
- Recovery time 0 sec
- 82% reduced energy consumption
Energy Efficiency

Energy-Efficient Technology Incorporated into the i860/i865

1. Adoption of low energy consumption DC/DC power converter
2. Improvements in firmware
3. Clock stop function for logic circuit
4. Low energy consumption control system

Life-Cycle

New Generation iR - launch November 2004

- On-demand-technology up to 45ppm
- First copy after 3.9 sec. or 4.9 sec.
- Warm-up time from sleep-mode 10sec.
- New controller board
- Power consumption in sleep mode 1.5 Watt (also when connected to LAN)
Refrigeration

Refrigeration - LCA

Percentage contribution of Life Cycle Stages to total environmental impact

- Production
- Transport
- Use
- Disposal
- Packaging
- Energy
- Raw materials
- Air emission
- Water emission
- Solid waste
- Water consumption

Refrigeration - Use

- Energy is the main environmental concern
  - Energy Efficiency => Significant improvements obtained

Refrigeration – EE average of products

We were there

We are here

With no incentives
Refrigeration - CECED vs Notary data

Very high convergence

Refrigeration - Production

Only 0.5-1% loss

Refrigeration - End of life

- WEEE directive

- Efficiency of treatment

- 98% recovery of all CFC and HFC

- Environmental impact neutralised
*Market: 5 Mio RAC units sold per year in the EU – enlarged market*

- Energy consumption per year based upon EERAC study (RAC): 15,000 GWh
- Average Energy Efficiency: 2.4 (Cool Cap (W)/ Power consumption (W))

Very rapid expanding market, mainly in the South of Europe

**Room Air Conditioning Market in Europe**

Energy Efficiency of RAC’s marketed on the EU market

**Technical classification based on cooling (heating) cycle:**

*Indirect Expansion systems*

The refrigerant is used to cool/heat water and the water is used to cool/heat the room (or technical applications)
**Previous studies (EERAC – EUROVENT)**

In the EERAC study they used the Life Cycle Cost (LCC) approach like other technical SAVE studies. Four average EU products were extracted from a data basis of 2000 appliances by clustering. A key study aim was to analyse the technical options available to improve RAC energy efficiency and to appraise the economical implications of raising RAC energy efficiency using proven technical options in order to reduce the electricity consumption of room air conditioners.

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**Room Air Conditioning Market in Europe**

**Scenarios in which the heat transfer surface area is increased**
- Increased frontal coil area
- Increased coil depth
- Increased fin density
- Addition of sub cooler to condenser coil

**Scenarios in which the heat transfer coefficients are increased**
- Improved fin design
- Improved tube design

**Other scenarios**
- Improved fan efficiency
- Improved compressor efficiency
- Variable speed compressors
- Alternative refrigerants
- Electronic expansion valves
- Thermostatic cyclic (fuzzy) controls

**Result:**
- Improvement of +25% = better LCC
- Improvement of +35% = not always better LCC

---

**Room Air Conditioning Market in Europe**

**Start-up time reduced by 1/3**

- Ordinary method
- Inverter method

**Small temperature difference**

**Inverter**

**30% less power consumption**
Achieving the optimum policy balance

By stimulating DEMAND

Eco profile as a procurement specification

Incandescent  Halogen  FL/CFL  HID

Eco profile sets minimum required standard enforced by market surveillance authorities supported by industry.

By restricting SUPPLY

Investigate possible phase cut = Imp Measure
Amended Energy Label for eff/eco-design

Ultimate Goal
To achieve CO2 emissions savings of 24 million tons

What is 24 Mton CO2?

EUP-target: 24 Mton CO2/yr
=> annual consumption of 1.2 billion trees
=> 30,000 km² land planted each year
=> 85% of Holland each year

SAVE OUR CLIMATE

ELC ref.nr.050126
Ecodesign for Energy Using Products
Copiers/Printers

Henk Douven,
Océ-Technologies B.V.

Health, Safety and Environmental issues regarding copying and printing

PS&E issues

Safety
- heat
- dust
- emc
- vapour
- ozone
- noise
- copy / print

Environment
- electricity / energy maintenance
- paper
- toner
- packaging
- photoconductor
- worn parts
- equipment
- toner waste

Total life cycle

Development
- Manufacturing
- Use
- Remanufacturing
- Burning
- Landfill
- Recycled parts
- Virgin materials
Eco- and Energy labels

Driving force for improvement by Eco- and Energy efficiency labels (Since 1985 and is still a continuous process)

Environmental/ Energy labels
- Blue Angel
- White Swan
- Energy Star

Environmental awareness customers
- image of the product
- image of supplier
- requirements at buy

Competition
- offering ‘green’ products

Environmental achievements

What has been achieved?

Examples:
- Efficient paper-use by duplex-function as default
- Energy efficiency improvements (off-mode, sleep, standby, run)
- Improvement of the life time photoconductor
- Elimination of a lot of hazardous substances e.g. asbest, pcb/pct, freons, cadmium, mercury, pbb/pbde by RoHS from 1.7.2006 also lead and chromium6
- no carcinogenic, mutagenic or reprotoxic toner/ink
- Reduction of chemical emissions (VOC’s, ozone, dust)
- Reduction of Noise emissions

Environmental achievements

What has been achieved?

Examples:
- More reliable equipment: Reduction of maintenance visits (reduction of car-km)
- Recyclable design
  - ease of disassembly
  - parts are fit for re-use
  - materials marking and recyclable
- Reduction of packaging
APPENDIX IV: STAKEHOLDER EXPERT MEETING 28 APRIL 2005

- Minutes
- Presentations
  - VHK
  - ELC (street lighting)
  - CECED (refrigerators)
  - CECED (dishwashers)
  - CECED (vacuum cleaners)
Minutes of 2nd MEEUP Meeting, Brussels, 28-4-2005

Minutes 2nd MEEUP Meeting

Place: Holiday Inn - Brussels City Centre, Chaussee De Charleroi 38, Brussels
Time: 28.4.2005, 9.30h – 17.15h
Language: English
Organisation: VHK (service contract to the European Commission, DG ENTR)
Documents: www.eupproject.org

Participants

| European Commission | Michael Papadoyanakis | DG ENTR |
| Project team        | René Kemna (chair)    | VHK     |
| Project team        | Martijn van Elburg    | VHK     |
| Central Heating Boilers | Felix van Eyken | EHI     |
| Airconditioning     | Martijn Dieryckx      | Daikin Europe |
| Airconditioning     | Els Baert             | Daikin Europe |
| Lighting            | Berno Ram             | Philips Lighting |
| Lighting            | Gerald Strickland     | ELC Federation |
| Refrigerators       | Franco Moretti        | Whirlpool |
| Dishwashers         | Hans Beer             | BSH GmbH |
| Small appliances    | Matteo Rambaldi       | CECEd |
| Small appliances    | Florent Renaudin      | CECEd |
| Copiers             | Henk Douven           | Océ     |
| Copiers             | Yoshinobu Kuriyama    | Canon Europe |
| PC/laptop           | Reinhard Höhn         | IBM Deutschland |
| PC/laptop           | Ferdinand Quella      | Siemens AG |
| Televisions         | Martin Armishaw       | AEAT |
| Televisions         | (subst. P. Dolley)    | AEAT |
| Televisions         | Maarten ten Houten    | Philips CE |
| EPIC study          | Constantin Hermann    | PE Europe |

Excused:

| Circulators         | Niels Bidstrup        | Grundfos managament |

Draft Agenda:
  1. Opening, incl. minutes [9.00h]
  2. Environmental impact analysis (Task 1)
     a. presentation VHK of EuP EcoReport, company presentations (BOM, etc.)
     b. discussion and way forward
  3. Improvement potential (Task 3)
     a. presentation and discussion
  4. Interim report to the Commission
  5. Any other business [16.45h]
Point 1: Opening
The participants are welcomed by project leader René Kemna (RK). Niels Bidstrup is excused for his absence. The agenda and minutes of previous meeting are agreed.

A short tour-de-table allows ‘new’ experts to the group to introduce themselves.

Michael Papadoyanakis (MP) adds that the European Parliament recently adopted the Ecodesign Directive. Final text will be available shortly. MP mentions the wish of the Parliament to arrive at first Implementing Measures soon. First implementing measures are expected in the 2nd half of 2007. Andre Brisear (AB) adds that the Package of Amendments by the Parliament specifically mention a horizontal measure on standby energy consumption and an indicative list of product groups (allowing room for manoeuvring in selecting/identifying product groups). The Commission will soon start preparing Tenders for preparatory studies for specific product groups and the Terms of Reference will include references to the Methodology being developed here today.

RK introduces the documents that have been sent to the expert group for preparation of today. These contain:
- a 6 pages EcoReport;
- the Excel fill-in form;
- a memo on LCIA;
- three examples of Ecoreports;
- and a discussion paper on Task 3 (Improvement)\(^1\).

As a reminder RK presents some slides from the previous expert-meeting to introduce the project aim, tasks, working method, study outline, etc.

Point 2: Environmental impact (Task 1)
As regards data sources for materials RK shows that VHK encountered a broad range in outcomes of impacts associated with (the production of) 1 kg of certain materials (presented is the range in outcomes for 1 kg of steel with differences in certain impact categories up to 150%).

As regards the bill-of-materials (BOM) RK shows that on Jan 26 for most product groups at least one BOM was available. Today, for most of the product groups newer BOMs were made available or were discussed with industry. Only for circulators, small-medium copiers (check with Canon?) and RAC VHK expects some more/recent material to arrive. For televisions it was agreed with the stakeholder expert to use the existing BOM (CRT, LCD + tuner).

MP asks if the BOMs were circulated. RK replies they were not, but will be used in the Interim Report as far as possible.

Franco Moretti (FM) asks if in the EcoReport the recycling percentages/scenarios are based upon ‘future’ (WEEE/RoHS implemented) production and recycling. RK replies this has been applied as much as possible (e.g. metal recycling is established practice) but fore some materials VHK had to revert to ‘old’ data in lack of more current data. RK emphasises that all input from industry on this would be greatly appreciated.

\(^1\) DRAFT DISCUSSION PAPER FOR MEETING 28.4.2005, Least-Life-Cycle-Cost LLCC and Best Available Technology BAT
Reinhard Höhn (RH) enquires about the presence of halogenated materials in the recycling scenarios (lines # 93-97 of EcoReport). RK explains that this is a factor that might determine whether at the end-of-life you will classify a material as “incinerated” or “fit for thermal recovery”. Choices will have to be made for an end-of-life situation that lies far into the future and the lines 93-97, that are also a part of the EcoReport form, give every sector a means to determine its own scenario. The three scenarios that are offered in the explanatory notes just sketch some possibilities.

Constantin Hermann (CH) asks how recycling credits are accounted for in the life cycle (inventory of unit process). RK explains column 3 of the EcoReport indicator table (recycling %). CH wants to know why only for plastics some credits are given afterwards. This practice is not accepted within the EIC-study setting. RK explains that indeed the way VHK treats recycling is relatively new but definitely in line with what certain LCA-experts are saying (e.g. Bo Weidema, Jaco Huisman with QWERTY method). It is all a matter of supply and demand on the recycling market and what the most likely (economic) behaviour of the market actors will be. In the case of metals VHK assumes that – under WEEE conditions – there will be a 95% metal recycling, because metals are the easiest to separate in an economic (shredder based) recycling process. “If this is “always true” for metals and there is little a designer can do about it (apart from some general rules as indicated in the ECMA standard), why then don’t we give that credit right away and translate it in a reduced impact of the production of certain metal products. In that way we also work on the supply side of the recycling market and favour that the designer chooses those metal products that can absorb a high percentage of secondary scrap, like die casts. So, VHK has attributed the technologically maximum recycling percentage to the die-cast metal products, which is around 85% (not more, because virgin metal is needed to ascertain a correct composition of the alloy), instead of e.g. the max. 66% which would be current practice. In the EcoReport form the percentage of 95% metal recycling can be changed, but we assume 95%.

With plastics and electronics the matter is different: Recycling (to raw material) is much more difficult/ expensive. Removing hazardous materials so that the plastics fractions can be used as a fuel in non-hazardous incineration is much more difficult. And finally there is not the absolute necessity to recycle every thing to reach the WEEE rates, if 95% of metals are recycled and if the recovery percentage is high enough. In other words: here the designer has the choice. And this choice determines what fractions will end up as recycled(closed-loop or reuse), fit for thermal recovery, incinerated, etc..”

Martijn Dieryckx (MD) asks how relevant recycling is for EuP. RK replies it represents (in very general terms) approximately 1% of total impact (maybe more for electronics, maybe less for boilers).

RH finds the figures for thermal recycling in the 2005 practice misleading. RK replies that in the EcoReport tool thermal recycling is default and this is used for PC’s. It just wasn’t changed in table 6. (follows debate).

MP inquires whether it is the fraction of halogenated plastics that define hazardous waste incineration. RK says it is related but also depends on the type of waste, e.g. electronics is often defined as ‘mixed waste’ and then needs to be incinerated as “hazardous”. RH adds that with incineration always energy recovery takes place. RK replies that in principle this is true, but if the waste is hazardous incineration at much higher temperatures applies. E.g. in a US lab they have shredded a PC and found that in an incineration process the plastics contributed 17% to the total fuel consumption. You can say this is a 17% saving, but if the temperatures are much higher (850-900 oC) and therefore the energy consumption much
higher because it is “hazardous” you may question this type of fuel saving. In any case non-hazardous incineration is better. MP mentions that he has worked with the Waste Directive and can provide some input there [e.g. the distinction between R1 and R2 fraction]
Ferdinand Quella (FQ) describes the situation in Germany where shreddering in combination with copper smelting is now seldom applied, but may prove necessary in the future.

Maarten ten Houten (MtH) specifically mentions he will compare this study with previous Philips studies. CH mentions that his study accounts material recycling credits in a different way, on which consensus is achieved. He also could not find the recommendation (or message) for designers to use low-grade metals. RK points out the difference between die-cast (85% recycled) and galvanized steel sheet (5% recycled). FM also foresees open-loop recycling and confirms the specifications for (surface) quality determining choice for materials.

MtH inquires about sheet-metal scrap (line 207 in EcoReport-tool). RK replies 25% is presented as average, but users may adjust percentage if applicable / justified.

MtH wonders whether the recycling scenarios in the tool will penalize manufacturers over 120 years, since it is now known what decisions will be made in the next 10 years. FM repeats that the scenarios must be based upon legal reality as of 2006 in which 70% of material fraction (wt) has to be recycled. RK closes the discussion of recycling scenarios and repeats the call for all to take a critical look at the table and assumptions and react in writing.
MD asks why #67 (ground source heat pump) is included. RK replies that since electricity is already in there it is essentially not needed, but added to complete the picture of heating appliances. Gas-driven heat pumps are not included, but may be treated is similar way as other boilers (in GJ output). RK adds that VHK opted for EPER data for electricity instead of UCPTE..

FM inquires about “nw EU10” in table #61. RK confirms these are the Accession countries.

RK proceeds to the subject of LCIA (Life Cycle Impact Assessment). VHK has asked five LCA experts (C. Herman – IKP, Mark Goedkoop – Pré, Rolf Frischknecht – ESU, Gjalt Huppes – CML and David Pennington – JRC.) for comments and are currently awaiting their replies.

FQ states that only scientifically accepted impact methods exist for global warming and ozone depletion potential. In order to avoid problems with the results in the future he recommends a mechanism to discuss impact indicators.

RK confirms that for certain impact categories (e.g. toxicity) little scientific consensus exists. The choice for indicators based upon legislation is pragmatic but also reflects certain consensus, since science apparently was not able to convince legislators as regards “missing indicators”. RK adds that uncertainties of 15-20% apply to the overall results (due to use of averages etc.).

CH appreciates the approach and method, but feels it is “mixed up”. He recommends to follow a certain LCA-school like e.g. CML and make adaptations where necessary. RK explains the problem of what to do with opposing opinions, e.g. on toxicity. Also he asks CH to consider the opposite. Suppose that a methodology would go in a different direction than EU legislation? “Suppose that after many years of technical study, consultations, discussions
in Council and Parliament there is an air- or water quality directive that says that substance A is twice as polluting as substance B, how could we explain if we are using e.g. the opposite? A case in point is PVC, where many years of study have been invested with no clear result. Should we then be the one to say PVC should be included? “

MP - states that the Commission appreciates the innovative character of the VHK approach. Aim of the meeting is also to receive feedback from experts and result in a sound methodology, adapted to the purposes of the study.

Florent Renaudin (FR) introduces the consideration that weighting across categories is a political decision in the first place. MtH and RH state that impacts are science domain, but weighting is political. RK states that it is not the VHK assignment to weigh between categories like Global Warming and Acidification. “The question if it is better e.g. to have sick people than dead birds has been debated for decades and we are not going to give that answer. “Coffee break

RK proceeds with slides presenting overall EU impacts of the product groups cold appliances, PCs and vacuum cleaners as a possible conclusion of task 1 and 2. Task 3 involves the establishment of improvement potential.

RK proceeds with boilers and explains current LLCC (condensing boilers) and BAT. Calculations show that conversion from conventional to LLCC has payback times of 1 -4 years.

Felix van Eyken (FE) confirms condensing boilers as LLCC, but mentions that industry still invests in conventional technology as well. FE also points out the ‘system’ issues involved in energy use by boilers: oversizing (just as significant effect as conventional vs condensing), lack of knowledge / conservative practice, low sulphate is not a problem for the technology for oil condensing boilers. As regards the identification of LLCC FE marks out:

- Low NOx is not problem
- the nominal efficiency based on the lower calorific value are different for gas and oil fired boilers; correct achievable figures would be 106 % for gas and 101 % for oil fired appliances.
- industry agrees with full modulation and with weather controlled as LLCC
- savings on electric power consumption is too optimistic and the sector prefers double so high figures
- weight issue: might be feasible but safety must be considered
- biomass: not fully matured (problems after 2-3 years, related to fuel quality

RK asks for comments about biomass emissions. FE replies that as a technology pellet boilers are okay but the problem could lie in fuel supply (high costs). No comments on dioxin emissions.

RK asks for comments about market data. FE finds data are acceptable on gas boilers. FE mentions industry does try to follow shift to condensing (main markets NL, DE and UK) and sizing of new installations (not visible, contrary to what expected from higher insulation standards) and the trend to low-temp. heating (also significant savings), but the problem is that the statistics don’t show the savings in a sense of lower power per boiler

MD adds that boiler control is also an important factor. MD asks what the scope is. RK replies that the scope is limited to the product alone including the way it interfaces with the building system, but the system itself is not part of the scope .
Minutes of 2nd MEEUP Meeting, Brussels, 28-4-2005

MP returns to biomass emissions and offers his contacts in this field. RK explains focus on oil and gas, biomass is less than 1% of installed park.

MP asks FE about reduced profit margin on condensing boilers. FE confirms this and explains the related problems in new EU countries where conventional boilers are actively promoted. The sector has mixed feelings about this: 10-15% wants condensing, 10-15% is neutral, remaining 70% is conservative – probably due to mergers, so that they now want to avoid cannibalization within product palette. Also new for industry is offering of whole installations. End conclusion is that shift from conventional to HR can bring significant savings, but that equal or bigger savings can be achieved on the system level. When asked by RK on how industry feels about dealing with the bulk of emissions, FE replies that the industry regards itself more like the transport sector – with no reflection on impacts compared to other EuP.

MP asks FE for comments of LCC for boilers. FE agrees with LCC approach for products, but still sees problems on system level in market. FE says that the move towards condensing appliances was driven by the changes in the Building Regulations. Also heating only and combined boilers need to be treated separately. Gerald Strickland (ELC) mentioned that condensing market is driven by subsidies (UK example). MD would like to know the indicator values for pure gas as input for gas-fired heat pumps and asks how LLCC is prepared, what values will be used to assess costs and performance. RK replies that Eurostat figures will be used for electricity costs and interest rate. FE adds that product price is not installed price.

**Pumps**

RK explains that the central heating pump is probably the biggest single electricity user in the home. Good alternatives exist (variable speed drive, permanent magnet motors). FE adds that uptake in industry is very slow, also because of commercial reasons. FM adds that installer education is also important for uptake.

MtH asks whether this is still ecodesign? The options are already out there in the market. RK confirms that technology often isn’t the problem, but that the market standards have to be “pushed up”, so it makes more sense for manufacturers to look for a better product. CH agrees and confirms the importance of system design (which is a scope issue)

**Airconditioners**

RK mentions the apparent “battle of standards” regarding flame refrigerants in larger products. A new EU draft standard seems to give some leniency. But for certain amounts of refrigerants (> 300 g) non-flammable is still prescribed. MD mentions new type of refrigerant R32 – less toxic, non-flammable. MD also stresses that manufacturers will avoid problems with Liability and not give in on safety. Refrigerant choice is also cost issue: manufacturers either choose for non-flammable refrigerant or invest in energy efficiency. BATs are: inverter technology (market prices have changed completely and inverter is now very popular – but does not show in Energy Label due to fixed speed), controls, SR motor, linear compressors, heat pumps COP.

LUNCH offered by VHK

Airco c’t’d

MD mentions recent study by IPCC on greenhouse gasses, includes chapters on refrigeration (www.ipcc.ch).
Street lighting

Berno Ram (BR) explains current reference is high pressure mercury vapour lamp (HPL). LLCC is high pressure sodium and metal halide. Low pressure sodium is also efficient but no good colour rendering. Fluorescent is niche product. LEDs and PV-powered are not ripe. BR mentions the lack of focus on LCC at end-users: Although acquisition costs may be 4 to 9 times higher, payback times are usually expressed in months rather than years. A specification for minimal lumens/Watt would help. Exchanging conventional bulbs for efficient bulb may imply change of ballast and luminaire as well for best results.

RK and GS say BOMs of lamps are available now, and luminaires and ballasts will follow shortly. Both ELC and CELMA are working on this.

Personal Computers

RK starts presentation of LLCC and BAT. RH comments that values for standby power consumption of laptops are too high, and when corrected for more up to date data the savings potential will not be as large as presented on basis of older data. “The data are 80% wrong so the saving potential is 80% wrong”. RK explains that rounded data was gathered in a considerable effort when conceiving the EU Energy Star website, database and ‘Energy Calculator’ by the end of 2003. The Energy Calculator has been on the web and used for over a year without much comments. Furthermore, the standby energy consumption is not that influential on overall outcome anyway; the on-mode is much more influential because of the power management being disabled. RH disagrees, also because enabling of power management (PM) is higher than stated. RK explains sources for PM (misc. US surveys, pers. comm.. from energy agencies) and demonstrates on his own laptop the typical Power Scheme setting for “Office”, namely only display off after 20 minutes, never in standby, never HDD off and never hibernate. FQ and MtH also quote lower power consumption for Siemens PC and TV’s than reported by VHK. RK asks if the industry can supply EU surveys on power management. RH mentions that VHK should consult Mr. Stinglwagner (BMWi) for PM-use in offices because the sector has made comments also to the CEPE/Fraunhofer report. RH mentions that the estimates of CEPE/Fraunhofer were also too high. RH says that the latest data should be used because the sector is changing very fast.

Specifically on market data RK asks the industry to check and give feedback. Only few sources consider the sales of PC components for self-built PC’s as “PCs sold” and VHK had to calculate this share from stock-model considerations. If no other data is available within 2 weeks then the current figures will be used for market assessment.
RK proceeds with BAT, illustrated by minitiaturisation of PC’s (apple mini, PC on a chip, bump-chip, stacked die). CH agrees on general trend, but misses the link with the EcoReport-indicators. How is the EcoReport outcome linked to improvement potential? CH: minitiaturisation is not better persé. MP asks CH to elaborate on his project (follows an explanation of EPIC study). MtH mentions that improvement options are not independent. RH also misses the steps from EU impacts to improvement potential. RK replies that most of this is part of Task 3 and still to come. The information provided was intended as document to start discussions, not as “expert model” or as a final conclusion.

MP explains that followed methodology is in line with what is expected by the Commission. It will identify product characteristics relevant for the environment.

CH recommends that the analysis should allow tracing back of impacts to list of product features and that interaction of complex products should be avoided.

Copiers
Yoshinobu Kuriyama (YK) feels that application of electronic paper is outside of copier scope. Duplexing is already implemented in most machines, especially at those for higher copy speeds. RK explains that for standby energy consumption, this is probably most relevant for smaller machines (<10 cpm?) and paper use becomes more dominant the larger the machine. YK replies that duplex is default for machines > 45 cpm and optional for > 20 cpm in EnergyStar requirement, in case of German BlueAngel >45cpm default, >25 cpm optional. RK clarifies that “duplexing” in his list does not imply a duplexing unit to be bought as an add-on. It implies not only that a) it is always there and b) it should be very difficult to disable (e.g. at least 3 clicks down in a menu, comparable to the effort today to enable it).

RK asks Henk Douven for more information of paper use of large copiers. For smaller copiers VHK will make an appointment with Canon.

Televisions
MtH is okay with approach in general, but is critical about certain gaps and flaws: use of generic data introduces uncertainty – is this the general idea?. Further MtH would like to incorporate ‘sanity checks’ in the process and recommends to focus on important elements. RK confirms this is the approach taken and will be in contact with MtH for further remarks, especially on market data and LCD tv. MtH: LCDtv is not simply LCDdisplay plus tuner. Martin Armishaw offers to send a TV database, which is welcomed by RK.

MD asks what the final outcome of this process is: yes/no to CE declaration? RK replies that this study will not do that. It will result in a methodology/ indicators etc..

COFFEE BREAK

Refrigerators
FM presents some life cycle data to be used in BOM for refrigerators (see presentation). On HFC-free refrigerators FM mentions the policy is to avoid emissions (no explicit substance ban). MD adds that R600 may not be BAT in every application. Recommends to look at R32.

Vacuum cleaners
FR also presents some life cycle data to be used in BOMs. Problem in identifying BAT since no vacuum cleaner achieves test values (65% removal plus strokes count). The test by
Stiftung Warentest is different (measures % removal efficiency after a certain number of strokes). FR hopes to supply more data very shortly. Also test method has problems in repeatability. Difficult to relate energy consumption to performance.

**Dishwashers**
Hans Beer (HB) presents the dishwasher data and mentions an ongoing update of the GEA 95 study. Preliminary results of this are expected in June. Other issues discussed were salt-less machines (only tablets). Mr. Beer agrees on noise issue; “if we want to go further on noise reduction we have to consider that the additional insulation might have an environmental impact to be taken into account and weighted against the benefit of lower noise levels”. He would oppose further extension of cycle time. HB asks RK on the origin of the 25% improvement in energy consumption. RK reports this figure is not the result of a technical analysis of the improvement potential, but the result of a rough estimation, considering the average 2003 and the declaration of the best performing product advertised today.

All 3 CECED presentations present results of investigations on their electronics (controller board), which is very useful.

RK thanks all those present and closes meeting at 17.15h.

(Minutes: Martijn van Elburg, VHK)
Methodology study, Eco-design for Energy-using Products (EuP)
2nd stakeholders expert meeting, 28 April 2005, 9.30h – 17.00h

Draft Agenda:

1. Opening [9.30h]
2. Environmental impact analysis (Task 1)*,
   a. presentation VHK of EuP EcoReport, company presentations (BOM etc.)
   b. discussion and way forward
3. Improvement potential (Task 3)*
   a. Presentations and Discussions.
4. Interim Report to the Commission
5. Any other Business, incl. date next meeting in May. [16.45h]

Participants MEEUP Stakeholder Experts Meeting 28.4.2005, Brussels:

Felix Van Eyken, EHI (CH Boilers)
Niels Bidstrup, Grundfos (Circulator pumps)
Els Baerts, Daikin (RAC, subst. Jan Cluyse)
M. Dieryckx, Daikin (RAC, idem)
Berno Ram, Philips (Lighting)
Gerard Strickland, ELC (Lighting)
Maarten ten Houten, Philips (TV, subst. Schoemakers)
Rainhard Hoehn, IBM (PC)
Ferninand Quella, Siemens (PC)
Haris Douven, O&K (large Copiers)
Yoshinobu Kuriyama, Canon (small Copiers, subst. Persson)
Matteo Rambaldi, CECED (co-ord.)
Franco Moretti, Whirlpool (Refrigerators)
Florent Renaudin (Vacuum Cleaners)
Hans Beer, BSHG (Dishwashers)

Documents sent: Task 1 and 2

- Draft Agenda
- Task 1 and 2: EcoReport, Materials & Energy Indicators, Table and Notes
- EcoReport v2a, Excel form for All phases
- EcoReport, draft memo explaining weighting factors
- 3 Examples Task 1 and 2
- Discussion paper Task 3

The aim of this study (tender doc.)

…..is to contribute to the creation of a methodology allowing to evaluate whether and to which extent various energy-using products fulfil the above mentioned criteria.*

*= Such a methodology will be applied to products that have already been identified as relevant for certain environmental aspects and the volume of trade in the internal market in the context of other Community initiatives or policies such as the ECCP and the Eco-label.
Selected Products (tender doc.)

- Heating and water heating equipment (CH-boiler)
- Electric motors (CH Pump)
- Lighting (product to discuss)
- Domestic appliances
  - Refrigerators
  - Dishwashers
  - Small household appliance(s) (product to discuss)
- Office equipment (copier)
- Consumer electronics & ICT equipment (PC’s, including portables, input EPIC)
- Ventilating/air conditioning equipment (RAC)
- TV’s (input from JRC TV)

Tasks (tender doc.)

1. Environmental Analysis
2. Market Analysis
3. Assessment Improvement Potential

1. Environmental Analysis Approach (tender/offer)

- ‘Cradle-to-grave’: Production, distribution, use, end-of-life phases
- Simplified LCA, principles ISO 14040 series
- Impact categories proposed by the Commission
- Subtasks: Data retrieval, data analysis, reporting on data availability and methodology
- Primary data sources used are EU dossiers such as WEEE, RoHS, SAVE, Ecolabel, IPP, IPPC, etc.
- Consistency with legislation

1. Environmental Impacts, Resources

- Energy consumption
  - primary Gross Energy Requirement in MJ
  - electricity share (converted to primary)
- Water consumption in m3
- Material use (in kg), incl. recycling credits
  - Metals (St, Al, Cu)
  - Plastics (PE, PP, PS, etc.)
  - Others (glass, electronics, etc.)
- Waste generation
  - to landfill
  - to incinerator
- Hazardous waste generation
  - ROHS (exceptions)
  - non ROHS (voluntary list)

1. Environmental Impacts, Emissions

- Emissions to air
  - greenhouse gases (GHG, CO2-eq.)
  - acidifying agents (SO2-eq., incl. NOx, also eutroph. NH3)
  - volatile organic compounds (VOC)
  - ozone depleting substances (ODP, CFC-11 eq.)
  - persistent organic pollutants (POPs, e.g. PCB’s, dioxins)
  - heavy metals (As, Cd, Hg, Ni, Pb; also PAHs)
  - particulate matter (PM)

- Emissions to water
  - heavy metals (Cd, Hg, etc.)
  - substances affecting oxygen balance (P, N, BOD, COD)
  - persistent organic pollutants (List I substances)

- Other product specific

2. Market Analysis Approach (tender/offer)

- Identification/classification of appropriate product groups
  - standards, statistics, EU legislation
- EU production, intra/extra-EU trade, consumption
- Subtasks: Data retrieval, data analysis, reporting on data availability and methodology
- Primary data sources: Eurostat and publicly available market data sources
3. Improvement Potential Approach

- Theoretical best potential (BAT, ‘Best Available Technology’)
- Economic/social etc. feasible potential:
  - LLCC approach (‘Least Life Cycle Costs’) or comparable
  - Manufacturer and consumer impact analysis
- Focus: 2007-2008
- Primary data sources: LCA-studies, SAVE studies, manufacturer publications, VHK engineering expertise.

Project Planning 2005

- Stakeholder expert meeting Jan. (environmental market)
- Stakeholder expert meeting April (improvement potential)
- Interim Report May (tasks 1 and 2)
- Commission workshop Sept.-Oct. (draft results)
- Final report Nov.-Dec.

Task 1 (presented 26 Jan.)

Environmental Impact Analysis

Data Required

<table>
<thead>
<tr>
<th>LCI-design</th>
<th>LCI-unit processes</th>
<th>LCIA-weighting</th>
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<tr>
<td>e.g. in kg material used or kWh consumed</td>
<td>e.g. in emissions/kg material</td>
<td>in e.g. impact/kg emissions of type a, b or c (as defined in Commission table)</td>
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</table>

TOTAL IMPACT PER CATEGORY PER PRODUCT

Eligibility Criteria

COMPARE to total EU emissions/resources (part of)

ELIGIBILITY CRITERIA for EuP-directive

Data Required per Life Cycle Phase

<table>
<thead>
<tr>
<th>LCI-design</th>
<th>LCI-unit processes</th>
<th>LCIA-weighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. in kg material used or kWh consumed</td>
<td>e.g. in emissions/kg material</td>
<td>in e.g. impact/kg emissions of type a, b or c (as defined in Commission table)</td>
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Materials

Production & manufacturing

Distribution

Use

End-of-life

COMPARE to total EU emissions/resources (part of)

ELIGIBILITY CRITERIA for EuP-directive
**Data Sources**

- Full LCA tools (SimaPro 6, Gabi 4, etc.), databases (Ecoinvent 2003, Idemat 2001, BUWAL-250, Gabi 4, etc.) and weighting methodologies (Eco-Indicator 99, CML 2000, EDIP '97, etc.)
- Simplified LCA tools, (Eco-It,EcoScan, EIME, KEPI)
- Legislation and background reports from EU environmental and energy-related legislation. (IPPC BREFs and SAVE)
- Industry associations (APME, IISI, EuroCopper, Eurelectric, etc., for production. EICTA, CECED, EHA, Eurelectric etc., for consumption).
- Other literature sources(EU Ecolabel, Blue Angel and Nordic Swan), product-LCA studies, etc.
- Physical VHk product-analysis, disassembly for ‘BOM’
- Experts , both inside and outside the EuP stakeholder expert group

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**Full LCA emissions comparison from various sources**

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<th>Substance</th>
<th>unit/kg</th>
<th>CRF</th>
<th>Ecoinvent 99</th>
<th>Ecoinvent 2003</th>
<th>IPCC BREF</th>
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<th>weighting factor</th>
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<td>0.63</td>
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<td>20.18</td>
<td>26.63</td>
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<td>mg</td>
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<td>Nickel</td>
<td>mg</td>
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<td>PAH</td>
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<td>3.00</td>
<td>0.06</td>
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<td>Dust (PM10)</td>
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<td>0.58</td>
<td>0.00</td>
<td>9.21</td>
<td>3.25</td>
</tr>
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**BOM’s available 26.1.2005**

- CH-Pump UPS 25-40
- CH-boiler, gas-fired, Nefit Turbo 90, single, 21 kW
- Refrigerator, table-top, no freezer comp.
- Dishwasher, Bosch Day&Night 56M22B
- TV B&O Beovision LX550
- PC Displays: NEC 17” CRT, Cannon 15” LCD
- PC Dell 2.8 GHz P4 with CD/40 Gb HB/FD/’17’FPD
- Copier Rank Xerox XC855, table-top B&W analog, 8cpm
- RAC Amcor AC 7200 M, 2120 W cooling cap. (& Hitachi)
- Lamps misc. (general), D1-35W (detail), Ballast car

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**Task 1 (new 28 April)**

**Environmental Impact Analysis**

**LCI (BOM etc.)**

- LCI Unit Process emissions and resources (per kg)
- LCIA (weighting factor)

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**LCI: BOM’s available 28.4.2005**

- CH-Pump updates by Grundfos : UPS (fixed) and Alpha Pro (BAT)
- CH-boiler, EHI update: Gas- & oilfired, wall-hung & floor-standing
- Refrigerator, CECEd data, analysis EU Ecolabel
- Dishwasher, BSHG update on materials fraction
- TV B&O Beovision LX550, PC Displays: NEC 17” CRT, Cannon 15” LCD
- PC: VHk disassembly & analysis components
- Copier Rank Xerox XC855, table-top B&W analog, 8cpm (large copier LCA by Océ, small copier ?)
- RAC Amcor AC 7200 M, 2120 W cooling cap. (& Hitachi)
- Street lamps: Light source data available (ELC), reflectors and ballast will be provided (Philips/ELC/CELMa)

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**LCI: Other data available 28.4.2005**

- Most usage data available from SAVE studies, VHk analyses, etc. or from manufacturers.
- For main market data: idem (EU Sales, EU Stock in units; prices and trade figures less reliable but sufficient)
- Possible exceptions: Products with highest uncertainty regarding data are
  - Copiers
  - Room Air Conditioners
- Data for recycling 2010-2020: VHk default scenario (see EuP EcoReport)
LCI: Unit processes (Table & Notes)

- Eup EcoReport: Table Unit Processes generated, aiming at highest consensus. Expect comments and reviews by various materials sectors in coming months.
- Emission and resources data mainly from:
  - Industry associations (APME, IISI, Aluminium Inst., etc.)
  - Commission reports (EPER, IPPC, European Dioxin Inventory)
  - Manufacturer's environmental reports
- Data relate to average EU/Global technology 2005/2006
- Continuous update necessary, esp. regarding electronics
- Data: horizontal quality, using most informed, recent and transparent public source
- Data: vertical quality, allowing fair comparison between potentially competing materials and processes

LCIA: Weighting Factors

Table 1: Weighting factors per category

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<th>Category</th>
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<th>H</th>
<th>S</th>
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<tr>
<td>Waste</td>
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</tbody>
</table>

EuP EcoReport (Excel fill-in form)

- Examples
  - Product name: Vacuum Cleaner (VHK estimate avg. EU-25)
  - Author: VHK/RK
  - Draft 2a

Annual Impact (prod/use) Cold PC Vacuum

- Resources & Waste
  - Total Energy (GER) PJ: 1153 983 170
  - Water (process) ml: 106 90 15
  - Waste, non-hazardous/landfill t: 3156 453 12
  - Waste, hazardous/incinerated t: 272 202 83

- Emissions (Air)
  - Greenhouse Gases: CO₂ eq. Mg: 52 49 7.7
  - Acidification: SO₂ eq. kg: 30 349 52.8
  - Persistent Organic Pollutants (POP): g: 8 30 14.5
  - Heavy Metals: μg: 175 124 25.5

- Emissions (Water)
  - Heavy Metals: μg: 7 6 5.4

- Eutrophication
  - Phosphorus: kg: 1 1 0.1
**Task 3**

Environmental Improvement Potential

Discussion Paper

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**CH – Boilers: LLCC**

- Low-Nox
- Condensing, nominal efficiency >106%
- Good part-load efficiency
- Modulating (at least in 4 steps) burner going down 25%,
- Boiler temperature weather-controlled,
- Electronic control <5 W, Pre-mix fan < 20 W,
- Product weight (18-21 kW type); minus 15-20%.
- Extra demand for oil-fired CH: Optimized for low S fuel.
- Extra demand bio-mass/solids: Limit dioxins, PAHs, SO2/NOx, PM.

Saving: > 20% (fossil fuels & emissions), >30% electricity (excl. pump)

---

**Condensing Boiler (>106%, + € 120)**

1. Flue almost dry at the chimney exit
2. Sealed and corrosion resistant chimney
3. Insulation
4. “Primary” heat exchanger
5. Return water
6. Flow water
7. “Secondary” heat exchanger area
8. Fan
9. Trap

---

**Replacing Chimney 1 (+ € 116)**

Payback 1 year

Vertical flue terminal

---

**Replacing Chimney 2 (+ € 131)**

Move boiler + horizontal flue terminal

Payback 1 year

---

**Replacing Chimney 3 (+ € 389)**

Plastic innerliner (e.g. M&G)

Payback 3-4 years
Best Boiler & System Control

Heat demand of the dwelling (transm. & vent. Losses)

1 – 2 kW

Heat supply by the CH boiler & system

1 – 2 kW

100% on-off

Heat demand of the dwelling (transm. & vent. Losses)

1 – 2 kW

Heat supply by the CH boiler & system

Time

Modulated back to 30%

Heat demand of the dwelling (transm. & vent. Losses)

1 – 2 kW

Heat supply by the CH boiler & system (30% part load)

30% + good boiler temperature control

Heat demand of the dwelling (transm. & vent. Losses)

1 – 2 kW

Heat supply by the CH boiler & system (30% part load)

CH – Boilers: BAT

- Gas heat pump eff.=130%
- Electric ground source heat pump GSHP (net COP=2.5-3), efficiency on primary energy also 130%
- Micro-CHP if high-quality (system eff. >120-130%)
- Wood-pellet CH (high CO2-savings, bad for AD, POP, PM, VOC, PAH’s but still the best of all biomass CH)
- Solar thermal, mainly for hot water (CH combi) and mainly for South EU.
- Saving vs. average: >40%

MEEUP Project, VHK for Commission, 28 April 2005
**CH – Boilers: Eco-Design focus**

- Avoid cold bridges and thermal standby-losses: insulating rings and sockets in tube-connects
- Avoid start-stop losses: control regime (low temperature heating)
- Lambda-control, esp. for biomass
- Weight-saving through integration of components, use of polymer and metal die casts, wall-hung instead of floor-standing constructions, etc.
- No Pb-based solder in Cu-boilers (RoHS)
- Electronics: see PC’s for guidelines
- Recyclability is already high. Take care of compatibility of large plastic parts. Design for easy disassembly of electronics parts.

**CH – Circulators: LLCC & BAT**

- LLCC: Variable speed drives
  - Saving: >30%
- BAT: High-efficiency pumps (permanent magnet DC)
  - Saving: > 50%
- Design focus:
  - Type of variable speed control (V, f)
  - Motor controller
  - Motor technology

**Room Air Conditioners: LLCC & BAT**

- LLCC: COP chances as indicated by Daikin, 26 Jan (saving >30%). For larger units no alternative for R134a yet. For quantities of refrigerant <300 g, e.g. portable and pre-sealed single room RACs (< 2 kW), propane can be used (new Cenelec standard EN 60335-2-40 prAD).
- BATs: High temperature cooling, e.g. cooling ceilings, cool ventilating radiators (ClimaRad), Ground Source Heat Pump, etc. (savings > 50%).

**Design Focus:**
- R134a vs. propane/isobutane (battle of the standards)
- Refrigerant leakage (%)
- Variable speed, part load efficiency (linear compressors)
- See also refrigerator
Street Lighting

- LLCC: Replace high-pressure mercury lamps by high-pressure sodium lamps or metal halide (incl. reflector, ballast).
  Savings on electricity and Hg: >50%
- BAT: Low-pressure sodium (saves >70%) - LED&PV but limited applicability for both.

Personal Computer Systems (incl. Notebooks)

- LLCC: Energy Star negotiations now focused on 50 W in "on-mode idle", off-mode <2 W, which is still a bit cheaper on average than BAT. Power management, Weight saving & recyclability
  Saving: >40-50%
- BAT: Duty cycle energy use< 25 W ("on-mode idle" 18 W), off-mode <2 W
  Saving: >70%

Personal Computer Systems (incl. Notebooks)

Eco-design focus (apart from energy):
- Product weight & size reduction in general (relatively high impact vs. use phase),
- Power management,
- Increase density of packaged product, e.g. by more robust design (minimize packaging and logistics impact),
- Reduction –where possible—of Gold/PGM use in chips, interconnects, certain SMD’s, etc.,
- Design to enable (semi-) additive techniques instead of subtractive (etching) for semi-conductor manufacturing, keypad-PWB’s etc.

Personal Computer Systems (incl. Notebooks)

- Miniaturisation and design integration (SoC, integrating CPU with Northbridge/ Southbridge/ cache etc.)
- Efficiency of power supply (> 80% also in part load, following EU CoC/Energy Star) and VRM (Voltage Regulator Module)
- Use of LCD (pending feasibility of long-life OLED) instead of CRT,
- Avoid/reduce Hg in LCD backlights (e.g. LED-arrays instead of CCFL’s).
- Optimise battery type (notebooks only), nano-CHP
- Solid-state memory instead of HDD ?
- Use of smart PWB’s (3D microvia, robust, lightweight, good thermal design, etc.). Allow flexibility in design specs to enable purchase from the environmentally best OEM (large differences)
- Lead-free solder, avoid alternatives with precious metals

Apple Mac Mini

(desktop $ 499)

'Mode idle' 18.3 W
off-mode 0.8 W
standby 3.2 W
full load ca. 35.0 W

Mac Mini board
**Copiers**

- LLCC: Duplexing mandatory and default. Saving: 25 to >50% on impact (on average)
- BAT: Electronic "paper". Saving: >80%

**Eco-design focus (apart from above):**
- Toner composition and use
- Ozone emissions during use
- Energy consumption (EU Energy Star draft duty cycle)
- Waiting time reduction (fix. Unit), background power management
- Product weight reduction (relatively high impact for small residential applications)
- Recycled paper use

*Electronics: see PC’s.*
**Simplex = Duplex speed**

Double-sided as fast as single sided copying

---

**Television sets**

- **LLCD:** Up to 21" LCD is competitive and saves 10-50% depending on screen size (the smaller the better)
- **BAT:** Most recent 32" models LCD are claimed to save over 32" CRT (QED). >42" LCD (7.5 G fabs) starting up.

New technologies available starting 2006 - 2007 (e.g. OLED, product life still too short for TV's, etc.)

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**Television sets**

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**Overall display market grows but CRT-TV declines long-term**

- **World TV display market, in rear:**
  - LCD: 2002-2006: 70% growth
  - PDP: 2002-2006: 100% growth
  - CRT: 2002-2006: 40% decline

---

**TFT-TV and PDP show strong growth in the coming years**

- Market development (Q1-Q4)
  - 2003:
    - 32" LCD: 4.7 M units
    - 36" LCD: 1.6 M units
    - 42" LCD: 0.7 M units
  - 2004:
    - 32" LCD: 7.1 M units
    - 36" LCD: 2.1 M units
    - 42" LCD: 2.7 M units
  - 2005:
    - 32" LCD: 11.4 M units
    - 36" LCD: 3.5 M units
    - 42" LCD: 6.9 M units
  - 2006:
    - 32" LCD: 17.2 M units
    - 36" LCD: 5.1 M units
    - 42" LCD: 10.2 M units

---

**LCD sets**

- **LCD TV 32" (81 cm) diagonal**

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated Energy Consumption kWh/yr</td>
<td>25</td>
<td>305</td>
<td>131</td>
</tr>
<tr>
<td>VHK estimate standby power W</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>VHK estimate &quot;on&quot; power W</td>
<td>170</td>
<td>204</td>
<td>85</td>
</tr>
</tbody>
</table>

*source: Philips Sustainability Report 2004

*a according to test standard of ca. 50-100 cd/m2, energy use at factory setting is >40-50% higher, annual consumption according to EU standard (Voluntary Agreement), 32" tv ab 6.4 h on
**CRT sets**

<table>
<thead>
<tr>
<th>CRT TV 29&quot; (73 cm) diagonal</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated* Energy Consumption kWh/yr</td>
<td>265</td>
<td>262</td>
<td>215</td>
</tr>
<tr>
<td>VHK estimate rated standby use W</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>VHK estimate rated &quot;on&quot; use W</td>
<td>176</td>
<td>188</td>
<td>138</td>
</tr>
</tbody>
</table>

Source: Philips Sustainability Report 2004

*according to test standard at ca. 80-100 cd/m²; energy use at factory setting is >40-50% higher, annual consumption according to EU standard (Voluntary Agreement), 20 hr sb & 4 h on

---

**Refrigeration**

LLCC: Extending the line from the past will be the most economical: Presently fleet average with an Energy Index 65 and an aim of EI=55 in 2008. Extending to EI=50 (i.e. efficiency improvement of 50% vs. 1990) in 2010. Saving: 23%

BAT: For refrigerators and refrigerator-freezers EI=28. For freezers EI=32 to 36 (depending on type). Saving on average 2004: >50%

Eco-design focus:

- R134a side-by-side → HC, see also RAC’s
- Alternative compressor designs, esp. for large volumes (linear, variable speed)
- Special allowance for multi-door fridge/chiller/freezers (extend to “A”)
- Alternative insulation options, Evaporator/condensor design
- Commercial refrigeration: refrigerant leakage, cabinet covers

---

**CECED Stock Model 2001**

**Refrigerator Realistic, P=15, 12, 10 years**

**Freezer Realistic, P=15, 12, 10 years**

---

**Side-by-side**

with HC refrigerant and Linear compressor

R600a, up to 250 W cooling (CECOMAF)

Savings claimed up to 30% (with R134, HC less)
**Vacuum Cleaners**

**LCC**: Energy/CO2 saving >50% (500-750 W)

**BAT**: Energy/CO2 saving >70% (300 W)

**Eco-design focus (apart from above):**
- Product weight/size reduction (relatively high impact suspected, QED)
- Dust (PM) and noise (largely available technology)
- Filters and bags consumption (probably small problem, but to be taken into account)
- Minimum cleaning performance definition (EN 60312)
- Fan efficiency and control alternatives (CEMEP EFF1)

**Dishwashers**

**LLCC**: Further reduction of water and energy by 25% vs. average (up to 12 ltrs/cycle). Noise is already far below legal standard.

**BAT**: As LLCC. Dishwasher has lower environmental impact than hand-dishwash (Uni Bonn), so hand-wash is no BAT.

**Eco-design focus:**
- Promote dishwash vs. handwash (lower env. impact), e.g. through lower price.
- Optimise detergent dosage (avoid consumer overdosing by using fixed-dosage solutions like tablets or applying automated dosing systems)
- Noise (problem largely solved, but needs to be firmed up)
- Water and energy (see LLCC)

---

**CECED Stock Model 2001**

**Eco-Design: Inspiration for Innovation**

- **Design for Real Demand** (beyond the Maximum Demand Spec)
- **Small Is Beautiful** (Schumacher, 1973)
- **Think in Systems** (beyond the strict product definition)
- **Care for Precious** (materials are even more eco-expensive than their money price-tag suggests)
Interim-Report (May)

“...Deadline for the Interim report is May 2005. The selection of the representative products from the product categories listed will have been accomplished. Contacts with relevant stakeholders will have been established. Information sources for carrying out tasks 1-3 and possible information gaps will have been identified, as well as reliable ways for complementing these gaps. The methodological approach must be well developed...”
Street lighting

Energy Efficient Alternatives for Mercury Vapour Lamps

HPL and its alternatives

HPL = High Pressure Mercury (Ra 46)

- Low Pressure Sodium (Ra NA)
- High Pressure Sodium (Ra 25)
- Ceramic Metal Halide (Ra 20 - 70)
- Low Pressure Fluorescent (Ra 50 - 90)

High Pressure Sodium and Ceramic Metal Halide are the most suitable alternatives

HPL-N (mercury vapour lamps)

- Weight lamp-luminaire: 6.6 kg
- Lamp power: 125W
- Luminous flux: 6200 lm
- System power: 144W
- System efficacy: 43 lm/W

Electromagnetic ballast: EM

PM: light efficiency due to optics
MASTER SON-T PIA Plus  
(High Pressure Sodium Lamps)

- Weight lamp-luminaire: 6.8 kg
  - Lamp power: 70W
  - Luminous flux: 6600 lm
- System power electronic: 81W
  - System efficacy: 82 lm/W
  - System power EM: 88W
  - System efficacy: 75 lm/W
PM: light efficiency due to optics

CosmoWhite  
(Ceramic Metal Halide)

- Weight lamp-luminaire: PM kg
  - Lamp power: 60W
  - Luminous flux: 6600 lm
- System power: 67W
  - System efficacy: 99 lm/W
Electronic Ballast
PM: light efficiency due to optics

---

Energy Savings

<table>
<thead>
<tr>
<th>Lamp Technology</th>
<th>Ballast Technology</th>
<th>System Efficacy (lm/W)</th>
<th>Energy Saving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mercury Vapour</td>
<td>Electromagnetic</td>
<td>43</td>
<td>reference</td>
</tr>
<tr>
<td>High Pressure Sodium</td>
<td>Electromagnetic</td>
<td>75</td>
<td>42%</td>
</tr>
<tr>
<td></td>
<td>Electronic</td>
<td>82</td>
<td>48%</td>
</tr>
<tr>
<td>Ceramic Metal Halide</td>
<td>Electronic</td>
<td>99</td>
<td>57%</td>
</tr>
</tbody>
</table>

Additional 10-15% savings for optics Ceramic Metal Halide due to compact design

---

Saving Money

Total cost of ownership

- Electricity cost
- Lamp Replacement/Cost per annum

70W high-pressure sodium lamp
125W Mercury lamp
Improvements - Commitment goals

Hard target
• Stop producing/importing refrigerators EEI = 75 by 31st December 04
• Stop producing/importing chest freezers EEI = 90 by 31st December 04

Fleet Target
• Weighted Average for each participants EEI <= 57 (or <= 55 if supported by EU frame effective market transformation tools) by 2006

Soft Target
Join effort with consumers to save energy:
• Appropriate size of refrigerators with regard to the household size
• Rational use of the appliance
• Manufacturers/Authorities common programmes to promote efficient use

Refrigeration – CECED vs Notary data

Very high convergence
Improvements vs VHK

Progress report on CECED commitment is in line with VHK proposals

Proposals of VHK
• Present: fleet average with an Energy Index 65
• 2008: aim EI=55
• 2010: aim EI=50
Electronics

<table>
<thead>
<tr>
<th>Penetration</th>
<th>more than 90% of DW has electronic control units. Of these:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- with LED &gt; 90%</td>
</tr>
<tr>
<td></td>
<td>- with LCD &lt; 10%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Size/Layers</th>
<th>equal share of 1 to 2 layers size of layer appr. 150 sqcm 80% size of layer appr. 300 sqcm 20%</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Lead</th>
<th>lead-free soldering introduction in early 2006 to comply with RoHS</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Palladium</th>
<th>the used NTC sensors, capacitors and interference suppressors are free of palladium</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Gold</th>
<th>no gold plated connectors or contacts</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Others</th>
<th>- the majority of all devices is equipped with &quot;switched power supplies&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- less than 20% of all units are equipped with traditional electronic parts, more than 80% with flip-chip (SMD) parts</td>
</tr>
<tr>
<td></td>
<td>- all have IC devices</td>
</tr>
</tbody>
</table>

Improvements (1)

Promote mechanical dishwashing vs. hand dishwashing
- lower environmental impact
- lower costs for consumers (including machine price and use phase)
- higher penetration: environmental performing products promoted through public financial incentives

Current investigation to update the GEA study (1995)
- what has been done from '95 till today?
- which technologies have been implemented?
- which technological options have still to be fully exploited?
- are there new technical options widely accessible?

Promote innovation in correlated fields (e.g. use of detergents)

Improvements (2)

Additional remarks
- significant cost increase for DW due to marginal improvements have to be avoided
- all decisions should target customer expectation
- extended cycle time & compromise on washing and drying quality should be avoided
Questions

• Is 25% reduction in energy usage and water consumption based on a scientific investigation?

• Is this figure only an indicative target to test the methodology?

• On which base LLCC and BAT are equal?
Vacuum cleaners
28 April 2005

---

**Title**

BOM - Electronics

<table>
<thead>
<tr>
<th>Penetration</th>
<th>Nearly 40% of small appliances has a PCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size/Layers</td>
<td>size: average size is 60x60 mm</td>
</tr>
<tr>
<td></td>
<td>Number of components &lt; 50 components</td>
</tr>
<tr>
<td></td>
<td>Mostly in single layer</td>
</tr>
<tr>
<td>Lead Palladium &amp; Gold</td>
<td>Lead will be no longer used (RoHS)</td>
</tr>
<tr>
<td></td>
<td>No palladium capacitors &amp; no gold plating</td>
</tr>
<tr>
<td>Others</td>
<td>Big components: relays, switches, potentiometers, triacs, thyristors, and more and more LCD like in mobile phones…</td>
</tr>
<tr>
<td></td>
<td>Integrated circuits: like in mobile phones, but no more of 1 or 2 units</td>
</tr>
</tbody>
</table>

---

**Title**

Improvements – Work within CECED

Energy labelling for VC

But … environmental impacts (e.g. energy consumption) must be reduced, but linked with a good efficiency…

Main issues of VC eco-design:

- Definition of cleaning performance (on carpets, on hard floor) : dust pickup, etc …
- Measurement of cleaning performance
  - Repeatability of tests
  - Tolerances

---

**Title**

Question

“Earlier tests have shown than an energy consumption of 80-150 Wh was enough”

- for which dust pickup (wilson carpet / hard floor)
- how many strokes to reach a good cleaning ?
- …
APPENDIX V: COMMISSION WORKSHOP 3 OCT. 2005

- Minutes
- Presentations
  - VHK Methodology
  - VHK Special Subjects
  - ELC Case Street Lighting
  - VHK Product Cases
Minutes MEEUP Workshop (v.2)

Place: Centre Borschette, Brussels
Time: 3.10.2005, 10.00h – 16.30h
Language: English
Organisation: European Commission, DG ENTR
Documents: www.eupproject.org

Pre-registrations for attendance (as sent 28.9.2005 by mrs. Zeliha Topak DG ENTR)

See appendix.

Agenda (as sent by Mrs. Garcia Lopez, DG ENTR on 21.9.2005)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.00 – 10.20</td>
<td>Opening remarks by H. Zourek, Acting Director General of DG Enterprise and Industry</td>
</tr>
<tr>
<td></td>
<td>Introduction and aim of the workshop</td>
</tr>
<tr>
<td>Moderator of the morning session : L. Montoya, Head of Unit DG ENTR H5, Mechanical and Electrical Equipment</td>
<td></td>
</tr>
<tr>
<td>10.20 – 11.00</td>
<td>Presentation of the draft final report (VHK)</td>
</tr>
<tr>
<td>11.00 – 11.15</td>
<td>Coffee Break</td>
</tr>
<tr>
<td>11.15 – 11.30</td>
<td>Illustration of the use of the methodology on a particular product</td>
</tr>
<tr>
<td>11.30 – 12.30</td>
<td>Special topics</td>
</tr>
<tr>
<td></td>
<td>approach used for the assessment of the environmental impact, in particular weighting factors and recycling credits</td>
</tr>
<tr>
<td></td>
<td>indicators for assessing fulfilment of Article 15 criteria</td>
</tr>
<tr>
<td>12.30 – 13.30</td>
<td>Lunch Break</td>
</tr>
<tr>
<td>Moderator of the afternoon session : M. Spiliopoulou, Deputy Head of Unit DG ENTR H5, Mechanical and Electrical Equipment</td>
<td></td>
</tr>
<tr>
<td>13.30 – 14.30</td>
<td>Special topics (continued) Best Available Technologies (BAT) and Least Life Cycle Costs (LLCC) ¹: Discussion of the concepts in the context of the illustrative product cases.</td>
</tr>
<tr>
<td>14.30 – 16.30</td>
<td>Reply to questions sent in writing ahead of the workshop and not yet addressed during the workshop (VHK and Commission services). Other questions /Closing remarks</td>
</tr>
</tbody>
</table>

Minutes MEEUP Workshop 3 Oct. 2005

Mr. L. Montoya, Head of Unit DG ENTR H5, Mechanical and Electrical Equipment leads the morning session. He welcomes the attendants and introduces the agenda.

Mr. H. Zourek, Acting Director General of DG Enterprise and Industry provides the opening remarks. In this he briefly sketches the history of the making of the EuP Directive, which he considers a kick-off in a new regulatory era, the guiding principles and aims of the Directive: EuP aims at the sustainable development of a vast range of products, many of which are key

¹ Concepts of Best Available Technology (BAT) and Least Life Cycle Cost (LLCC) are explained in the Draft Final Methodology Report.
to our prosperity and well-being. It will contribute to this objective by ensuring that environmentally improved, energy-efficient products are granted free movement in our internal market. It introduces an integrated and holistic way to address the product’s environmental performance, thus avoiding the risk of focusing in a fragmented way on particular environmental aspects or phases of the product’s life cycle.

Mr. Zourek indicates that it was of utmost importance that a balance between striving for environmental perfection and at the same time maintaining the principles for the internal market had to be struck. Feedback from stakeholders is very important. EuP leaves adequate room for voluntary agreements and at the same time allows speedy decision-making.

Mr. Zourek says that the interinstitutional discussions were not always easy but now that EuP is adopted we must show that it works. The Commission needs a methodology for the implementation of the Article 15 criteria, which is coherent, transparent, scientifically sound but also efficient and pragmatic. Important elements of the methodology are the identification of economical aspects and the room for (environmental) improvement. In this context it is very important that realistic and practical LLCC and BAT levels are identified, e.g. not solutions that have only worked once in a laboratory. The methodology should be a common basis, a guiding line, to be further refined for each product.

He concludes that today is one of several opportunities for industry and other stakeholders to discuss the methodology. More detailed studies will pave the way for deciding whether and which kind of implementing measures are justified or necessary. The fact that certain products have been selected to illustrate the methodology does not mean these products will be necessarily the subject of implementing measures at a later stage.

Mr. Montoya introduces Mr. Kemna, project leader of MEEUP.

Mr. Kemna (VHK) presents the main elements of the methodology and briefly discusses the choices that were made during the development of the methodology. [This presentation can be downloaded from the website www.eupproject.org: VHK_Presentation Draft Final Report]

After the coffee break Mr. Kemna continues with the last slides of the methodology-presentation, before giving the floor to Mr. Ram, for ELC, who demonstrates the use of the methodology in the product case "street lighting" [presentation ELC Presentation Case Street Lighting can be downloaded from the website www.eupproject.org].

After the presentation by Mr. Ram, Mr Kemna provides more details on certain methodological elements of the environmental impact assessment. [download VHK Presentation Methodology Special Topics at www.eupproject.org].

From 12.30 hr to 13.30hr the meeting is interrupted for lunch.

After lunch Mrs. M.Spiliopoulou, Deputy Head of Unit DG ENTR H5, Mechanical and Electrical Equipment chairs the meeting.

Mr. Kemna continues the presentation on special topics of the Methodology. This is followed by a presentation by Mr. Kemna on LLCC, BAT and B(N)AT for the test product cases [download VHK Presentation Illustration Product Cases].
At 14.30 hour the last item of the afternoon session begins, concerning replies to questions received in writing the week before.

Mr. M. Papadoyannakis (DGENTR) starts with replying to questions directed to the Commission:

As regards the EIPRO project and other related studies Mr. Papadoyannakis explains that the EIPRO project applied a much more general approach, aimed at a higher level of aggregation. DG JRC's European Platform on Life Cycle Assessment project should be seen as complementary to the MEEUP project: Due to a tight time schedule laid upon the Commission by the Directive, the Commission needed the result of the Methodology study fast and could not wait for the DG JRC European Platform on Life Cycle Assessment project to be finished before starting preparatory activities for EuP implementation. But this does not exclude the possibility of data generated within the MEEUP project to be revised and/or updated by the European Platform on Life Cycle Assessment project. The IPP- mobile phone project was aimed to investigate a possible methodology for reducing the environmental impact from mobile phones; product design measures might be one way to achieve this; if such legal requirements are deemed necessary, they will be adopted under the EuP framework. It was not intended to supply a methodology for general EuP in the light of the eligibility criteria of the Directive.

The preparatory studies for which tenders have been submitted at 21.9.2005 will investigate in much more detail than the MEEUP study the economic, environmental and technical aspects of some EuPs.

Mr. Papadoyannakis continues by saying that the MEEUP methodology is not intended to follow exactly the requirements of ISO 14040 and/or other international standards. The MEEUP is developed in the light of a EU Directive on product design - the scope of ISO 14040 is different. Furthermore the MEEUP is developed to follow closely other Community Legislation. This does not however exclude the use of ISO 14040 where appropriate, e.g. for certain definition matters.

In the same sense MEEUP is not intended to replace LCAs performed by manufacturers but merely to produce the methodology needed for implementing the Directive.

The Commission does not intend the MEEUP to be turned into a standard through the mandate to CENELEC for a work program for standards for the EuP Directive. Mr. Papadoyannakis mentions that the role of standards is different to that of legislation - the MEEUP is part of preparing for the latter-- and the tight time schedule alone would prohibit the Commission to wait for the results of standardisation activities before starting to implement EuP.

Mrs. Spiliopoulou gives the floor to Mr. Kemna to answer questions regarding other aspects of the methodology:

Mr. Kemna starts with answering two written questions received before. He emphasises that many other questions have already been addressed during the previous presentations.
Many have asked: "Why is the LLCC approach also recommended for non-energy aspects?" Mr. Kemna replies that for many of the environmental categories considered (energy, GWP, acidification) the LLCC method is appropriate in the sense that the use phase makes a difference. There are however impacts, mainly those related to production stage, where LLCC seems less appropriate since no financial benefit (reduced costs) during product use occurs. Obviously this means a simplification of the LLCC (no running cost benefit), but the LLCC method in itself still is appropriate and allows identification of the option with most environmental benefits against least costs. It is however up to the Consultation Forum and other stakeholders involved in the future decision making process how to interpret these results and weigh them against results for other impact categories.

Another question often asked is: "how does the MEEUP methodology guarantees correct identification of LLCC and BAT". Mr. Kemna points to Chapter 7 of the report which describes that multiple ways of identifying eco-efficient design options – modelling, testing, etc.—are open and the methodology does not exclude any route in this respect, as long as the economic (LCC) and technical feasibility of the outcome can be proven. This is the main issue. As Mr. Zourek has stated in his opening remarks the type of solutions applied in LLCC and BAT have to be available and realistic. In this respect it is also important to consider that the roles of LLCC and BAT are different. The former is a minimum level that is indicative for self-regulatory or mandatory targets; the latter provides an indicative range of solutions that will be left – with the LLCC targets implemented—for product differentiation and possible more ambitious eco-design.

The meeting proceeds with answering questions from the audience.

Mr. Höhn (IBM) wants to know how the Commission will avoid problems in defining product group boundaries, for example putting PC workstations in the same group as pocket PCs.

Mrs. Spiliopoulou replies that product group boundaries should take into account future trends but the eventual legislation must be for existing products.

Mr. Papadoyannakis reminds the audience that the MEEUP study addressed PCs as a test case and that preparatory studies are underway which will allow more resources to be allocated towards the definition of boundaries between product groups.

Mr. Kemna, repeating his statement at the beginning of his first presentation that product definition is of decisive importance for the outcome of studies, also makes the point that when it comes down to comparing product performance the application of duty cycles is the preferred way to go. As regards the definition of product boundaries the ideal solution would be not to make these on the basis of technologies applied but on the basis of the function they perform for the user.

Mr. Buxmann (European Aluminium Association) asks why the substitution method proposed in ISO14040 is not followed. (He also mentions that the European Aluminium Institute is coordinating with IISI the principles for execution of LCA).
Mr. Kemna \(^2\) replies—as also mentioned earlier by other speakers— that although VHK tried to stay close to existing ISO standards it was not the only consideration. The directive is about changing emissions and the use of resources in a time-scope that is relevant for achieving EU policy goals. Within this scope, the expected future equilibrium between supply and demand of secondary was taken as a basis for allocating environmental credits of recycling.

Mr. Kemna continues that this is done by presuming certain percentages of recycled material present in the specified material, the percentage of recycled content depending on the final application of the material: 10% recycled content in aluminium sheet / extrusion, 85% (post-WEEE) recycled content in die-cast aluminium.

Mr. Höhn asks what the process for identification of BAT is.

Mr. Papadoyannakis replies that the MEEUP Methodology is not an algorithm [with a computable outcome]. He refers to responses to similar questions before and points to the ample opportunity for industry to provide input in this.

Mr. Höhn refers to a message from Apple Corp. stating that the "mini" (presented in the MEEUP study as current BAT for PCs) is not suited for all applications considered in the product group.

Mr. Kemna replies that the Apple message said the mini is not a workstation. The subject of the difference between a ‘PC’ – being a device that covers the functionality of internet/e-mail, word processing, spreadsheet and basic web content creation—and a workstation – with an extended functionality for CAD, 3D, etc.-- is properly addressed in the case study. It is also identified as one of the subjects to be cleared in future studies, e.g. in the context of defining duty-cycle type test standards.

Mr. Hermann (PE Europe) fears the MEEUP study could be viewed by stakeholders in Europe as being state-of-the-art and thus the only method for environmental assessment of EuP.

Mr. Papadoyannakis refers to the other studies that will look into more detail to the elements presented in the MEEUP study: The DG JRC European Platform on Life Cycle Assessment project might add and improve upon environmental data contained in the MEEUP study. The Preparatory studies will provide more detailed information on product groups. As regards the impact assessment methodology and the treatment of heavy metals in this the MEEUP provided the applicability needed by the Commission and suffices as a first step. The Commission however does not exclude beforehand changes to the methodology if needed.

Mr. Hermann asks why there is no differentiation between "LCA toxicity" and "inherent toxicity".

Mr. Papadoyannakis says the method is aimed at measurable product features. Mr. Kemna adds that the MEEUP does not pretend to have provided the ultimate solution.

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\(^2\) Interpreting 'substitution' as: the recycling and subsequent re-use of 1 kg aluminum avoids ("substitutes") the emissions of production of 1 kg virgin aluminum. This can also be referred to as closed-loop recycling (emissions on the production side are avoided by using recycled materials in equal applications)
to this and other complex questions; it follows existing legislation, it does not precede it. The MEEUP is primarily intended to provide guidance to the Commission to deliver what the Parliament has asked for.

Mrs. Slade (UK Market Transformation Program) asks 1) what will happen next, 2) if there will be future consultation and 3) if the Member States will be able to discuss the methodology.

Mr. Papadoyannakis describes the steps after the finalisation of the MEEUP study in December. A Consultation forum will be set up, ultimately in 2007 but most likely in 2006, in which Member States and other stakeholders are represented (Invitation to take part will be published). One of the first activities of the Forum will be to contribute to the production of a Working Plan. In 2007, at the end of the transitional period of two years after adoption of the Directive in July 2005, the Forum will assist the Commission in proposing implementing measures. Meantime there will still be room for Voluntary Agreements to be put forward. Other activities are the Preparatory Studies for which tenders have been received.

Mr. Hermann (PE Europe) asks how the MEEUP methodology will be improved.

Mr. Kemna refers to earlier statements on other studies that will use and possibly elaborate on the methodology.

There is a question asking how the MEEUP Methodology is linked to the CE marking mentioned in the Directive text.

Mr. Papadoyannakis replies that the study is only describing the methodology to generate the information needed for assessment if and how the products fulfils the criteria of article 15 (previously art.12) of the Directive. The implementing measures (e.g. CE marking) are subject to following steps.

Mr. Wolf (DG JRC) asks which aspects of the MEEUP can be supplemented/replaced by newer standards, methods, data, etc.

Mr. Papadoyannakis and Mr. Kolb (DG TREN) answer that the MEEUP provides a framework, but that flexibility should be allowed to account for future developments.

Mr. Sicsic (Hewlett Packard France) notes that the MEEUP study in its description of Product Groups identified only one base case per product group, whereas the wide range in product performance within product groups might require more.

Mr. Kemna replies that the identification of more than one base case is allowed, although it is advisable to keep the number manageable. An example is e.g. the EU Energy label for fridges/freezers that uses as much as 10 different sub-groups (base cases).

Mr. Schoenmakers (EICTA) asks 1) if there will be more time for sending in comments/questions, 2) how the European Commission will weigh between 10 -15 environmental impact categories.
Mr. Kemna replies that written comments/questions may be sent in until the 15th of October 2005, allowing VHK to finalise the draft final report by the end of October. Regarding the weighting of environmental indicators between each other, this was clearly not in the Tender and not proposed in the MEEUP methodology. VHK has formulated some shortcuts in an annex and there are several LCA-software programs that provide this type of information (normalisation, weighting against per capita emissions, etc.), but basically the European Commission and the Consultation Forum will have the flexibility to make their assessment on a case by case basis also depending—Mr. Papadoyannakis—on the general policy priorities. Mrs. Linher (Orgalime) asks 1) whether the LLCC method will be applied on a general basis or specific impacts only, 2) who will decide what is BAT and 3) if other environmental indicators such as depletion will be covered.

Mr. Papadoyannakis answers that the LLCC method is indeed identified in annex II for application for use-phase related resources (energy, water, etc.) and acknowledges that it has been used extensively in the past for energy consumption. For other impacts the outcome of the use of the LLCC method will be assessed together with inputs from other stakeholders. The MEEUP methodology is not an algorithm leading to identification of BAT without inputs from other sources. The identification of design options is an element of the MEEUP, so is the method for ranking these (LLCC), however the impact assessment and final identification of appropriate eco-design requirements will be made by the Commission with stakeholder involvement.

The depletion of raw materials is partially covered by the listing of other indicators such as the raw material use, but (as said before) the method may be improved. A representative of Orgalime remarks that application of LLCC methodology to other impacts than energy consumption is problematic in case energy consumption during use is no key variable.

Mr. Kemna replies that the added value of using LCC is limited/self-evident in cases where there is no financial benefit during the use phase. Still, it is useful for policy makers to know which option gives the most environmental benefit against the least costs and this is basically what the LCC-approach does when you take out the running costs.

Mr. Sattler (ZVEI/ motors) asks for more awareness of the place of a product in systems and the benefits to be gained by improving the system.

Mr. Dierickx (Daikin Europe NV) asks 1) whether the MEEUP study is one of the inputs for possible future legislation, 2) how the affordability of products and 3) how product safety will be accounted for.

Mr. Papadoyannakis replies to the first question with "yes", the MEEUP will supply the methodology to be used in preparing possible future legislation and "no" that the conclusions regarding product impacts in the MEEUP study report will be used directly in the legislative process since these the product cases were only intended as test cases and illustrations for the development of the methodology. Mr. Kemna continues that—apart from the LCC—“affordability” (in terms of an absolute purchase...
price increase of the product) can be one of the elements in the consumer impact studies in future studies. As regards product safety, the relevant minimum safety standards provide absolute boundaries that should not be compromised by environmental measures.

Mr. Rambaldi (CECED) asks what the relation is between the MEEUP and standards being developed by CENELEC Technical Committee 111x.

Mr. Papadoyannakis replies that MEEUP should be seen as a tool to be used in the light of a political decision making process, which is outside the scope of CENELEC. The EC has no plans to propose to develop a standard based on the MEEUP study.

Mr. Washington (Chairman of CENELEC TC 111X) confirms that the TC is only in its start-up phase. The mandate mentions providing the Commission support in the light of the development of implementing measures, but not for the process that may lead to such measures.

Mr. Buxman asks why the initiative leading to the MEEUP was not coordinated with the introduction of EPD [Environmental Product Declarations] that provide similar information and use the ISO 14025 standard.

Mr. Papadoyannakis replies that an environmental assessment according ISO 14025 was not asked by the Commission. EPDs also serve a different purpose than the MEEUP study. The ISO standard 14025 for EPDs however might play a role in the CENELEC Mandate. Combination of the MEEUP Study with the development of EPDs for building products was not sought since Energy-using Products are a different product group that warrant a separate approach. Mr. Kemna adds that although ISO 14040 nor 14025 were prescribed, most of the environmental impact assessment follows ISO 14040 apart from the documentation of LCI. Therefore Mr. Kemna does not expect the results of EPDs in general to differ much from the MEEUP data. And he also asks to consider that in case differences do occur, this is more likely to be a consequence of the input/LCI data used than the methodology.

Mr. Dierickx remarks that certain bodies involved in the development of harmonised standards feel left out of the EuP process.

Mr. Papadoyannakis confirms that the EC supports the commitment to development of standards as indicated before (CENELEC Mandate).

At 16.30 hour Mrs. Spiliopoulou ends this last part of the workshop. The audience is reminded that questions can be submitted in writing until 15th of October 2005. The attendees are thanked for their presence and input upon which Mrs. Spiliopoulou closes the meeting.

M. van Elburg,
VHK,
Delft, 28.10.2005

APPENDIX - Attendants workshop 3 October 2005
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<th>No.</th>
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<td>Reinhard Höhn</td>
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<td>Andrea Andriani</td>
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<td>Matteo Rambaldi</td>
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<td>Martijn van Elburg</td>
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<td>Henk Douven</td>
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<td>Francis E. Farrugia</td>
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<td>Richard Cukovic</td>
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Agenda: European Commission Workshop
Methodology study, Eco-design for Energy-using Products (MEEuP)
3 Oct. 2005, Brussels

1. 10.00-10.20h Introduction H. Zourek acting Director General, DG Enterprise and Industry

Moderator L. Montoya, Head of Unit DG ENTR H5
- 10.20-11.00h Presentation draft final report MEEUP
- 11.00-11.15h Coffee Break
- 11.15-11.30h Case: Street Lighting
- 11.30-12.30h Methodology Special Topics

LUNCH 12.30-13.30h

Moderator M. Spiliopoulou, Deputy Head of Unit DG ENTR H5
- 13.30-14.30h Illustration Methodology: Product Cases
- 14.30-16.30h Questions and discussion
The aim of the study (relating to the 2005/32/EC Directive)

…..is to contribute to the creation of a methodology allowing to evaluate whether and to which extent various energy-using products fulfil the above mentioned criteria.*

*Such a methodology will be applied to products that have already been identified as relevant for certain environmental aspects and/or the volume of trade in the internal market in the context of other Community initiatives or policies such as the ECCP and the Eco-label.

Tasks

1. Environmental Analysis
2. Market Analysis
3. Assessment Improvement Potential

Selected Products

Climate
1. CH Boilers
2. Room Air Conditioners
3. Circulator pumps
4. Street Lighting

Domestic Appliances
5. Refrigerators
6. Dishwashers
7. Vacuum Cleaners

Electronics & ICT
8. Copiers
9. Television sets
10. Personal Computer systems

Participants MEEUP Expert Meetings

Climate
Felix Van Eyken, EHI (CH Boilers)
Niels Bidstrup, Grundfos (Circulator pumps)
Elis Baerts, Daikin (RAC)**
M. Daczka, Daikin (RAC)**
Jan Cluyse, Daikin (RAC)**
Baron Ram, Philips (Lighting)
Gerald Strickland, ELC (Lighting)
Maarten ten Houten, Philips (TV)**
Theo Schoenmakers, Philips (TV)**
Reinhard Hoefn, IBM (PC)
Ferdinand Quella, Siemens (PC)**
Eddy Roelants, Siemens (PC)**
Hans de Vos, Philips (Large Copiers)
Yoshihiro Kuriyama, Canon (small Copiers)
Christian Parisson, Canon (small Copiers)**
Matteo Rambaldi (co-ord/subst. Renaudin)
Francesco Moretti, Whirlpool (Refrigerators)

Domestic Appliances
Florent Renaudin (Vacuum Cleaners)**
Hans Beer, BSHG (Dishwashers)
Matthew Armishaw, AEAT**
Constantin Herrmann, PE-Europe (EPIC)
Melissa Shinn, EEB**
Jean-Philippe de Royler, Greenpeace**

Electronics & ICT
Michalis Papadoyannis (Commission)
André Brisaer (Commission)
Christopher Maxwell (Commission)
Marijn van Elburg (VHK)
René Kemna (VHK)

**= 1st meeting only
**= 2nd meeting only
Methodology Reviewers

Gjalt Huppes, Jeroen Guinee, CML
Mark Goedkoop, Prá (SimaPro)
Rolf Frischknecht, ESU (Ecoinvent)
David Pennington, JRC Ispra
Braune/Herrmann (IKP/PE-Europe, GABI/EPIC-ICT)
Quella (Siemens)/Herrmann/ Hoehn/IBM
van der Wel, Schoenmakers, ten Houten (Philips)

Data Reviewers *

AMD (ICs)
Philips (CRT)
Sharp (LCD factory)

* Intermediate and base LCI data not in public domain

1. Environmental Analysis Approach

- ‘Cradle-to-grave’: Production, distribution, use, end-of-life phases
- No ‘LCA’ but ‘indicators’ (ISO 14040 not imperative)
- Impact categories given by the Commission
- Data availability is a high priority (no ‘empty’ methodology)
- Consistency with legislation
- Expert & stakeholder consultation
- Subtasks: Data retrieval, analysis, reporting

1. Environmental Impacts, Resources (EC)

- Energy consumption
  - primary Gross Energy Requirement in MJ
  - electricity share (converted to primary)
- Water consumption in m3
- Material use (in kg), incl. recycling credits
  - Metals (St, Al, Cu)
  - Plastics(PE, PP, PS, etc.)
  - Others (glass, electronics, etc.)
- Waste generation
  - to landfill
  - to incinerator
- Hazardous waste generation
  - ROHS (exceptions)
  - non-ROHS (voluntary lists)

1. Environmental Impacts, Emissions (EC)

- Emissions to air
  - greenhouse gases (GHG, CO2-eq.)
  - acidifying agents (SO2-eq., incl. NOx, also eutroph. NH3)
  - volatile organic compounds (VOC)
  - ozone depleting substances (ODP, CFC-11 eq.)
  - persistent organic pollutants (POP, e.g. PCB’s, dioxins)
  - heavy metals (As, Cd, Hg, Ni, Pb; also PAHs)
  - particulate matter (PM)
- Emissions to water
  - heavy metals (Cd, Hg, etc.)
  - substances affecting oxygen balance (P, N, BOD, COD)
  - persistent organic pollutants (List I substances)
- Other product specific

2. Market Analysis Approach

- Identification/classification of appropriate product groups (standards, statistics, EU legislation)
- EU production, intra/extra-EU trade, consumption
- Subtasks: Data retrieval, data analysis, reporting on data availability and methodology
- Primary data sources: Eurostat and publicly available market data

3. Improvement Potential Approach

- Theoretical best potential (BAT, ‘Best Available Technology’)
- Economic/social/etc. feasible potential:
  - LLCC approach (‘Least Life Cycle Costs’) or comparable
  - Manufacturer and consumer impact analysis
- Focus: 2007-2008
- Primary data sources: LCA-studies, SAVE studies, manufacturer publications, VHK engineering expertise.
MEEuP Project Milestones & Consultations

- Nov.'04 • Start
- Dec. • Project website: www.eupproject.org
- Jan.'05 • 1st Expert Meeting
- April • 2nd Expert Meeting
- May • Ext. Review on Draft Interim Report
- June • Interim Report
- Sept • Draft Final Report
- Oct. • Commission Workshop
- Oct./Nov. • Final Report → Commission

BASICS

What do Commission and Consultation Forum need to know—according to the text of the directive (esp. Art. 15*)—before they decide on whether and how to make an implementing directive under the 2005/32/EC Ecodesign of EuP Framework Directive?

(Methodology Report Chapter 1)

* Previously Art. 12

What is the Existing Legislation & Self-regulation?

1. PRODUCT DEFINITION, STANDARDS & LEGISLATION
   - Product classification, definition of primary and secondary functional parameters,
   - Relevant harmonized standards for performance testing/energy use/health & safety,
   - Existing relevant environmental legislation inside and outside EU, existing self-regulation

2. ECONOMICS & MARKET
   - Macro data on EU trade, production and apparent consumption,
   - Market trends in product features and key parameters (e.g. energy use, product weight)
   - Consumer expenditure: Rates, tariffs, prices

How important is the product for the EU economy (industry, trade, consumer expenditure, etc.)?

How does the current product design look like and how are consumers using these product?

3. CONSUMER ANALYSIS & LOCAL INFRASTRUCTURE
   - Real load efficiency (vs. nominal),
   - Temperature/timer settings, dosage of aux. inputs during use,
   - Economical Product Life (=in practice) & End-of-Life actual behaviour
   - Best Practice in sustainable product use
   - Local infrastructure (energy, water, telecom, physical distribution, etc.)

4. TECHNICAL ANALYSIS EXISTING PRODUCTS
   - Bills-of-Materials (BOM) & key manufacturing parameters
   - Resources Use (energy, water) during product life
   - Technical Product Life (technical durability)
   - Maintenance and repair, End-of-life (Technical potential for recycling, re-use, etc.)
   - System analysis: Trade-offs and interactions with environmental and functional parameters outside the direct product scope.
Can we now create a reference for the present situation, i.e. the average product today?

5. DEFINITION OF ‘BASECASE’
Selection/construction of avg. EU representative model (from 1. To 4.)
Definition of standard basecase, i.e. the environmental impact, functionality and Life Cycle Costs for a reference year measured according to harmonized test standards (that would also be used for compliance testing.)
•Definition of real-life basecase, as above but in real-life with actual consumer behaviour and ambient conditions.

How can we improve on the present situation? We know of the best products on the markets, we have engineering skills, but do we need to know more?

6. TECHNICAL ANALYSIS
BEST AVAILABLE TECHNOLOGY (BAT)
State-of-the-art in applied research of the product (prototype level)
State-of-the-art at component level (prototype, test and field trial level)
State-of-the-art of best existing product technology globally (extra-EU)

How to translate all this into ‘The technically and economically feasible improvement potential’ as a basis for targets?

7. IMPROVEMENT POTENTIAL
•Identification of design options,
•Their monetary costs and benefits (lower operating expense)
•Their environmental benefits and — if any — adverse trade-offs.
•Ranking of options according to Life Cycle Costs/Payback Period and identification of point of Least Life Cycle Cost LLCC, with its environmental improvement potential.
•Assessment of (cluster of) options with the highest absolute environmental saving potential: the so-called Best Available Technology BAT, with its environmental improvement potential.

Once we have preliminary targets, what will be their impact on the environment and stakeholders? How robust are these targets e.g. with new prices?

8. POLICY, IMPACT AND SENSITIVITY ANALYSES
Policy- and Scenario Analyses: Assessment of what is “significant”, “appropriate”, etc. and what policy measures are appropriate (Annex I or II, legislation or self-regulation), what would be the gain over “Business-as-Usual”, etc.
Impact analysis: Industry and consumers: Investment level, appropriate timing (in line with platform change).
Sensitivity analysis: Test of the robustness of the “significant environmental aspects”, varying base assumptions.

Basic Structure: Information for 2005/32/EC

Scope

Chapter 2
**Product features (not production, sales, finance)**

- **STRATEGIC/POLICY LEVEL**, e.g. product policy, product/market combinations, etc.
- **PRODUCTION DEVELOPMENT**
- **PRODUCT DEVELOPMENT**
- **MARKETING**
- **PURCHASING**
- **PRODUCT ION**
- **SALES**

**EuP Interface with other products**

- **food, beverages, detergents**
- **buildings & materials**
- **textiles**
- **tableware**
- **industrial machinery**
- **paper, cardboard**
- **energy industry**
- **industry**

**EuP differences with non-EuP**

- Trade-off Purchase price vs. Running costs (LCC)
- Large number of components (100-2000), materials fractions (20+)
- Functionally complex: interface with energy source (safety), traction/heat/light/data energy transformation, control unit
- Combustion emissions (CO2, CO, CH4, SO2, Nox, etc.) dominant. Heavy metals less influence
- Use phase dominant. With non-EuP more production/disposal
- Medium-long Product Life (5-20 years). Most non-EuP have shorter Life (<1-5 years), buildings much longer (>100 yrs.). Product life maximization may be sub-optimizing.
- Important influence consumer behaviour on env. Impact of EuP

**EuP - industry: boundaries of influence**

- **MATERIALS PRODUCTION**
- **MANUFACTURING**
- **DISTRIBUTION**
- **USE**
- **RECYCLING**
- **WASTE DISPOSAL**

**Eco-design decisions**

At company policy level:
The product developer assumes shared responsibility with production and market developers—for the product policy and the definition of new product/market combinations

At tactical level:
The product developer is responsible for

- Selection of materials
- Design of the geometry
- Selection of the type of production processes to realize the geometry
- Prescription of the way that the product should be used.
Eco-analysis tool in design-loop

Easy and understandable indicators for industrial product developers

• refer to a clearly defined functional product category
• be numerical or Boolean (yes/no)
• be up-to-date (e.g. not relating to legacy parameters)
• when numerical they should
  – preferably be absolute rather than relative
  – preferably relating to physical/chemical parameters
  – have clearly defined tolerances (with respect of a threshold value)

Task 1
Environmental Impact Analysis
Methodology Report Chapters 3 to 5

Data Required

Data Required per Life Cycle Phase

Materials
Production & manufacturing
Distribution
Use
End-of-life

COMPARISON (part of) ELIGIBILITY CRITERIA for EuP-directive
Data Sources

- Full LCA tools (SimaPro 6, Gabi 4, etc.), databases (EcoInvent 2003, Idemat 2001, BUWAL-250, Gabi 4, etc.) and weighting methodologies (Eco-Indicator 99, CML 2000, EDIP ’97, etc.)
- Simplified LCA tools, (EcoIt,EcoScan, EIME, KEPI)
- Legislation and background reports from EU environmental and energy-related legislation. (IPPC BREFs and SAVE)
- Industry associations (APME, IISI, EuroCopper, Eurelectric, etc., for production. EICTA, CECE, EHA, Eurelectric etc., for consumption).
- Other literature sources(EU Ecolabel, Blue Angel and Nordic Swan), product-LCA studies, etc.
- Physical VHk product-analysis, disassembly for ‘BOM’
- Experts, both inside and outside the EuP stakeholder expert group

Full LCA emissions comparison from various sources 1

<table>
<thead>
<tr>
<th>Substance</th>
<th>Substance</th>
<th>BREF</th>
<th>IPPC</th>
<th>Ecoinvent system</th>
<th>Ecoinvent system, FE</th>
<th>ETHESU</th>
<th>Idemat, FE</th>
<th>vol/Whg European, FE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>g</td>
<td>1.6</td>
<td>0.43</td>
<td>6.43</td>
<td>1.91</td>
<td>1.07</td>
<td>0.96</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>g</td>
<td>3.3</td>
<td>9.6</td>
<td>9.6</td>
<td>8.95</td>
<td>1.08</td>
<td>0.92</td>
<td></td>
</tr>
<tr>
<td>SO2</td>
<td>g</td>
<td>1.63</td>
<td>2.6</td>
<td>2.6</td>
<td>2.62</td>
<td>0.31</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>PAH</td>
<td>µg</td>
<td>380</td>
<td>15.61</td>
<td>15.61</td>
<td>15.40</td>
<td>0.09</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Sulfur dioxide</td>
<td>g</td>
<td>1.63</td>
<td>2.6</td>
<td>2.6</td>
<td>2.62</td>
<td>0.31</td>
<td>0.35</td>
<td></td>
</tr>
</tbody>
</table>

LCI: BOM’s available

- CH-Pump updates by Grundfos: UPS (fixed) and Alpha Pro (BAT)
- CH-boiler, EHI update: Gas- & oilfired, wall-hung & floor-standing
- Refrigerator, CECEED data, analysis EU Ecolabel
- Dishwasher, BSHG update on materials fraction
- TV & Beovision LX550, PC Displays: NEC 17" CRT, Cannon 15" LCD → no better data available
- PC : VHk disassembly & analysis components
- Copier Rank Xerox XC855, table-top B&W analog, 8cpm → large copier LCA by Oöt, small copier Canon
- RAC Amcor AC 7200 M, 2120 W cooling cap. (& Hitachi) → ?
- Street lamps: Light source data available (ELC), reflectors and ballast provided (Philips/ECL/CELMA)

LCI: Other data available 28.4.2005

- Most usage data available from SAVE studies, VHk analyses, etc. or from manufacturers.
- For main market data: Idem. (EU Sales, EU Stock in units; prices and trade figures less reliable but sufficient)
Possible exceptions: Products with highest uncertainty regarding data 2010
- Copiers and
- Room Air Conditioners

Data for recycling 2010-2020: VHk default scenario (see EuP EcoReport)

LCI: Unit processes (Table & Notes)

- EuP EcoReport Table Unit Processes generated, aiming at highest consensus. Expect comments and reviews by various materials sectors in coming months.
- Emission and resources data mainly from:
  - Industry associations (APME, IISI, Aluminium Inst., etc.)
  - Commission reports (EPER, IPPC, European Dioxin Inventory)
  - Manufacturer’s environmental reports
- Data relate to average EU/Global technology 2005/2006
- Continuous update necessary, esp. regarding electronics
- Data: horizontal quality, using most informed, recent and transparent public source
- Data: vertical quality, allowing fair comparison between potentially competing materials and processes
Task 2

Market Analysis
Chapter 6

- Relevance for Art. 95 (barriers for trade)
- CE-conformity → product definitions
- New Approach → technical test standards
- Barriers trade → identify existing intra- and extra EU legislation
- Minimum volume of 200,000 units/year
- Trends → eco-design in line or not?
Product definition and classification

- Functional parameter (not technology)
- PRODCOM definitions (Eurostat), international harmonisation (SIC, NACE, ISIC)
- PRODCOM 6-digit level appropriate
- 8-digit level only in exceptions (circulator, vacuum cleaner)

Existing legislation

- Internal EU: mainly for HVAC appliances & CH circulators (installed appliances, sometimes linked to performance of buildings)
- Extra EU: Except for circulators, vacuum cleaners and PCs, there is mandatory legislation for each of 10 product cases in other parts of the world
- Table for existing MEPS (Minimum Energy Performance Standards) and labelling [NACEE source]

Generic economic & market data

- PRODCOM for production, import, export (official data)
- Market research specialists (better quality)
- Stock model: better long term reliability

Market trends (examples)

- CH Boilers: More wall-hung, gas-fired, modulating, condensing and away from coal, floor-standing.
- PCs: More laptops, more silent, more LCD monitors
- TVs: Bigger screen size, HD Ready, premium for shallow profile/flat panel
- RACs: Rapid growth overall, more inverter technology, reversible (heat pump)
- Street Lighting: More mercury vapour
- Vacuum Cleaners: More power (in W), smaller dimensions (portability)
- Copiers: More multi-function, more digital, more colour

Rates & Prices (inputs LCC)

- Product life X years;
- Discount rate 5%/year (Present Worth Factor PWF) e.g. 10.38 at product life 15 years);
- Electricity price € 0.15/kWh;
- Water price € 4.25/m3 (this is the projected price halfway product life, i.e. in 7.5 years from now; the 2003 price is around € 3.50/m3);
- Detergent, softener (regeneration salt), rinsing agent: € 1.91/kg, € 0.50/kg, € 5.90/kg;
- Maintenance & repairs € 5.50/ year;
- Machine price (basecase): € XXX,XX

Checklist

- Is there clear, comprehensive and legislatively univocal product-definition ?
- Are there harmonised test standards to assess the most important environmental impact ?
- What is the already existing product-specific legislation – and thereby potential trade barriers between Member States and globally-- relating to the most important environmental impacts ?
- Does the EuP represent a significant volume of sales and trade( indicative more than 200 000 units a year ) ?
- Are there sales and stock data that are reliable enough to assess the impact of measures?
- Is there enough insight in general market trends to predict, together with the sales and stock data, a reference “Business-as-Usual” scenario?
Task 3

Environmental Improvement Potential

Chapter 7

Directive 2005/32/EC, Annex II, par. 1

"..Concerning energy consumption in use, the level of energy efficiency or consumption will be set aiming at the life-cycle cost minimum to end-users for representative EuP models, taking into account the consequences on other environmental aspects. The life-cycle cost analysis method uses a real discount rate on the basis of data provided from the European Central Bank and a realistic lifetime for the EuP; it is based on the sum of the variations in purchase price (resulting from the variations in industrial costs) and in operating expenses, which result from the different levels of technical improvement options, discounted over the lifetime of the representative EuP models considered. The operating expenses cover primarily energy consumption and additional expenses in other resources (such as water or detergent)...."

Steps in Assessment Potential

1. Definition of Base Case
2. Identify EcoDesign Options
   - From BAT
   - From R&D also at component level
   - From engineering (modelling, experiments, intuition)
3. Costs and environmental benefits per design option
4. Analysis LLCC and BAT (ranking)
5. Long-term targets (BNAT) and Systems Analysis
6. Scenario, policy, sensitivity analysis

References

- Stock 2005 (avg. 3-7 years old)
- Sales 2005 (Base Case)
- Least Life Cycle Costs saving potential (LLCC)
- Best Available Technology saving potential (BAT)
- Best Not (yet) Available Technology saving potential (BNAT)

LCC/Impact curve
Appendices (in Methodology Report)

I. Structure of parameters
II. Reviews
III. Assignment VHK
IV. ECCP Tables
V. Example single/double value indicators
VI. References (>700)
MEEuP Methodology Report

Special Topics

European Commission Workshop
3 Oct. 2005, Brussels (11.30-12.30h)

Topics (from Chapter 3)

- General: Unit, System Boundaries, partitioning, product life
- Recycling
- Weighting factors (esp. regarding Heavy Metals)

General

- Energy accounting unit: Lower Heating Value (Gross Energy Requirement)
- Process Analysis (bottom-up). Hybrid I/O-Process analysis (EIPRO) complementary: Less accurate but covers whole economy (EuP vs. Food/Transport/Building/ etc.)
- System boundaries: “Minimum up to 2nd level, preferably 3rd.”

System boundaries

Multi-product Processes
(partitioning according physical parameter target outputs)

<table>
<thead>
<tr>
<th>raw process</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Na and Cl From NaCl (weight basis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. Fractions from naphta cracker (enthalpy basis)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Multi-product Processes
(partitioning waste/ byproducts vs. target output)

<table>
<thead>
<tr>
<th>raw process</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>e.g. Na and Cl From NaCl (weight basis)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>e.g. Fractions from naphta cracker (enthalpy basis)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

New account
Multi-Process Products
(e.g. typical metals mining)

Take energy from main process, staying clear from multi-product processes

Recycling

- Aim: To influence demand/ materials mix to decrease or increase impact less, based on (impact * kg)
- The Reality: The relative size of the recycling flow from EuP (Effect of WEEE?)
- Price forming: Stimulate attraction by lowering costs (recyclability) vs. increasing demand (materials that can support high recycled content). [Weidema]
- QWERTY method [Jaco Huisman] → the environmental costs of recycling
- The choice & scenario

Recycling EuP (pre-WEEE)

Recycling EuP (post-WEEE)

Recycling EuP vs. rest

Effect WEEE Recycling supply side Ca. <+10% (+6mt)

Stock 3000-4000 mt (St, non-ferro, plastics)

EuP <6-7%

Materials Produced 250

EuP Produced

EuP Stock

Disposal

Recycled

EuP Produced

EuP Stock

Disposal

Recycled

Materials Produced 250

EuP <6-7%

Stock 3000-4000 mt (St, non-ferro, plastics)

Conclusion WEEE & recycling

- The effect of WEEE will be limited (increase of supply max. 10%) and will not change the basic economics of recycling drastically.
- Recycling percentages of today will stay beyond 2006, perhaps +10% (if recyclability is the problem)
- As a result: No extra incentive to upgrade aluminium beyond die-cast or construction industry standards → high surface-quality sheet will require virgin material also tomorrow.
Price-forming

Price-forming: Increasing recyclability → higher margin for recycler or potential to lower price if needed

Price-forming Cu: Increasing costs → recyclers closing down → higher price at lower recycled volume to reach sufficient margin

Price-forming: Increasing recycled content → higher demand (+supply abundant) → higher price (short term) → higher quantity q (long term)

Conclusion Price

- If the aim is to increase recycling a strategy of increasing demand for recycled raw material is just as valid as a strategy of decreasing costs
- This is especially true if supply will be more abundant and demand is diminishing (less foundry products), like for metals.

Technology

- Recycled content with metals depends a) on required surface quality (e.g. 2) and b) manufacturing technology (die-casts, profiles, sheet). This is the field of designer.
- Low surface quality steel sheet (4) → up to 15%
- High surface quality steel sheet (2) → max. 5-10%
- Recyclability of metals: There is very little the designer can do about it. Most likely scenario: Shredder-based recycling of EEE.
- This methodology is used also in study Aluminium Institute for car industry
**Choices**

- For metals/ ceramics: Stimulating demand side (Recycled content) Recyclability assumed 95%
- For plastics/PWB: Both supply and demand need stimulation, but we choose stimulating supply side: recyclability and heat recovery as a function of design-for-disassembly, closed loop logistics, etc.
- Default recycling scenario’s are developed to help policy makers and sectors. Scenarios B and C follow WEEE requirements in terms of recycling, but assume higher recovery rates (>90%)

---

**Recycling%, GER in MJ/kg**

<table>
<thead>
<tr>
<th>Material</th>
<th>Recycling%</th>
<th>GER in MJ/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDPE</td>
<td>0%</td>
<td>78</td>
</tr>
<tr>
<td>HDPE</td>
<td>0%</td>
<td>77</td>
</tr>
<tr>
<td>LLOPE</td>
<td>0%</td>
<td>71</td>
</tr>
<tr>
<td>PP</td>
<td>0%</td>
<td>73</td>
</tr>
<tr>
<td>PS</td>
<td>0%</td>
<td>87</td>
</tr>
<tr>
<td>EPS</td>
<td>0%</td>
<td>84</td>
</tr>
<tr>
<td>Hi-PS</td>
<td>0%</td>
<td>92</td>
</tr>
<tr>
<td>PVC</td>
<td>0%</td>
<td>57</td>
</tr>
<tr>
<td>SAN</td>
<td>0%</td>
<td>89</td>
</tr>
<tr>
<td>ABS</td>
<td>0%</td>
<td>95</td>
</tr>
<tr>
<td>PA 6</td>
<td>0%</td>
<td>120</td>
</tr>
<tr>
<td>PC</td>
<td>0%</td>
<td>117</td>
</tr>
<tr>
<td>PMMA</td>
<td>0%</td>
<td>110</td>
</tr>
<tr>
<td>Epoxy</td>
<td>0%</td>
<td>141</td>
</tr>
<tr>
<td>Rigid PUR</td>
<td>0%</td>
<td>104</td>
</tr>
<tr>
<td>Flex PUR</td>
<td>0%</td>
<td>104</td>
</tr>
</tbody>
</table>

**Recycling%, GER in MJ/kg**

<table>
<thead>
<tr>
<th>Material</th>
<th>Recycling%</th>
<th>GER in MJ/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1 sheet, galv.</td>
<td>5%</td>
<td>34</td>
</tr>
<tr>
<td>B1 tube, profile</td>
<td>50%</td>
<td>17</td>
</tr>
<tr>
<td>Cast iron</td>
<td>85%</td>
<td>10</td>
</tr>
<tr>
<td>Ferrite</td>
<td>0%</td>
<td>51</td>
</tr>
<tr>
<td>Stainless 18/8 coil</td>
<td>63%</td>
<td>82</td>
</tr>
<tr>
<td>Al sheet, extrusion</td>
<td>11%</td>
<td>193</td>
</tr>
<tr>
<td>Al die-cast</td>
<td>85%</td>
<td>55</td>
</tr>
<tr>
<td>Cu winding wire</td>
<td>0%</td>
<td>143</td>
</tr>
<tr>
<td>Cu wire</td>
<td>0%</td>
<td>117</td>
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<tr>
<td>Cu tube, sheet</td>
<td>65%</td>
<td>51</td>
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<tr>
<td>CuZn38 cast</td>
<td>85%</td>
<td>38</td>
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<tr>
<td>ZnAl4 cast</td>
<td>85%</td>
<td>28</td>
</tr>
<tr>
<td>MgZn5 cast</td>
<td>50%</td>
<td>162</td>
</tr>
</tbody>
</table>

---

**Figure**: Stimulating demand for recycled materials.

**LCIA: Recycling**

- Assignment determines categories and level of detail desired by European Commission: Not 700 emissions and not single value indicator, but 10-15 environmental indicators.
- EU Legislation, based on international treaties determines largely the weighting factors to sum LCI data.
- EU Legislation at the level of Ambient Air Quality Directive or Water Quality Directive or above: emission limit values (ELV) not linked to technology and based on grid monitoring.
- Avoid as much as possible point-source legislation
Legislation

- Awareness (accident, research)
- International Treaty
- Council Regulation, NECs
- Framework Directives AAQD, WQFD + implement. directives
- Point-source ELVs

Check with CML/EDIP/Eco-indicator etc.

International Treaties & EU Policy

- Kyoto (GWP | CO2-eq.)
- Montreal (ODP | R-11 eq.)
- Gothenborg (AP | SO2-eq.)
- Stockholm (PDP | 2,3,7,8 TCDD)
- Arhus (HM air | UNECE: Hg, Pb, Cr VI, Cd, PBB, PBDE)
- AAQFD (Dir. 2004/107/EC): PAHs | Benzo(a)pyrene eq.
- AAQFD (Dir. 1999/30/EC): PM
- Security of Supply/ Energy Efficiency (green paper), EPBD
- RoHS, WEEE, etc.
VHK Eco Report
Street Lighting

051003

Make the Switch

If all Europe’s high Pressure Mercury lamps are switched to more efficient High Pressure Sodium and Compact Metal Halide lamps this could potentially save up to 4.5 million tons of unnecessary CO2 emissions each year.

This is equivalent to the CO2 consumption of over 200 million tons per year, or 28% of the surface area of Belgium.


Intro

- Opening remarks
  - Methodology and Data
- VHK EcoReport applied to street lighting
- Big picture issues
  - Concept of added value
    - Level of accuracy of methodology
    - Making the Switch to energy efficient
Methodology – opening remarks

- **EuP EcoReport Methodology**
  - Generally acceptable
  - Recognise that treatment/weighting of heavy metals is debatable
  - Result potentially too complex and impracticable (prefer single-value parameter)
  - Preference to KISS

- **EuP EcoReport Data**
  - In the case of lighting – data goes in the right direction
  - However:
    - Low accuracy for production phase
    - See excel tables next slides
  - We do not take responsibility for the accuracy of the criteria in the eco report
The Life Cycle of a Lamp
The User Phase most relevant

The product life cycle of a lamp
Where does all electricity go?

R&D and Production

Product Use

Recycling

4% 95% 1%

VHK EcoReport Methodology applied to street lighting (HPL)

Table: Summary Environmental Impacts EU-Stock 2005, Street Lights

<table>
<thead>
<tr>
<th>Main Life Cycle Indicators</th>
<th>Value (eu)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Energy (GJ)</td>
<td>362 (J)</td>
</tr>
<tr>
<td>Electric power</td>
<td>216 (W)</td>
</tr>
<tr>
<td>Water (provision)</td>
<td>8 (m³/ha)</td>
</tr>
<tr>
<td>Waste, recycling</td>
<td>382 (ton)</td>
</tr>
<tr>
<td>Waste, hazardous incinerated</td>
<td>90 (ton)</td>
</tr>
</tbody>
</table>

Emissions (Air)

- Greenhouse Gases (GHG) 13 (mCt/ha)
- Acidifying agents (AP) 79 (mCt/ha)
- Volatile Organic Compounds (VOC) 0 (ton)
- Persistent Organic Pollutants (POP) 0 (ton)
- Heavy Metals (HM) 6 (ton/ha)
- PM10 6 (ton/ha)
- PM2.5 6 (ton/ha)

Emissions (Water)

- Heavy Metals (HM) 4 (ton/kg)
- Eutrophication (EU) 0 (ton/ha)

*Note: low measuring for production phase

Mercury Vapour Lamps 125W

Table: Life Cycle Cost per product and Total annual expenditure (2005) in the EU-25

<table>
<thead>
<tr>
<th>Street Lights</th>
<th>LCC mean product</th>
<th>Total annual consumer expenditure in EU-25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Product price</td>
<td>750 €</td>
<td>1275 min. €</td>
</tr>
<tr>
<td>Installation/ acquisition costs (0 km)</td>
<td>400 €</td>
<td>400 min. €</td>
</tr>
<tr>
<td>Fuel (gas, oil, wood)</td>
<td>2 €</td>
<td>2 min. €</td>
</tr>
<tr>
<td>Electricity</td>
<td>1649 €</td>
<td>2700 min. €</td>
</tr>
<tr>
<td>Water</td>
<td>0 €</td>
<td>0 min. €</td>
</tr>
<tr>
<td>Aux. 1: None</td>
<td>0 €</td>
<td>0 min. €</td>
</tr>
<tr>
<td>Aux. 2: None</td>
<td>0 €</td>
<td>0 min. €</td>
</tr>
<tr>
<td>Aux. 3: None</td>
<td>0 €</td>
<td>0 min. €</td>
</tr>
<tr>
<td>Repair &amp; maintenance costs</td>
<td>38 €</td>
<td>125 min. €</td>
</tr>
<tr>
<td>Total</td>
<td>2819 €</td>
<td>500 min. €</td>
</tr>
</tbody>
</table>
Switch installed base to the second best energy efficient lamp using VHK Eco Report

Switch

HPL 125W

HPS 70W

What did we change in the input eco report

- Mercury content from 20 mg to 10 mg
- Energy consumption from 548 kWh to 328 kWh
- Lamp costs from 2.5 euro to 12.5 euro (product price from 750 euro to 815 euro)

Note: lifetime HPL = 3yr and HPS = 4yr

Table: Summary Environmental Impacts EU Stock 2005, Street Lights

<table>
<thead>
<tr>
<th>Environmental Impact</th>
<th>Value Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Energy (GEP)</td>
<td>8.97 kJ</td>
</tr>
<tr>
<td>Water (kWh)</td>
<td>13.5 kJ</td>
</tr>
<tr>
<td>Waste, non hazardous</td>
<td>500 kg</td>
</tr>
<tr>
<td>Waste, hazardous</td>
<td>700 kg</td>
</tr>
<tr>
<td>Emissions (kg)</td>
<td></td>
</tr>
<tr>
<td>Greenhouse gases (CO2eq)</td>
<td>8.41 CO2eq</td>
</tr>
<tr>
<td>Volatile Org. Compounds (VOC)</td>
<td>109</td>
</tr>
<tr>
<td>Persistent Org. Pollutants (POPs)</td>
<td>63.4</td>
</tr>
<tr>
<td>Heavy Metals (Hg)</td>
<td>0.0001 kg</td>
</tr>
<tr>
<td>PCBs</td>
<td>0.0001 kg</td>
</tr>
<tr>
<td>Particulate Matter (PM2.5)</td>
<td>10 µg/m³</td>
</tr>
<tr>
<td>Emissions (Water)</td>
<td></td>
</tr>
<tr>
<td>Heavy Metals (Cd)</td>
<td>2 µg/litre</td>
</tr>
<tr>
<td>Eutrophication (P)</td>
<td>8 parts/kg</td>
</tr>
</tbody>
</table>

VHK EcoReport Methodology applied to street lighting (HPS)

Table: Life Cycle Costs per product and Total annual expenditure (2005) in the EU 25

<table>
<thead>
<tr>
<th>Street Lights</th>
<th>LCC new product</th>
<th>total annual consumer expenditure in 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Green house gases: reduced with 40%
Heavy Metals: reduced with 35%
Life cycle costs: reduced by 20%

In line with industry calculations
Conclusion - Big Picture Issues

- Where is the **added value**?
  - Do we need a scientifically correct methodology?
    - resulting potentially in too *complex* and *impractical*
  
  **OR**

- A practical instrument that allows for:
  - Technology improvement within a particular product category
  - Upgrade old technology to newer existing technology – *lighting preference*
Illustration of VHK Methodology: Product Cases

European Commission Workshop
3 Oct. 2005, Brussels (13.30-14.30h)

IMPORTANT NOTICE
All data in this presentation are preliminary and intended as an illustration of the VHK methodology proposed.
The data need to be elaborated, firmed up and expanded in the future preparatory studies.
The authors accept no liability for any material or immaterial direct or indirect damage resulting from the use of this report or its content.
This presentation contains the results of research by the authors and is not to be perceived as the opinion of the European Commission.

References

- **Stock** 2005 (avg. 3-7 years old), scope: current situation
- **Sales** 2005 (Base Case), scope: reference
- Least Life Cycle Costs saving potential (LLCC), scope: minimum target (e.g. 2005/32/EC Annex II)
- Best Available Technology saving potential (BAT), scope: show that product-differentiation is guaranteed with LLCC target implemented
- Best Not (yet) Available Technology saving potential (BNAT), scope: future long-term concepts (direction R&D)

- EU-25 consumer expenditure (residential, heating only, stock 92.4 mln. units, sales 4.6 mln. units/yr): € 97 billion, of which € 5-6 billion in purchase of the product.
- LLCC: € 12,200 of which product price and installation € 2,100 and running costs € 10,100
- Main environmental impacts (stock):
  - No. 1 in Energy and GWP, acidification 292 kt SO₂ of which >95% during use phase.
- Efficiency Sales vs. Stock: 4% (8 years)
- LLCC saving potential (vs. sales): ca. 20%
- B(N)AT saving potential: up to 40%

- Stock η 81 % [gas], η 77 % [oil]; mostly atmospheric
- Sales η 87 % [gas], η 81 % [oil]; mostly atmospheric and low-T
- LLCC η 106 % [gas], η 101 % [oil]; condensing, modulating, weather-controlled
- BAT η 125-130 % : heat pump technology, gas-fired absorption heat pump
- BNAT η 140 % : hybrids of LLCC/BAT with high-efficiency fuel cell micro-CHP (target η on power generation not yet achieved)
• EU-25 consumer expenditure (stock 25 mln., sales 4.5 mln./yr): € 13.5 billion, of which € 4.5 billion in purchase of the product.
• LCC: € 3,660 of which product price € 1,000, installation € 920 and running costs € 1,740

Main environmental impacts (stock):
- Energy 269 PJ,
- GWP 20 mt CO₂ eq.
- Acidification 75 kt SO₂

Of which >90% during use phase.

• Efficiency Sales vs. Stock: 8% (over 6 years)
• LLCC saving potential (vs. sales): ca. 30-40%
• B(N)AT saving potential: up to 50%

**BAT**

- e.g. Gas-absorption heat pump
- η: 125-130% [gas]

**Room Air Conditioner** (focus GWP & Energy)

- **Stock COP** 2.7
- **Sales COP** 2.9

**LLCC**: Inverter technology, higher efficiency compressors, etc. COP > 4
**BAT**: COP > 4 + System solutions, e.g. Re-use heat/cold in building, adiabatic cooling, etc.
**B(N)AT**: High-temperature cooling (beams, active radiators/convectors) with hydronic systems + load-dependent control (e.g. CO₂ sensors)

* = Coefficient of Performance
- EU-25 consumer expenditure (stock 103 mln., sales 9.7 mln.units/yr): € 7 billion, of which € 1 billion in purchase of the product.
- LCC: € 650 of which product price € 100 and discounted running costs € 550
- Main environmental impacts (stock):
  - Energy 434 PJ
  - GWP 19 mt CO\textsubscript{2} eq.
  - acidification 115 kt SO\textsubscript{2}
  - Of which >90% during use phase.
- Efficiency Sales vs. Stock: 5% (over 6 years)
- LLCC saving potential vs. sales: ca. 30% (variable speed drive)
- BAT saving potential: up to 50% (VSD + permanent magnet)

- EU-25 annual expenditure (50 million units stock): € 4.8 billion, of which € 1.2 billion in purchase of the product.
- LCC: € 2030 of which product price € 750, installation € 750 and running costs € 850
- Main environmental impacts (stock):
  - Energy 302 PJ
  - GWP 13 mt CO\textsubscript{2} eq.
  - acidification 79 kt SO\textsubscript{2}
  - heavy metals (Hg) 6 t Ni. Eq.
  - Of which >80-90% during use phase.
- LLCC saving potential (vs. sales): ca. 30%
- BAT: >40% (compact MH + system)
- BNAT (after 2010): LED/PV
- EU-25 annual expenditure (287 million units stock, 21 mln. sales): € 27 billion, of which € 9 billion in purchase of the product.
- LCC: € 920 of which product price € 425 and running costs € 495
- Main environmental impacts (stock):
  - Energy 1293 PJ
  - GWP 58 mt CO₂ eq
  - acidification 342 kt SO₂
  of which >90% during use phase.
- Efficiency Sales vs. Stock: ca. 30% (7 years)
- LLCC saving potential (vs. sales): ca. 20%
- BAT saving potential (vs. sales): ca. 40-50%
- BNAT: full vacuum cabinet, food specific solutions

- Refrigerators & Freezers

- EU-25 annual expenditure (65 million units stock, 6.2 mln. unit sales): € 9 billion, of which € 3 billion in purchase of the dishwasher.
- LCC: € 1300 of which product price ca. € 500 and running costs ca. € 800
- Main environmental impacts (stock):
  - Eutrophication 31 kt N
  - Water >310 m³
  - Energy 270 PJ
  - GWP 12 mt CO₂ eq
  - acidification 72 kt SO₂
  of which >90% during use phase.
- Efficiency Sales vs. Stock: ca. 33% (7 years)
- LLCC saving potential (vs. sales): ca. 15-20%
- BAT saving potential (vs. sales): ca. 30%
**Vacuum Cleaners**

**Stock**
- 1.4 kWh/cyc.
- 18 litre/cyc.

**Sales**
- 1.12 kWh/cyc.
- 14 litre/cyc.

**LLCC**
- 0.88-0.95 kWh/cycle
- 11 litre/cyc

**BAT**
- 0.8 kWh/cyc.
- 11 litre

**BNAT**
- Tablet only
  - [no salt regen. tank]
- Automatic Dosage
  - [soil-dependent]
- -30% detergent
  - 0.7-0.75 kWh
  - 9-10 litre

- EU-25 annual expenditure (170 million units stock, 22 mln. unit sales): € 7.6 billion, of which € 2.7 billion in purchase of the vacuum cleaner.

- LCC: € 335 of which product price ca. € 125 and running costs ca. € 210 (energy € 90)

- Main environmental impacts (stock):
  - Energy: 147 PJ
  - GWP: 7 mt CO$_2$ eq.
  - Acidification: 47 kt SO$_2$
  - of which >90% during use phase.

- Energy Sales vs. Stock: ca. -25% (7 years)
- LLCC saving potential (vs. sales): ca. 30%
- BAT saving potential (vs. sales): > 50%
- BNAT: optimised aerodynamics & motor control

- Some models 2

---

**Stock**
- 1100-1200 W
- ca. 55%

**Sales**
- 1550-1600 W
- ca. 65% dpu

**Example**
- Bagless VC

**Example**
- Cordless
- EU-25 annual expenditure (9 million units stock, 1.6 mln. unit sales): € 31 billion, of which € 6 billion in purchase of the copier
- LCC: € 18,270 (@ 150,000 copies/year) of which product price ca. € 3,500 and running costs ca. € 16,500 (energy € 570, paper € 6100, toner € 7600, maintenance, etc.)
- Main environmental impacts (stock):
  - Eutrophication 30 kt N
  - Energy 318 PJ (>90% use phase)
  - GWP 7 mt CO₂ eq. (>85% use phase)
  - acidification 47 kt SO₂ (>90% use phase)
  - PM 20 kt (>60% use phase)*
- Energy Sales vs. Stock: ca. -5% (3 years)
- LLCC saving potential (vs. sales): ca. 30%
- B(N)AT saving potential (vs. sales): > 50% (electronic paper etc.)

**Copiers**

*direct dust & ozone emission of some machines during use not included [to do]*

**Sales**

*example*

**Volume**

**Copier**

**Safety**

- heat
- dust
- electricity / energy
- maintenance
- light
- vapour
- emc
- noise
- copy / print
- paper
- toner
- packaging
- photoconductor
- worn parts
- equipment
- toner waste

**Environment**

- packaging
- photoconductor
- equipment
- worn parts
- emc
- heat
- dust
- electricity / energy
- maintenance
- light
- vapour
- paper
- toner
- packaging
- photoconductor
- equipment
- toner waste

**Sales**

*example*

**Multi-functional device (MFD)**

**LLCC**

**Saving 30%**

Duplex default [saving paper] & Quick Start-up+low standby power [making full, efficient Power Management acceptable]
Television

**Stock**
- EI 1.3 (20-21")

**Sales**
- EI 1.3 (22-23")

**LLCC/BAT**
Ca. <EI 1
Test standards
Problem+
LCC lower priority
because of techn. shift (trend to flat displays)

- EU-25 annual expenditure (270 million units stock, 32 min. unit sales): € 27 billion, of which € 6 billion in purchase of the TV
- LCC: € 1040 of which product price ca. € 825 and running costs ca. € 210 (energy € 175)

- Main environmental impacts (stock):
  - Energy 538 PJ (81% use phase)
  - GWP 26 mt CO₂ eq. (73% use phase)
  - Acidification 152 kt SO₂ (60% use phase)
  - HM 25 t Ni. Eq. (>30% use, 50% prod.)
  - of which >90% during use phase.

- Energy Sales vs. Stock: ca. -15% (6 years)
- LLCC/BAT saving potential (vs. sales): ca. 20%
- B(N)AT saving potential (vs. sales): > 40%

---

**B(N)AT**
**OLED**
(form 2007)

**LED TV**
(from 2010 LED 100 lm/W)

PCs

**B(N)AT**
**OLED**
(form 2007)

**B(N)AT**
**OLED**
(form 2007)

**B(N)AT**
**OLED**
(form 2007)

**B(N)AT**
**OLED**
(form 2007)

**B(N)AT**
**OLED**
(form 2007)

**B(N)AT**
**OLED**
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**OLED**
(form 2007)

**B(N)AT**
**OLED**
(form 2007)

**B(N)AT**
**OLED**
(form 2007)

**B(N)AT**
**OLED**
(form 2007)

---

EU-25 annual expenditure (170 million units stock, 38 min. unit sales): € 46 billion, of which € 38 billion in purchase of the PC

- LCC: € 1250 of which product price ca. € 1000* and running costs ca. € 240 (energy € 205)

- Main environmental impacts (stock):
  - Energy 630 PJ (75% in use phase)
  - GWP 32 mt CO₂ eq. (65% in use phase)
  - Acidification 191 kt SO₂ (65% in use phase)
  - HM to air 26 t (Ni_eq) (30% in use, 50% prod.)
  - of which >90% during use phase.

- LLCC saving potential (vs. sales): ca. 50%
- BAT saving potential (vs. sales): > 80%
- BNAT: ultraportables, PC-on-a-chip

*VHK estimate for Oct.'05

---

Sales & Stock

**Desktops** 75% of stock
60-70% of sales [100 W on, 10 sb, 5 off]

**Notebooks** 25% of stock
30-40% of sales [30 W on, 4 sb, 3 off]
EU-Stock (10 product cases)

<table>
<thead>
<tr>
<th>Material Type</th>
<th>Total (kt)</th>
<th>% in Use Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>9731 PJ</td>
<td>95%</td>
</tr>
<tr>
<td>Water (process)</td>
<td>832 mln. M</td>
<td>89%</td>
</tr>
<tr>
<td>GWP (global warming)</td>
<td>521 mt CO2 eq.</td>
<td>92%</td>
</tr>
<tr>
<td>AP (acidification)</td>
<td>1429 kt SO2 eq.</td>
<td>85%</td>
</tr>
<tr>
<td>VOC (volatile organic)</td>
<td>68 kt VOC</td>
<td>10%</td>
</tr>
<tr>
<td>POP (dioxins, furans)</td>
<td>157 t Ni eq.</td>
<td>45%</td>
</tr>
<tr>
<td>HM air (Ni, Hg, etc.)</td>
<td>49 t Ni eq.</td>
<td>18%</td>
</tr>
<tr>
<td>PAHs</td>
<td>341 kt</td>
<td>18%*</td>
</tr>
<tr>
<td>PM/dust</td>
<td>104 t Hg/20</td>
<td>25%</td>
</tr>
<tr>
<td>HM water</td>
<td>63 kt N</td>
<td>95%</td>
</tr>
<tr>
<td>Materials (kt) of which estimated to be Recycled (WEEE)</td>
<td>4188 kt</td>
<td>na</td>
</tr>
<tr>
<td>Materials in 10 EuP Cases, total 4.2 mt</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

EU-Totals For the 10 Product Cases

- 13.9% of EU-total (1675 mtoe)
- 12.6% of EU-total electr. (2944 TWh)
- 23% of EuP fuel-related CO2 (ca. 2200-2300 mt CO2) at EU15 sectors, excl. Cars (EECP source)
- 90% of GWP relates to residential and 10% to tertiary sector. In the residential sector they constitute 50-60% of total GWP; in the tertiary 10% of total for that sector.
- 1.3 % of 145 mt of finished steel products annual EU-consumption
- 1.5% of ca. 35 mt
- 2.4% of ca. 10 mt

EU-Sales (10 product cases)

- Total Consumer Expenditure ca. € 280 billion/year (EU-25)
  - of which
    - Product Price ca. € 97 billion,
      - Of which approx.
        - 19 product tax
        - 39 distribution
        - 39 industry
      - Installation costs (CH&RAC&light): € 9 billion and
    - Running Costs ca. € 173 billion
      - Of which
        - 130 Energy
        - 30 Other consumables (toner 13, paper 10, bags 2, water 1.2, detergent 1.2)
        - 13 repairs & maintenance
Eco-design

Notes

Design for the Real Load
(not just the static nominal load)

Examples: Modulating burner (CH), Inverter (RAC), VSD (Circulator), CPU-speed control (PC), Locally dimmed (backlight TV)

Lightweight is Beautiful
(in the trade off between less mass and perhaps a higher impact per kg, the overall outcome is that lightweight usually wins. But keep checking …)

Examples weight saved in: CH Boiler, street lights, dishwashers, fridges, copiers, TVs, PCs, etc.

Mind the Eco-Peaks
(paper, detergent, mercury, gold, etc.)

Examples: RAC/side-by-sides (GWP refrigerant), street lights (mercury), dishwashers (phosphates), copiers (paper, ozone, dust), TVs (mercury, PFCs), PCs (gold, etc.), etc.

Think in Systems
(not just products)

Examples: CH boiler/RAC (house), circulators (heating system), dishwashers (better than handwash, hotfill), copiers (office information system), etc.
APPENDIX VI: REVIEWS

A special effort has been made to receive feedback from the foremost LCA-experts on the proposed methodology. The following experts have reacted to the interim report and we are grateful for their comments:

A specific effort has been undertaken to receive feedback from the foremost LCA-experts on the proposed methodology. The following experts have collaborated in this and we are grateful for their comments:

- **Mark Goedkoop**, Pré consultants, Amersfoort, the Netherlands. Pré is the developer and publisher of the SIMAPro 6 LCA software-tool. The tool accommodates both multiple LCI databases and multiple LCIA (weighting) methods and is distributed worldwide. Also, Pré has created the EcoIndicator95 and EcoIndicator99 method, which are single value indicators trying to incorporate all or most of the environmental impacts.

- **David Pennington**, JRC Ispra, Italy. Pennington is the author on several scientific publications in the field of Life Cycle Analysis and presently working for the European institutions in Ispra, Italy.

- **Anna Braune**, IKP Stuttgart, with the assistance of Constantin Herrmann (PE-Europe), developers resp. users of the Gabi 4 LCA software tool. Gabi 4 is a single LCI database tool with multiple LCIA (weighting) options. It is distributed worldwide (EU, Japan, US).

- **Gjalt Huppes**, CML (Centrum voor Milieukunde, Centre for Environmental Technology), Leiden University, the Netherlands. CML is a scientific authority in the field of life cycle impact analysis (LCIA) worldwide. It provides the chair for the UNEP/SETAC Life Cycle Initiative and is presently engaged in the EIPRO study for the European Commission, looking at the use of Input-Output analysis for Integrated Product Policy (IPP).

- **Rolf Frischknecht**, ESU, expert for Ecoinvent database, Switzerland. Ecoinvent is an extensive and detailed LCI (Life Cycle Inventory) database, containing emission and resources consumption data of over 1000 unit processes. Ecoinvent is the latest product of the Swiss government engagement in LCA activities, starting more than 25 years ago with the BUWAL publications.

Apart from the above experts we also received feedback on the methodology from industry experts in the field of LCA:

- **Ferdinand Quella** (Siemens) with Reinhard Höhn (IBM) and Constantin Herrmann (PE-Europe). PE-Europe is an environmental consultancy firm, originating from IKP and coordinating with IKP the EPIC ICT project.

- **Hans van der Wel** (Philips Environmental Services), Theo Schoenmakers, Maarten ten Houten (Philips Consumer Electronics).
I have screened the documents you send, and I must say I am impressed by what you have achieved in a relatively short time. As an LCA and ecodesign expert, who developed simplified LCA methodologies, like the eco-indicator 95 and 99. The methodology you developed seems to be based on a kind of reasoning that I also used when developing the Eco-indicator 95 method. In a way this means you have developed a method that puts us back ten year, but I see that such a step can have real advantages, depending on the scope I take. As an LCA specialist, developing state of the art methodology I am disappointed, but having understood the context you need to work in, it is I believe quite a clever compromise between the transparency you need and the representative ness of the results.

I would like to make a number of comments and suggestions:

My main comment is that I expect that many users will have great difficulty to interpret the result. They somehow have to weight 15 indicators, and all these indicators have very different units. My fear is that people will make a single score, by just adding up nanograms POP, and MJ energy. Unfortunately I have seen this happening too often. At the same time I realise that weighting will always be controversial, but I strongly recommend to at least add a normalisation step (divide each score with the sore of a reference environmental profile. We usually take the average load of an European citizen as reference.) In this way you can translate the results in 15 dimensionless figures. These figures may still not be added, but at least they become more comparable.

Although weighting is controversial, my second suggestion is to cover this issues in the following ways:

- Develop a short do and don't for weighting in case people want to set their own weight.
- Suggest a series of default weights, for instance by comparing the results with results of well established LCA methods I fully understand that this cannot be fitted within the budget, but you could make a recommendation for further results.

Another suggestion is to reduce the number of impact categories. Experience shows that many impact categories are highly correlated. Often greenhouse gas, fine particle mater, and land use can very well represent the environmental profile. The first one indicates the use of fossil fuels which highly correlates with acidification nutripication, and even quite a large share of the toxic emissions, the second mainly represents the traffic and indirectly the noise, while the third represents bio based fuels and bio polymers, it also has some elements from mining.

I have been thinking about your very simple approach in the characterization of toxic substances. The last ten years LCA methods are thought to have Fate modelling. From a scientific point of view this can hardly debated. Fate models provide the link between an emission and the concentration of a substance in the environment. The norms you use deal with the acceptable concentration, and not with the seriousness of the emission. so in fact one can say fate cannot be missed. Another issue is that the norms set by regulators are set for any kind of health effect, which means, for a regulator a mild skin irritation needs to be prevented as if it is a cancer case.

Having said this, I realise that so far the use of fate models has been problematic, especially regarding the metals. This has resulted in methods that come up with unrealistically high scores for metals. The problem is that fate models do not have a good model for speciation (formation of stable compounds) and for bio availability.
This has lead to the so called declaration of Apeldoorn (http://www.mep.tno.nl/perskamer/Mededelingen/Declaratie_van_Apeldoorn.html) in which experts and industry representatives set a roadmap for future research.

For the EuP I realise there is no time to wait, but you may well expect discussions as the EuP method may give different results from what some LCA methods give. I would also like to point out that currently we are making a complete rework of the eco-indicator methodology were we try to solve these problems. the project is funded by the Dutch government. I suggest you recommend to the Commission to develop some kind of verification study, where an assessment is made how different the results of your relatively simple approach is compared to more state of the art approaches.

Finally I looked at the data table. I think you should add clear definitions what you mean with each entry. For instance, with the plastics, are fillers included (PVC often gets up to 1% of metals as a stabilizer in injection moulding). Cables do they include insulation? etc. The waste figures may also deserve extra attention. For instance, designers, often cannot influence the municipal waste scenario, and such scenarios are often a complex mixture of landfill, incineration and recycling. Recycling is especially complex as sometimes consumers separate parts, and sometimes his happens at the municipality. Another issue is the timeframe. Some only assume there is significant leaching in a landfill in the first 50 to 150 years, some maintain that everything will be leached (which means the landfill becomes cleaner than the surroundings.....). Also the waste handling of ashes is a complex issue. We have quite up to date transfer calculation data available to solve this.

Apart from the link to the Apeldoorn Declaration, Mark Goedkoop also sent a recent call for research, stipulating the methodological problems with toxicity of metals.

Note: No written comments by VHK were made, but the suggestions by Goedkoop were discussed in person at the Pré office in Amersfoort (NL).
Call for proposal, issued 20.4.2005

UNEP-SETAC Life Cycle Initiative

LCIA programme element: Ecotoxicity Assessment

Call for Project Proposals

Improvement of Characterisation Factors in Life Cycle Impact Assessment of Ecotoxicity (Fate-Exposure-Effects)

Project Goal:
Development of characterisation factors for inorganic substances (metals and metalloid) that reflect state of the art modelling and environmental realism.

Context:
Two workshops were carried out in Montreal and Apeldoorn as a collaborative effort between ICMM and the UNEP-SETAC Life Cycle Initiative. These workshops have allowed for identification of key issues in the life cycle assessment of metals that need improvement in order to develop a robust methodology and guidance on the assessment of metals ecotoxicity impacts within LCA (see appendix 1: Apeldoorn declaration). It is recognized that the characterization factors (CFs) for metal require additional research to improve their reliability.

Recently, the LCIA Toxic impacts Task Force of the UNEP-SETAC Life Cycle Initiative has formed a subgroup to address the issues specific to ecotoxicity impacts of metals and guide the work towards the establishment of sound characterization factors for metals. Support for this activity has come not only from the broad scientific community, but also from the International Council for Mining and Metals (ICMM).

Call for proposal 20 April 2005
Deadline for final project report 1 July 2008

Key Issues & Potential Improvements

LCIA fate modelling:
• Metal speciation can influence many fate processes. Current models do not appropriately address the fate of metal species:
  – There is a need to incorporate speciation as part of the fate modelling.
• Fate models should allow LCIA to include assessment as a function of the degree of spatial differentiation of releases:
  – the matrix at the point of release is very influential on metal behaviour (particularly Kds),
  – the model should account for different types of aquatic systems (hydrological cycle).
• Some fate processes are missing in the existing approaches e.g.:
  – sulphide binding of metals in sediments (acid volatile sulphide),
  – precipitation,
  – stabilisation of bound metal (i.e., burial / loss to sediments),
  – geological processes (formation of secondary minerals).
  – ageing of metals in sediment or soils
• Some fate modelling compartments are missing or need improvements:
  – there is no estuarine compartment in the current approach to modelling (metals being transported to open ocean are lost in estuarine environment) (this is likely to be an Important sink for metals)
  – coastal compartment
  – suspended particles
• Key factors to consider including in the model:
  – sorption
• Kds are dependent on matrix, therefore different Kds are needed for different environments
• accurate estimation or measurement of suspended matter, i.e., suspended solids and

MEEuP Project Report, Final | 28.11.2005 | VHK for European Commission
algae and possibly define a suspended matter compartment in the fate model.

- incorporation of settling rates in the fate model,
  - transport processes (diffusion, advection, volatilisation).
- Uncertainty estimate in fate modelling
- Ensure compatibility with LCI results
- Essentiality
  - How can this concept be incorporated into fate modelling,
  - Open oceans may be metal limited for essential elements,
  - Current characterization factors (CF) for marine sediments and water column are large for
    metals for some models
- How can we reconcile existing fate models results which indicate long residence times in the open ocean
  translate to extensive build-up of metals in the water column with current literature which does not support
  this?
- Is it realistic for both the water and sediment to reflect large CF (i.e., do metals reside in both
  compartments — to the same extent?).

**LCIA Exposure and effect modelling:**

- Identification of key parameters for exposure modelling
  - For freshwater compartment
  - For estuarine compartment
  - For marine compartment
- Quantification of the uncertainty of the parameters
- Site specific assessment of effects compatible with spatial differentiation of fate modelling
- Effect factors accounting of bioavailability modelling:
  - For freshwater, estuarine and salt water ecosystems
  - Extrapolation of effect factors from freshwater to marine water
- Bioavailability and speciation for effects assessment:
  - Considering the dissolved fraction or the labile fraction, in the freshwater, estuarine, and
    marine compartment
  - BLM: assess the feasibility of using this in LCIA
- i.e., data requirements, availability of models
- Investigate the true improvement that could be had by using BLM - trade off of time & effort versus
  improvement.
  - Assess the utility of using the free ion activity model (FIAM) as a means to assessing toxic
    effects (i.e., for use in PEC / PNEC comparisons)
- Address the use of only the free ion versus soluble metal and or multiple metal species?
- Effect on terrestrial ecosystems
  - Literature review for improving current approaches (identifying the main limits of current
    approaches and proposing some research issues).
- Essentiality
- Literature review for identifying efficiency level in ocean for metals considered
**David Pennington, 26.4.2005**

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Disclaimer:  

Views expressed are those of the individual and do not necessarily represent official views of the European Commission.

“Review comments (limited to impact assessment aspects, not emissions):”

Climate change indicators — A time horizon of 100 years has been selected as a basis for the indicators. The choice of this time horizon from the options available from IPCC may affect the results of a study and should be justified, possibly through a comparison of the different time horizons.

Acidification — SO₂ equivalents are a common and simple indicator. Other alternatives exist that account more fully for spatial variations and the fate of acidifying chemicals. Many of these build on the well-established RAINS model, which was developed and used for policy support in the context of trans-boundary air pollution. It is unclear which of the methods summarised adopt this approach and also whether the cited methods reflect the current state-of-the-art.

Interestingly, for acidification, all the factors proposed are very similar. The variation between the proposed factors and the uncertainty is perhaps negligible. It might be considered that adding the quantities of acidifying chemicals released will be as robust as applying these SO₂ equivalency factors.

As with SOₓ and NOₓ, particulates are also mentioned under the heading of acidification. These are of high concern from an air quality perspective and related policy in the context of human health. It may be beneficial to also take this air quality issue into consideration, as is the case with most energy-related impact assessments.

POPs — The table presented for dioxins and furans provides a basis for toxic equivalents, although this may not account for differences in chemical fate, exposure, and hence potential risk. It may also be that dioxins and furans are reported as totals (e.g. TEQs) in most cases, rather than in terms of individual congeners. Hence, these indicators will essentially reflect the quantities of dioxins and furans released. Further complexity may not be required here.
Heavy metals — Inclusion of organic chemicals such as benzene and PAHs under this heading is incorrect and causes some complication. The threshold values only reflect toxicity, hence ignore the fate and exposure attributes of these chemicals. The resultant factors will not reflect differences in risk or hazard. For a group of chemicals with a similar environmental fate behaviour, such as say some metals, ranking them based on toxicological differences alone could be considered acceptable. Using policy thresholds, the ranking will provide an indicator that is interpretable in terms of policy-based equivalents.

Note that the toxicological effects can differ. Differences in potential consequences, such as between cancer vs. skin irritation, will not be reflected using an indicator based on toxicity alone. However, this problem is avoided by stating that the indicators reflect equivalents based on policy thresholds. They will not necessarily reflect equivalents in terms of relative potential impacts.

Considering a recent LCIA method, such as IMPACT 2002 (www.epfl.ch/impact), differences between benzene and say cadmium can be 8 orders of magnitude in terms of relative hazard. This differs from the 3 orders of magnitude presented, likely for the reasons stated above.

The general trends for metals such as Cadmium having a higher indicator than lead or aluminium appears to be appropriate. However, in practice, the exact ratio of say cadmium-to-lead factors can differ depending on the LCIA methodology selected. It will be useful to have a table comparing the characterisation factors from recent methods for these chemicals, as was presented for acidification. This should include the CML2000, EPS, Ecoindicator 99, IMPACT 2002, and other recent methods. Old methods should be excluded.

It should be noted that time-horizons are considered in some approaches for metals. To be consistent with climate change, a time horizon or cut-off of 100 years could be adopted.

Another source for toxicological impact indicators is the European Chemicals Bureau’s (ECB) EU risk assessment reports, for example. These present Margins of Safety for human health and PEC/PNEC ratios for ecotoxicological effects that could be adopted as the basis for use in LCA to reflect current chemical’s policy. Perhaps the nearest method to this would be CML2000, based on the work of Huijbregt’s et al. using the USES model (similar to the EU’s EUSES consensus methods/models for providing generic estimates of disperse chemical toxicological hazard and risk indicators).

VOCs — For NMVOCs, it is perhaps acceptable to report the total quantities. Again, it may be that the variation/uncertainty amongst different methods will be higher than the actual difference in published factors. For this reason, they could be assumed equivalent. A check could be done to assess this by comparing different existing factors. As NOx also plays a key role in the context of tropospheric ozone formation, this should also be considered and may have a slightly different factor to NMVOCs.

Eutrophication — There may be factors available in the context of the Water Framework Directive. The factors presented from CML 1992 are likely to be out of date. Reference should be made to more recent approaches, such as Ecoindicator 99, CML 2000, IMPACT 2000, …

With specific reference to the EuP EcoReport PDF document:

Particulate matter — Check if particulates are a precursor of smog/ozone, as this is currently stated in the PDF EuP EcoReport and may not be correct.

It may be problematic to consider (eco)toxicity on the basis of whether substances are addressed by EU policy. Most chemicals are subject to the chemical’s policy, which addresses toxicological affects. This is being updated, see REACH White paper. Currently the model EUSES 2.0 appears to reflect the consensus approach based on the revised Technical Guidance Documents for regulatory screening in an EU policy context, although the results do not
necessarily reflect relative risk for use in comparative assessment tools such as LCA. They will, however, provide relative indicators from a regulatory-equivalents perspective.”

Note: Comments by Pennington were directed to the Commission and not answered directly by VHK. However, a large part of the suggestions by Pennington were taken into account in the methodology chapter 3. The part that was not taken into account, e.g. suggestions for further research, was mostly not dealt with because it was outside the scope of the study.

Anna Braune (IKP) and Constantin Herrmann (PE-Europe), 4.5.2005

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Anna Braune made a comparison of our weighting factors and the ones used in Gabi LCA programme and pointed out differences. These have been reviewed. Constantin Herrmann provided some comments on both their behalves:

- “There are some differences in single values per category. As science develops this is in principal correct, but should be made consistent per method (no mixture of methods).
- Some categories are better developed (as science allows it) some not. GWP is mostly established, EP, POCP and partly AP is fairly developed and quite good accepted (methodological questions and problems, but the error is supposed to be not as crucial). Toxicity is purely coverable with LCA and many different opinions and methods exist. Therefore we recommend to be consistent in the method (decision, which one shall be taken, e.g. CML) and to take weighting factors as they are currently given by one method (update, if updates take place from the researches on regular time intervals, not every day a new one). Specifically for toxicity categories it might be fair to describe an impact value, but at least in addition it should be stated which inventory flows dominate this category by effect (most three contributing ones or similar)
- Toxicity shouldn’t be a category as base for decision making (see also declaration of Appledoorn as attached)
- Base of weighting factors shouldn’t be legal limitation values (Dr. Quella prepares a document relating to that)”
Gjalt Huppes et al. (CML), 9.5.2005

Leiden, 9 May 2005

Comments on
DRAFT MEMO MEEUP:
LCIA – Life Cycle Impact Assessment

This work is of central importance for practical work in design. It would be good to align with the LCA procedures as much as possible, as in many design situations these are used at a certain stage in the design process.

We have a few proposals on extending the work, on the one hand by integrating a number of toxicity categories based on fate and effect modelling (POP and Heavy Metals Water and Heavy Metals Air) and on the other hand taking into account more relevant toxic substances, which is easily possible within this expanded modelling framework. By reducing the number of impact categories, this allows for a more flexible use of the data in a design process.

As a next step we would suggest to use a European normalisation, expressing the score of materials or products as a fraction of the total score on the environmental impact by total European emissions. The result is independent of the choice of reference substance. This can be done regardless of the method used for integration and the choice of category of integration. Estimated total EU25 emission data are available in the EIPRO publication by IPTS.

We go through the categories as specified in the draft report and next come back on the main lines.

Ad Introduction

The energy is a mix of in-system flows and flows at system boundary. This may easily lead to double counting in design practice.

The waste approach is generally superseded by emissions from waste processing

Threshold values do not apply for GWP and ODP. Where they apply, there is a substantial difference between primarily science based thresholds and environmental policy goals which basically have a political nature. These political goals of course are to be met, but the science based approach may be more fundamental in the long run for which product design is relevant. Also, in LCA as used by many firms and consultants, most impact categories are science based and compatibility would indicate their use.

The exclusion of POP emission to water (and in the same reasoning other agricultural emissions) is not justified. Especially biomaterials and bio-energy would seem environmentally attractive, on totally unjustified grounds. This is one good reason to go for general toxicity approach in stead of the partial and mutually incompatible approaches as developed in the document.

GWP & ODP

There is only one method, not a threshold method, for both; always good.
Acidification

EPS seems to have a conversion problem with ammonium-compounds; CML and EDIP are the same. The only difference is the new EcoIndicator which is at an endpoint/damage level which will be somewhat disputed. Reasons for the choice for EPS are not clear. Sticking to the RAINS based versions seems most safe.

POPs and Heavy metals

The POP conversion table for dioxins and furans is a first step towards a more encompassing toxicity assessment. It would be most useful to distinguish between human toxicity and eco-toxicity.

The heavy metals cover more toxic substances than heavy metals, but in a very haphazard way, by including benzene and carbon monoxide, but not the hundreds of other toxic substances. The PAH are represented by Benzo(a)pyrene. For this group, a similar conversion can be made as in the POP conversion for dioxins. This still leaves open the question on how to deal with their toxicity relative to other toxic substances. As the POP and Heavy metals both refer to toxic effects, it would be better to group them into one human toxicity score, and three ecotoxicity scores, or one by integrating these three addition.

All methods considered in the text have as a problem that emissions cannot be related to concentrations, as the contribution to concentration depends on time the substance remains in the environment. This time depends on breakdown and immobilisation processes. Substances also migrate through, medial like water air and soil and persistent pollutants may go into the oceans. Some substances show biomagnification, as when they are taken up in fat and go up the food chain. Though surely not final, reckoning with such mechanisms makes the comparison between substances, and adding them up according to their potential toxicity totally superior to methods based on allowable concentrations. This is a clear advice.

VOC

Non-methane VOCs have the same effect as methane, contributing to POCP (Photochemical Ozone Creation Potential; summer smog). Several VOCs also contribute to other environmental themes, like climate change, ODP, or toxic effects. This is no reason to exclude them from their POCP contribution. VOCs tend to be added up by mass, which makes no sense. It would be more elegant to aggregate them based on their contribution to summer smog formation. VOCs are not the only contributors to summer smog, so the list of POCP relevant substances could be extended, especially with nitrogen oxides. One POCP category would reduce the list to a single number.

Eutrophication

A choice on method has not yet been made.

Excluded

Several substances with toxic effects are excluded. There is no good reason to do so.

Other Aspects

For designers, there is binding regulations (and similar semi-binding, or expected binding) regulations, much more than specified under ROHS and NonROHS.

The design guidelines mentioned in 6.8 have a very different status from regulations, as they are supposed to contribute to lowering environmental effects, even if regulatory requirements are met.

*Gjalt Huppes sent a selection of tox-factors, focus on heavy metals, for the purpose of comparison*
Table 1. HTP factors for characterising human toxic releases

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<th>CAS number</th>
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Please note that, without addressing every single issue, the comments by Gjalt Huppes were largely taken into account in the underlying draft in as much as the boundary conditions of this assignment allowed.

Rolf Frischknecht, 21.5.2005

Below please find comments by Mr. Frischknecht and —per issue— our answer

Comments by Rolf Frischknecht, ESU-services, Switzerland on EuP_EcoReport_Unit_Indicators_v2.pdf

First of all I think it is very valuable and nice to have quite a few LCIA datasets on two pages and comments on how data has been compiled on another 4 pages. I can imagine the tremendous amount of work lying behind you. I am impressed.

Secondly, I wish to thank you very much for the opportunity to comment on this project report and calculation tool. I consider it very important both for policy making and LCA promotion.

Please allow me to take the chance and make a few critical comments on the list displayed in EuP_EcoReport_Unit_Indicators_v2.pdf. In the LCIAdoc_ROF.doc file I added additional comments on the impact assessment methods description. Please note that I appreciate your work and the principle goal, which I consider appealing and enhancing the use of LCA thinking in industry.

I would appreciate it very much if you would be willing to discuss these comments together with your commissioner. I am prepared to join such a discussion if considered appropriate.

... will include your comments (as such) in our interim report by way of “FAQ” section (Frequently Asked Questions…) together with our answers. I will do so also with the comments of other experts (Goedkoop, Huppes, Herrmann/Quella, Pennington). This format is probably more attractive and it shows the concerns of LCA experts.

Columns:

Primary energy

The energy indicators are partly redundant (at least electricity and prim). The figures seem to show that you are using primary energy non renewable AND renewable. I very much doubt this approach as these energy sources have very much differing qualities and scarcities. Please separate renewables from non renewable ones. Please specify the was GER was calculated (in particular regarding nuclear power).
Missing nuclear waste and radionuclide emissions

Please refer to the comments I made in the LCIAdoc_RoF document. I think that a few important impact categories are missing in the current version!!

See other document for my answer

Waste

What source did you use to estimate waste amounts in metals mining?

Depends. For common metals we used USGS, recent US DoE EER data, data from commercial exploration and mining companies. Partitioning was done mostly on the basis of real or estimated primary mining. E.g. for silver we took the ore concentrations from the few primary silver mines as a yardstick (around 200 g/t ore) and not a partitioned value of lead-mines (90 g/t).

For precious metals we retrieved data from several sources, mainly company sustainability reports which we compared with some data from older LCAs. We did not buy your LCA-data on gold, because we would not have been able to use them in a public report. However I have a fair idea of the GER value you use and ours —from different sources— is similar (e.g. 4 g/t ore and with a stripping ratio close to 10 for open pit mining and 2 for underground mining)

Waste

The characterisation table in this document is far more comprehensive than the one shown in the LCIAdoc.doc. The documentation and reasoning is missing (in both documents).

See answer in other document

Comment on ODP substances

In the LCIA document you mention that ODP substances are used in electronics manufacturing. Hence, it would be important to have this category listed here as a trade off between less electricity consumption but increased electronics manufacturing may occur!!

As mentioned in the other doc, we retrieved the values initially but —also in electronics manufacturing— the contribution of ozone depleting substances in terms of CFC-11 equivalent is small. Certain HCFCs are used in semiconductor manufacturing, but their main effect is as fluorinated greenhouse gas. The trade off between more electronics and less electricity in the use phase may occur but it is one that would remain within one indicator, namely GWP.

Rows:

Electricity

I am not sure whether it is useful to only offer EU25 electricity. There are of course EuP that are sold all around Europe. But there are certainly quite a few products with a rather nation-oriented market. Furthermore I could expect that depending on the country of use (and of manufacturing, where even mixes from outside Europe might be more appropriate), the conclusions may differ. I suggest to reconsider this aspect.

I am sorry, but unfortunately there are not many EuP left that are sold in one country, at least not in the cases that we have to study. I only know of some small biomass boiler manufacturers that are selling in Austria mainly (but also in
Germany). In the field of ovens (AGA) and water boilers (vented) there are still some national niche markets in the UK. Apart from these very rare exceptions the market for EuP is at least European if not global and usually dominated by not more than 5-10 manufacturers per product group.

Disposal: environmental costs …

How comes that incineration requires 67MJ primary energy per kg waste? This would mean that 1.5 kg oil is required to incinerate 1 kg of waste!!

Our data came from the IPPC BREF on waste incineration, but if you have other references please let us know and we will gladly consider those.

Disposal: environmental benefits …

I have my reservations on the recycling approach chosen for metals (considering 85% recycling rate in the data themselves). I guess you applied an avoided burden approach which I cannot support.

Actually, our approach is more inspired by (not identical to!) work of Bo Weidema, who is linking recycling credits to market economics: supply and demand, and the work of Jaco Huisman on QWERTY. They have to be in balance if recycling is going to work. It is very nice to give a 100% recycling credit for plastics just because they are being offered for recycling. But if no one is using them or just using them in low quality applications (replacing low quality construction wood or sand/peelings in a road bed), it is all just theory. Likewise, if there is no supply it is hard to expect a lasting demand. So, a methodology that is effective has to anticipate the market balance and stimulate supply if there is a lack of supply and stimulate demand if there is a lack of demand. So, what is the market balance with metals and what is the market balance with plastics and how will it be if the WEEE directive starts to take effect?

According to Huisman, but also according to common sense, the WEEE will increase the recycling rate of metals. They are cheapest to recycle, just using shredder based recycling without any difficult or expensive Design-for-Disassembly measures.

So there will be a significant increase in metals supply. But will there be more spontaneous demand? Probably not…. In fact, some secondary metal recycling rates are already slowly decreasing since the mid 1990s (e.g. copper). One reason is, that the EuP-industry has very limited demand for parts with a high percentage of recycled materials (die-casts, frames). Installed appliances (e.g. some CH boilers) may use a significant part of die-casts, but other than that I can only think of counter-weights in washing machines (iron castings), frames in dishwashers (steel profiles), aluminium motor housings and magnesium laptop housings. All the rest of the metal, that hasn’t been substituted by plastics, is sheet or extrusion that only supports a low recycling percentage because it needs to meet a certain surface quality for coating. So, for certain metal parts like die-casts and metal frames it makes sense to make their use attractive by attributing the recycling credits beforehand, rather than attributing imaginary recycling credits afterwards by inventing unused Design-for-Disassembly methods.

For plastics the situation is different. As far as EuP are concerned there is hardly a recycled plastics market at all. There are some markets for reusable plastic parts like toner-cartridges, but—as a lecture at EGG 2004 showed—the logistics costs should be contained to gain an environmental profit. In other words, to create true plastics recycling requires a major effort, not only in design but also in logistics and organisation. Only if that special effort is made there should be a credit.

The share of recycled metal in the input is the important information not the rate of scrap being recycled.

Correct, the run-around scrap should not be counted. The recycling percentages in the table refer to the recycled input % to keep the process going. Furthermore the initial LCIA result and the credits should at least be shown separately.
Did you consider the production of secondary gold, palladium, platinum (its recycling impacts? In the precious metals we assumed 25% from recycled material, if it is used for decorative applications. For raw material in electronics there should normally not be any recycling credit. For gold bonding wire a 99.999% pure metal is required and then an input of post-consumer recycled material is almost impossible.

I also have my reservations with the plastics credits. There is no incinerator that is able to extract 75% of the feedstock energy of a plastic product. In Switzerland the average efficiency is somewhat below 30%. And with that the heat is not yet delivered to the client. Another at least ten percent is lost in the district heating network. Hence, I assume that the credit (if granted at all, what I dislike) can be 25% at maximum.

I would need a bit more background. The exact conditions of the incinerator and the feed are very important. Do you have any reference I could check?

Furthermore it is questioned whether oil is the only and correct replaced heating fuel.

**Data sources**

I am really a bit astonished that you did not use the actual ecoinvent Data v1.1 (or at least I did not find any hint to it). Although I am aware of some errors that are currently being corrected (e.g. particulate emissions from limestone mining or dioxin emissions in steel making) I would have expected this database to be one viable source for one or the other product/service (for instance for a good picture of the electricity supply in Europe, or for the Pt-extraction and production). Even more when considering the fact that the ecoinvent data available allow for a detailed assessment according to any impact category you could think of.

I would appreciate it very much to know the reason for this reservation towards ecoinvent Database. Because established by a non member state? Other political reasons? Industry-related reasons?

If it is a misunderstanding on my side the better!!

*Don’t worry. It has nothing to do with a boycott of the Swiss and I am very impressed with the broad data collection in ecoinvent (we have a license with SIMAPRO 6). We mention ecoinvent in the first chapters, when discussing our choice of data sources. And we would have liked to use a ready database like Ecoinvent. There are some compelling reasons we did not.*

The first reason is, that we have to work with publicly accessible data, not with commercial databases that are copyrighted.

The second reason is that we have seen that there can be significant differences between the ecoinvent data and data from industry sources for metals (And often the industry data would report higher emissions). In those cases we would have a big problem explaining the steel and aluminium industry that their LCAs are wrong.

The third reason is that —despite the fact that ecoinvent is very extensive in other fields— there were very little materials/unit processes relevant for EuP. There is a list of plastics and a list of metals, but very little on e.g. electronics/electroplating/etc..

Therefore and with no disrespect, we limited the use of Ecoinvent to check up on manufacturer’s data.

RoF/ESU-services/May 20, 2005

[0] How is primary energy calculated? What are the characterisation factors used for oil, gas, coal, uranium? Do you include also renewable energy sources? If yes, why? I suggest to only consider non renewable energy
sources and to use the upper heating value of hard coal, lignite, oil and natural gas and the energy value of Uranium.

For most raw materials we took the values given by the source (APME, Aluminium Institute, IISI, etc.), after checking that the source took into account basic IFIAS rules for energy analysis. For several downstream items (Gold, PGM) metal plating, electronics, etc. this was not the case, i.e. only process energy was given, and we had to calculate inputs to (at least) the second level (energy, materials). In case of gold and other materials coming mainly from outside the EU we took the local power generation emissions, e.g. >90% carbon based power generation in Australia and South-Africa.

In case of electronic half-products where there is still some production in the EU we took the EU values. In the Unit indicator table you can see most of those values, e.g. for electricity and for heat generation using fossil fuels. The consensus in the EU is to use lower heating values, as is also the case with IPCC default values. So, in cases where we had to complete the energy analysis we used lower heating values. However, in cases where a source did use or could have used lower heating values we choose not to recalculate, because a) the data set was never that complete to allow a proper recalculation, b) the possible error (e.g. 5-6% with heating oil, which is the most used process fuel in materials production) was relatively small compared to other possible errors, and c) maintaining original data increases transparency e.g. towards stakeholders.

Regarding electricity the basis for our assessment is explained —although compact— exactly for emissions in the explanatory notes and can be traced back to the original source (EPER). And for energy we have followed the same consideration; unfortunately not with the same source (we had to use Eurelectric) but EPER allowed us to check the validity e.g. in terms of kg CO₂/kWh. Furthermore we checked consistency with EU policy data like e.g. used in Primes, Poles and ECCP. This leads to 10.5 MJ/kWh for the EU-25 (9.7 MJ/kWh for the EU-15) and e.g. 0.43 kg CO₂/kWh.

This may seem very simplistic for anyone —like us— who has followed the whole net energy analysis discussions and modelling over the last 25 years. But it is not: Actually it comes close to the ideal situation where values are actually measured at the source and are updated every 3 years. We believe that these robust data from a neutral source will survive the many possible discussions. There may still be a part that is debatable, e.g. the corrections for coal mining (Hg), fuel extraction, CHP, distribution, etc. .

As an implicit consequence the renewable energy sources play a role by default, i.e. if they succeed in lowering the total emissions and fossil energy use. We could have a discussion whether I personally think this is correct, but the fact remains that it is consistent with current EU policy. Another fact is, that this discussion is completely outside the sphere of influence of an Eco-designer of Energy Using Products.

[0] What is the purpose of electricity consumption as an impact category? Electricity is a technosphere input. In the LCI its emissions and resource extraction is included in the cumulative LCI results.

True, electricity consumption is not an impact category, but an auxiliary parameter. It is specified as a parameter that the Commission requires from us in its tender document. Apart from that, we think as an auxiliary parameter it is very useful because the energy/emissions from electricity make up a large part of the total impact of most EuP, not only during use but also during production. In that sense any environmental improvement in power generation has a major impact overall on the outcome of the environmental impact assessment. Anyway, we will mention more explicitly that it is an auxiliary parameter.

[0] What is the use of distinguishing feedstock oil consumption from other oil consumption when in the LCI the recycling and the energy recovery in waste incinerators seems to be reported in addition?
Feedstock energy is an auxiliary parameter that is needed to calculate the energy recovery potential at end-of-life. As it is typical of the material and for reasons of compactness we have added the feedstock (ca. combustion) values here, instead of separately at the end of the table.

Rather than a differentiation in use I suggest to make a differentiation of the water source, i.e. ground water, surface water

Apart from the fact that we are bound by our offer and the tender in this, we have a big practical problem here, namely the lack and diversity of data and sources. We have explained this in the “Explanatory Notes”. Some sources do not report water use, whereas clearly water is used. Some sources report “water consumption”; if this is in the primary process industry this is drinking water used as process water, but if it is in manufacturing some sources also include cooling water use. Our subdivision in process and cooling water is not intended as a proposal for two impact categories; it is pragmatic solution to a) report on cooling water should the source specify this and b) propose the “process water” as the more reliable indicator of water consumption. Also here, waste streams are not streams to nature and the emissions caused by incineration or landfilling are normally included in the LCI results. I therefore consider this item not very useful.

In any case I suggest to add high level and low and medium level radioactive waste, being especially important in energy using products.

Why not POCPs?

Our contract with the Commission specifically requires us to report on VOC emissions. VOC emissions are monitored in the context of summer smog (POCB) directive as one of the relevant substances, they are monitored in the context of a directive on human toxicity (painters, etc.) and they are monitored as fugitive emissions, mainly from leakages at chemical plants/ refineries etc.. So, for these three policy areas it is an indicator, although —for summer smog— incomplete. We have considered to extend on this indicator, differentiating with weighting factors, adding NOx as a separate column, etc. but decided against it. The short version of our consideration is that —given the current environmental priorities as laid down in the EU environmental action plan— summer smog alone is not important enough to get into that kind of trouble. We are already reporting on energy use, CO2 (incl. methane), acidification (incl. NOx ), etc. and basically the addition of another POCP related parameter (or an aggregate POCP parameter) would not add much new information.

On the other hand we also did not propose to the Commission to eliminate this parameter. One reason is the toxicity aspect with paints and varnishes. And another reason is the VOC emission from transport in general and airplanes in particular where VOCs are released at higher altitude levels.

I miss radionuclide emissions (to air but also to water), which are relevant in any energy using products. A characterisation model has been published in Environmental Impact Assessment Review No 2 2000 by Frischknecht, Hofstetter, Braunschweig and Suter. It is derived from the ExternE reports (on external costs of energy supply systems).

Thank you. This could be an addition in our explanatory notes. We will look into it and see if we can propose to add this information as an addition to the electricity parameter.

[from a discussion with the Commission follows that this would be outside the framework of our assignment]

APME for instance does not use ODPs but just report grams of CFC or HCFC. How did you transfer these values?
When we started out, we did collect data on ODP and used the conversion factors listed in the directive. However, after having done so for most materials and half-products we found that ODP did not differentiate (see Explanatory Notes) and generally levels were low. Regarding APME there was another reservation as well: We found that the levels of ozone-depleting substances reported were only significant in the older data (1994/’95) and not in the most recent APME reports. This —coupled with the pressure on the chemical industry in the last decade— led us to believe that we might be chasing ghosts if we put too much weight on these specific ODP values from this — otherwise authoritative— source.

As long as substances other than heavy metals are in this group I suggest to use another name. Up to this category the categories were named according to an environmental problem. This should be maintained as far as possible.

All the substances in this group are described in the implementing directives of the current EU Air Quality framework directive 96/62/EC. Their concentrations are measured in the same way (i.e. locally, not globally) and the main argument for all (in the “whereas” part of the legislation) used by the legislator is their harmful effect:

- “define and establish objectives for ambient air quality in the Community designed to avoid, prevent and reduce harmful effects on human health and the environment as a whole;
- assess ambient air quality in Member States on the basis of common methods and criteria;
- obtain adequate information on ambient air quality and ensure that it is made available to the public inter alia by means of alert thresholds;
- maintain ambient air quality where it is good, and improve it where it is not.”

Furthermore it is mentioned (e.g. for carcinogens in COM(2003)423) that

“Where ambient air concentrations and deposition give rise to harmful effects on human health and the environment harmonised monitoring is essential

- to assess the implementation and achievement of abatement measures in particular near fugitive and diffuse sources,
- to get information on local air quality and where improvement shall be envisaged,
- to monitor the state of the environment also with a view to soil degradation,
- to implement the UN/ECE Protocols on Heavy Metals and Persistent Organic Pollutants and the conclusions from the UNEP Global Mercury Assessment.

To combat problems of air pollution related to concentrations of heavy metals and PAH in ambient air the proposed Directive complements abatement strategies undertaken across the EU to comply with existing legislation and encourages further measures, where appropriate. Member States are responsible for determining and taking the specific actions, which are best suited to local circumstances.

As you probably can imagine, to use the header “toxic substances” implies much more than we are willing and able to imply. It would imply e.g. that substances that are not included would not be toxic: We have no way of knowing that. The only thing we know is that they are not part of EU legislation, nor even of draft legislation. In practice this means, unless there are emergency laws following disasters, that this list is fairly robust for the next 2 to 3 years. Furthermore, to use the header “toxic substances” would imply that the weighting factors are a measure of the toxicity of these substances. Again, we have no way of knowing that. We have studied of course whether there is a scientific consensus, some un-controversial (eco-)toxicity index that would appeal to all. But, as you probably know, there isn’t (e.g. see Declaration of Apeldoorn, see latest call for tender from ICCM). We are no toxicologists, we don’t make fate analyses or studies of these substances in nature in various persistent or non-persistent forms. The
only thing that we give here are weighting factors based on legally imposed threshold values. And the only thing that this tells our main audience, the policy makers: If an energy-using product has a high score on this indicator that there is a relatively high risk that certain items/actors in the product life cycle will surpass the legally imposed thresholds of the Air Quality directives. No more, no less. And when looking for "Improvement potential" (our task 3) we would probably (if it is significant enough) suggest to use alternative routes that have less risk of exceeding current legal max. concentration values. I know, also from comments of other LCA experts, that there was a hope that we would solve this huge problem, but it is not our contract or our mission to design new toxicity legislation.

In order to give you an impression of the preparatory work that is needed just for one EU air quality directive, I would like to cite again COM(2003)423 on carcinogens:

"The Air Quality Framework Directive provides that daughter legislation should have solid technical and scientific justification in accordance with the Treaty. Technical Working Groups of experts from Member States, industry, non-governmental organisations, the European Environment Agency, the World Health Organisation

and other representatives of international scientific groups and the Commission have met to assess the current state of knowledge and to prepare technical position papers on each pollutant. These Working Groups were chaired by experts from the Member States. They came up with three position papers, one on arsenic, cadmium and nickel, one on polycyclic aromatic hydrocarbons (PAH) and another on mercury. The latter not only covers mercury in ambient air but addresses the whole cycle of mercury in the environment. The position papers are available on the Commission's website.

The Commission signed a Common Agreement with the World Health Organisation’s Regional Office for Europe to work co-operatively on air quality and in particular on a revision of the Guidelines. The updated Air Quality Guidelines for Europe were made available to the Working Groups, and experts from the WHO European Centre for Environment and Health participated in the Working Groups referred to above. The Scientific Committee for Toxicity, Ecotoxicity and Environment (CSTEE) was consulted to give its view on the assessment of desirable concentration levels based on cancer and non cancer effects.

Two separate studies entitled “Economic evaluation of air quality targets for heavy metals” and “Economic evaluation of air quality targets for PAH”, respectively were undertaken by consultants for the Commission. These studies have included the EU 15 Member States plus to a large extent Accession Candidate Countries, i.e. Cyprus, Czech Republic, Estonia, Hungary, Poland and Slovenia. Data from Accession Candidate Countries were considered to the extent possible, thereby taking into account the situation in these countries. Both studies are also available on the Commission's website18. They took as their baseline a "business-as-usual" scenario taking into account policies at EU and international level that are expected to secure significant further reductions of emissions until 2010. They paid particular attention to the key policies listed in section 3.2.

The proposal was subject to consultations at several meetings of the Clean Air for Europe (CAFE)21 Steering Group, where representatives from Member States, Accession Candidate Countries and other stakeholders had the opportunity to comment.”

The air quality (daughter) directives can be downloaded from the europa.eu.int website.

[0] What does assessment threshold mean? What is the purpose of showing carbon monoxide in the list of heavy metals?

Referring to the carcinogens there is a small difference between the Commission proposal COM(2003)423 and the final approved directive 2004/107/EC of 15 December 2004. Where the former mentions “assessment thresholds”, the latter now says “target values” and in Annex II it gives upper and lower “assessment thresholds”. The relative
weight between the target values and the assessment thresholds is the same (so this would not change the weighting factors in our study), but the assessment thresholds (respectively 40 and 60% of target values) are now intended as technical measurement values at sampling points.

The annexes of directive 2004/107/EC give a comprehensive prescription of the location, sampling rate, type of sampling probes, etc.


[0] I must admit that I cannot reproduce your conclusion from the data shown above. What were your thoughts to derive this sequence and these characterisation factors?

You are absolutely right and I will extend the report on that issue. Also you made me notice a nasty error in the table and explanatory notes where Hg (air) was given a factor 1 instead of 20 (to air), which will be corrected. Thank you for that!

My thoughts were first pre-occupied with the fact that Hg was missing from the air quality legislation. Or rather there is an absolute ban (in the RoHS directive), which does not give much to go on in terms of relative weight especially because the RoHS directive also includes lead (Pb) which is a metal with low toxicity according to almost every reference we consulted.

Also some metals like Cu and Cr do not occur in current EU legislation, whereas most sources do report those emissions and EIA lists them as “materials of interest”.

Because of this we looked at the EPER threshold values, which is a reference that does include Hg, Cu, Cr and seemed fairly consistent with the air quality directives. In EPER the threshold values (above which reporting to the EU is mandatory for large emitters) showed Cd, Hg and As with the lowest values. One could argue that As is a little less harmful but they are in the same league. Next follows Ni, which is a factor 4 less harmful, also according to the 2004/107/EC directive. Then we have Cr and Cu with threshold values that are half of those of Nickel and finally Lead and Zinc that are again half of that. For Lead the legislation is not consistent: On the one hand the air quality directive of 1999 has targets/assessment thresholds for Lead (to air) that are relatively low, i.e. 500 ng/m³ versus e.g. 5 ng/m³ for Cadmium (but Cd directive is for 2004). This is a factor 100. In the EPER reporting, the threshold value is only a factor 20 lower than for Cadmium (200 vs. 10). And finally in the RoHS directive Lead is treated on the same level as the heaviest toxins mercury, cadmium, Cr VI, etc.. What to do? We chose the middle route, applying the EPER values for Lead and Zinc. By the way, had we chosen a factor 100 instead of 20 the sensitivity analysis would not have shown a big difference, at least not with most materials that are typical of EuP (for building materials it might be different).

Finally, for the non-metals and lighter metals we simply used the EPER threshold values, which for PAHs are similar to the air quality directive, namely 5 times higher than Cd. The carbon monoxide (1000 times less than Pb) and benzene values (50 times less than Pb) are thrown in as an afterthought, but effectively with these weighting factors they hardly contribute unless in huge quantities (which is never the case in any of the unit indicators).

[0] I suggest to apply the POCP concepts (according o CML 2001) and to call this category photochemical ozone creation (or summer smog). Methane has a POCP value (although very small) and therefore fits well into this category. If just kg VOC are reported quite some distortion are very probable due to the large differences in POCP attributed to individual hydrocarbons.

See earlier answer on VOC.
Why do you exclude emissions to air which contribute substantially to eutrophication?

Our contract requires to report “emissions to water that influence the oxygen demand”. Furthermore, the water quality directives specify BOD, COD, P, N and suspended solids. That is why we loosely used the term eutrophication; probably “water quality, excl. heavy metals” would be a better name. As regards the emissions to air that contribute to eutrophication I would imagine that the “acidification” substances are a good indicator for that.

As said above, I miss radio nuclide emissions to air and water.

See earlier answer

I suggest that you classify them under POCP like all other VOCs, same with Aldehydes. Hydrogen is of no environmental relevance and need not to be mentioned explicitly (just like O2 or N2, that are neither mentioned here).

I could mention that they are relevant for POCP but I will not include them, as the legislator does not.

What is the reason to exclude these pollutants?

The legislator does not include them.

I guess this should be another unit, namely PO₄-eq?

Correct. Thanks for the correction.

Ferdinand Quella (Siemens), Reinhard Höhn (IBM), Constantin Herrmann (PE-Europe)


Proposal for another evaluation in LCIA data

Within the indicator calculation of the LCIA the systems for “Heavy Metals” and their emissions to air and water data are not acceptable.

Basis for weighting factors and limits are in the VH K proposal the legal threshold limits.

These values are not solely derived from natural or environmentally based values. They are mostly based on toxicity, environmental and political values or on technical achievable solutions. Often they are related to work place etc. if taken for emissions to air. Therefore the weighting within the LCI method cannot be used, because this method is only an environmental method. Mixing political and pure environmental assessments will lead to misinterpretation and possibly to wrong decisions.

VHK

It is correct that we take threshold limits in EU environmental legislation as a basis for weighting. The legislation has been prepared by numerous experts from all relevant disciplines over time periods of typically 5 to 10 years and represents the areas where the democratic process and the scientific consensus is most advanced. To the best of our knowledge the legislation for e.g. the EU Air Quality directive and the EU Water Quality has been prepared with no
ulterior motive beyond the best interest of the environment. In this context it is surprising that you identify “toxicity”, “environmental” and “political” as three conflicting entities, whereas in my understanding toxicity and eco-toxicity are part of environmental policy (see also 6th Community Environmental Action Plan).

In any case, if you have indisputable proof that the Air- and Water Quality Directives have been designed with a motive to create trade barriers or similar inadmissible motives in the context of WTO-treaties, we would like to ask you to supply this proof which we will then most certainly take into account in our recommendations to the Commission.

If taken for aquatic effects there is a mixture of metals and compounds. Some much more toxic metals for aquatic toxicity like Ag-ions are forgotten. To my knowledge also about other elements the information is low (Bi, Ge, Ni, etc.) Therefore the selection happened more or less by accident and the system cannot be accepted.

VHK:

We took into account the state-of-the-art in existing legislation and considering the usual lead times for democratic decision making at EU level, we think that the weighting factors will be robust enough to make decisions in the relevant period.

In time it may well be that, following appropriate legislation, the set of weighting factors will be expanded with values for Ag, Bi, Ge etc. emissions. Until such time, as indicated also in our report on Unit Indicators, industry is urged to follow the qualitative guidelines in the ECMA Eco-design standard and the EIA list of ‘Materials of Interest’.

The selection did not happen by accident but—as mentioned before— on the basis of existing EU legislation, which is exactly the reason why Ag, Bi, Ge, etc. are not included.

All values must be comparable globally because the effects must be calculated everywhere in the world.

The methodology we propose does not make a distinction on the basis of geography; the proposed table of Unit Indicators should be applied irrespective of the country of origin of the materials, energy, etc.

Our suggestion to VHK to simplify the method for heavy metals is to mention only the kind of heavy metal which has either the highest value or if possible the three of the heavy metals which appear with the highest values. The reader must be informed that further information is available in the detailed LCA-studies or wherever. During a trace back other values can be discussed if necessary. Weighting should not be made.

VHK:

The selection of substances did not happen by accident but—as mentioned before— on the basis of existing EU legislation. There is no legal ground to exclude a priori certain substances that the legislator has deemed important enough to include in a directive. However, it is important to make a distinction between the a priori assessment of whether a product has a “significant environmental impact”, which uses aggregated parameters, the assessment of what are “significant environmental indicators” and the assessment of limit values according to Annex II of the directive. With the latter, the directive stipulates that policy measures should deal with measurable, physical parameters for Annex II. And it would seem logical that before implementing such a measure there would be an assessment (a posteriori) to confirm the validity of this specific measure.

For instance (bogus example with bogus data), our methodology would identify that a product group has a high environmental impact, that the Commission and consultation forum finds “significant”, amongst others on the basis of a high score in the category “Heavy Metals”. A detailed study would then investigate this product group and find e.g. that 80% of the impact in this category is due to mercury emissions from gold production and that 80% of the gold is needed in memory chips. The researchers will then talk with experts and stakeholders about the reason for the gold wire and whether technically/ economically it is feasible to reduce the gold content (set a limit) and over what period
this could be done. Consequently (a posteriori) the question would be “If we set this limit on the gold content of the memory-chips, what would be the effect?” E.g. would it achieve a significant reduction of heavy metal emissions? Would the technical alternative not be worse in terms of environmental effect? Etc..

Once this has been established the sector would then be consulted on the feasibility of self regulation or whether legislation is the better option.

It should be mentioned that in Germany in 1999 a Code of conduct was agreed between the German environmental ministry and the German Industry (BDI). In this agreement it is stated that all LCA and LCIA data disclosed to the public must be traceable and should be revised by a critical review. This Code of conduct was also given to the European Commission via Unice and was agreed as I remember.

VHK:

The data we are proposing in the Unit Indicators are for the most part (90%) based on publicly disclosed and (copyright-)free data sources indicated in the Explanatory Notes to the table. The weighting factors we applied and other details necessary for the calculations are also contained in the Explanatory Notes. Any analyst that would like to repeat our analysis leading up to the data will find no problem in doing so and publish about his/her findings. Adversely, any analyst that wants to compare his/her own data-set with our data will also not find problems in doing so. The exceptions to this rule relate to cases where no quality public data was available and where we either had to resort to employing non-public/ confidential sources to arrive at reasonable estimates or not have any data at all. In the interest of our study we chose the former. Most of these data refer to your sector, components for/of the electronics industry, and we would welcome any quality harmonised public data for your sector that you could supply.

The European Commission should know that e.g. the Ecoinformatics like Simapro are different for Europe, Japan and USA. It can happen that the same product manufactured identically in different countries gets different environmental impacts. This can also happen for acidification and for eutrophication.

VHK:

The methodology we propose does not make a distinction on the basis of geography; the proposed table of Unit Indicators should be applied irrespective of the country of origin of the materials, energy, etc.. In other words: Identical products will be subject to identical criteria of evaluation.

Political decisions can only be based on GWP and ODP. Otherwise the EU Commission can run into big trade problems.

VHK:

We think the policy makers are quite capable to judge for themselves on what basis they can or cannot make decisions. There are several international treaties (Stockholm, Aarhus, etc.) that deal with the restriction of certain types of emissions that are not linked to GWP and ODP.

Furthermore, the Framework Directive (e.g. Annex I) explicitly says not to restrict efforts to GWP and ODP only. If one feels that an approved piece of legislation is conflicting with existing agreements, I assume —although I am not a legal expert— that the normal course of action is to make a case with the proper authority which to the best of my knowledge is not the European Commission nor its contractor(s). So far we have not received a notice of a ruling or similar on this subject and therefore have no grounds to recommend to the European Commission what you are suggesting.

René Kemna, VHK, 9.6.2005
Hans van der Wel, Maarten ten Houten, Theo Schoenmakers (Philips)


As suggested by you we would like to react on your proposed methodology. Currently we use at Philips so called green focal areas (indicators for weight, hazardous substances, energy use, recycling percentage and packaging) for the assessment of the environmental impact of our products. In addition we internally use for more advanced assessment in product design the Eco Indicator 99 methodology for setting priorities and checking the green focal areas. In some Philips divisions the designers even use the Eco Indicators by themselves for calculating and improving the environmental impact of their products. We achieve good results with this approach, as was also showed at the EPIC-ICT workshop in Hannover in March this year and can be derived from our new Sustainability report of 2004.

Your approach is different from our approach on several points. In your methodology you generate a value for a number of environmental effects like energy use, acidification, global warming etc. similar to the CML methodology of 1992. These effects are given the same weighting in your assessment, whereas some effects in product assessments will be far more important than other effects. Therefore we have chosen in the past to perform a weighting step in our assessment to come up with a priority setting and finally a single score outcome, the Eco Indicator. Currently we use as weighting the Eco Indicator 99 methodology in which the importance of the environmental effects are assessed with a rather objective damage assessment step.

Therefore we suggest to include in your method an advanced weighting step such as is performed in the Eco Indicator 99 methodology.

In addition we suggest to have the values of the material and energy unit indicators based on a reasonable number of thorough product studies, creating real average values for these indicators. I know this cannot be reached on such a short notice, but should be one of the recommendations for future work.

VHK

Also on behalf of the European Commission, to whom I forwarded your message, I would like to thank you for your contribution. You are making an important point, i.e. that we have to strike a balance between scientific complexity and eventually producing results that are manageable and that can be communicated to the industry at a practical R&D level. In that sense we would like to incorporate your message and the underlying answer in our report.

The scope of our assignment is indicated by the European Commission and is an intermediate level between on one hand the several hundred single emission values in a more traditional Life Cycle Assessment and the single-value indicator that you are using. At the moment we are working with a set of 15 different main and auxiliary parameters for resources use and emissions in the stages of product-life, which are relevant for the different EU policy areas. Most of the parameters are aggregated, i.e. clustering emissions/impacts, but still at a level where we can hope to obtain consensus with the stakeholders because -very relevant- at a level where the democratic process and the scientific consensus is well advanced, namely up to the point where the legislators themselves have indicated weighting factors/threshold values within the existing and imminent legislation. That is also the problem with the route you are suggesting: There is as yet no quantitative base in policy or legislation to condense the number of parameters very much further.
For instance the 6th Community Environmental Action Programme (Decision 1600/2002/EC) lists key environmental priorities - climate change, nature and biodiversity, environment/health/quality of life, natural resources and waste - but it does not attribute relative weights to the priorities nor to determining parameters. In other words - in my personal view - there will be a qualitative element that is not fixed in the evaluation of whether a product has — as directive puts it— a "significant environmental impact". It is not our competence to eliminate that qualitative element.

Having said that, we will try to supply the Policy Decision Support information and tools to make the qualitative choice easier and more transparent. Eventually, the methodology should allow a comparison and ranking between products for one parameter/ policy area (horizontally). It also should provide an answer to which products score highest in how many categories. We will also try to provide a comparison with relevant EU-totals, e.g. the total GWP in a sector vs. the GWP of a product group. The environmental improvement potential can be compared with EU-target levels, etc., to provide another input. The economic impact is an important consideration, etc., etc..

I hope the above clarifies our motives and scope, which is different from yours but I think they are both valid in their own right.

Finally, I would like to address your last point. It is true that we are limited by budget in the product-case studies, that therefore estimates are used and that they are intended as illustrations of the methodology rather than comprehensive studies. I am happy that this well understood. On the other hand, we would like to present average EU values for a particular reference year as real as possible, if not for any other purpose then to show that the data for the methodology can be retrieved if needed. In that sense, as we have mentioned in the past, we would very much welcome your input and the input of your sector. Having said that, you can rest assured that we will recommend further study as appropriate.
APPENDIX VII: EXAMPLE DOUBLE AND SINGLE VALUE INDICATORS

The legal basis of emission limit values (ELVs) and some additional cross-links provided by CML, create some unique possibilities to summarize e.g. the various toxicity categories into one TOX-factor (covering human and eco-toxicity), which could be used side-by-side with a GWP-factor (covering global warming and the most part of resources depletion). As an example and without elaborating the issue\textsuperscript{15}, the TOX-factor (in mg, per kg air or water) could look like this:

\[
TOX = 30,000,000 \times POP_{air} + 1000 \times HM_{air} + 1,000 \times HM_{water} + 1,000 \times PAH_{air} + 0.3 \times EP_{water} + 0.3 \times AP_{air} + 0.1 \times PM + 0.05 \times VOC_{air}
\]

Where
\[
POP_{air} = \text{dioxins and furans to air, in mg } 2,3,7,8-\text{TCCD equivalent (TE)}
\]
\[
HM_{air} = \text{heavy metals to air, in mg Nickel equivalent}
\]
\[
HM_{water} = \text{heavy metals to water, in mg Hg/20 equivalent}
\]
\[
PAH_{air} = \text{carcinogenic poly-cyclic aromatic hydrocarbons, in mg Benzo(a)pyrene plus CO and benzene, all normalized to mg Nickel equivalent}
\]
\[
EP_{water} = \text{Eutrophication Potential of emissions to water, in mg PO4 equivalent}
\]
\[
AP_{air} = \text{Acidification Potential, in mg SO2 equivalent}
\]
\[
PM = \text{Particulate Matter to air, in mg}
\]
\[
VOC_{air} = \text{Volatile Organic Compounds, in mg (total mass)}
\]

Furthermore, using the average GWP and TOX-factor over the “basket” of all materials and energy in the Unit Indicator table in Chapter 5 and starting from the assumption that all 4 priorities in the 6th Environmental Action Plan (EAP) are equal (\(\Rightarrow\) avg. GWP= approx. avg. TOX) then this results in a single eco indicator “GWTOX” for EuP, expressed in mg/kg air or water:

\[
GWTOX = GWP + 75 \times TOX
\]

Where GWP is the global warming potential in mg CO2-equivalent (IPCC values) and TOX in mg/kg air or water is the toxicity factor derived from the previous formula.

Of course this last assumption (avg. GWP= avg. TOX) is much more subjective/ debatable than the assessment of the TOX-factor in the previous formula and it might well be that another “basket” and therefore TOX-multiplier is more appropriate. After analysis of all the EuP product-cases —in our final report— we can also indicate how the TOX-multiplier would change if we took the average EuP as a “basket” instead of the Unit Indicator Table. The assumption that GWP would cover also most materials depletion (fuels & minerals) is to a large extent confirmed in most

\textsuperscript{15} Most necessary ELVs can be found in the underlying report. E.g. table 16 gives e.g. Cd=5 and SO2=125,000 ng/m\(^3\) \(\Rightarrow\) ratio 1000:0.04 for human toxicity. To this has to be added also SO2=20,000 ng/m\(^3\) for eco-toxicity \(\Rightarrow\) ratio 1000:0.25 \(\Rightarrow\) total ca. 1000:0.3 for HM\(_{air}\):AP\(_{air}\). The cross-link between HM\(_{air}\) and HM\(_{water}\) is loosely given in 1.4 DCE equivalent per kg air/water as provided by CML. Only the multiplier for EP is hard to derive from given values and there we have assumed the same multiplier as for AP.
scientific publications, but the assumption that all 4 focal areas of the 6th EAP have the same priority is of course arbitrary.\textsuperscript{16}

**Important Note!**

Should one want to use the above multipliers e.g. in connection with the table of Unit Indicators in Chapter 5 it is very important to realise that the \textbf{weight unit is mg (1 milligram = 0.001 gram)}. The table of Unit Indicators uses for the sake of showing the relevant digits kg (10^3 mg, used for GWP), g (10^3 mg, used for AP, PM and VOC), mg (HM, PAH, EP) and ng (10^-6 mg, for POP), which then have to be converted to mg before applying the multipliers in the above formulas.

\textbf{Please note that for the intent and purpose of the underlying study we are not proposing to use a single or double value evaluation, because it will necessarily contain a degree of subjectivity that goes beyond the more robust legal basis that we have chosen for the single categories. Should one want to go down this route, further study and consultation is recommended.}

\textsuperscript{16} In short the 6th EAP focal areas are Global Warming, Human Toxicity, Eco-toxicity and Materials Depletion
APPENDIX VIII CORRESPONDENCE ON METALS RECYCLING

Between VHK, Mr. René Kemna, and the European Aluminium Association (EAA), represented by Mr. Kurt Buxmann (Alcan), and Eurofer (steel industry), represented by Ms. Clare Broadbent (Eurofer IPP manager).

Period: 29.9-19.11.2005 (leading up to and following the Commission Workshop on 3.10.2005)

E-mails are represented in chronological order (most recent on top). Attachments can be found after the e-mail trail.

This correspondence is published here with the permission of the various authors; For more information on the positions of the EAA and Eurofer see their respective websites at www.eaa.net and www.eurofer.org.

Between VHK and the European Aluminium Association, represented by Mr. Kurt Buxmann (Alcan)

From: René Kemna (VHK)  Sent: Friday, October 14, 2005, 17:26h.  To: Kurt Buxmann (Alcan).  Cc: as below

Dear Mr. Buxmann, I understand that you are disappointed that we adhere to the vision of the aluminium industry until 5 years ago and not completely to what appears to be the current vision. Let me just state for the record that I do not recognize "our vision" in what you have described below. It is our task to contribute to the creation of a methodology for the implementation of the framework directive to the best of our ability and knowledge and that is what we do. And as the experience with the EuP EcoReport will show as more examples will become available, the EcoReport is not biased against aluminium (or any material). I know the material not just as a consultant but also from a background as a design engineer and am sure to continue to use it in that capacity for its unique mix of properties. In the former capacity, I have just commented a comparison between the EuP EcoReport and two existing LCA-tools, performed by the TU Darmstadt and sent by ZVEI, where the EcoReport was the only one of the three concluding that a substitution of an aluminium drill housing by PA6 ("nylon") leading to a 20% weight reduction was NOT an environmental improvement. This was only a minor element of that document, but still.

So I hope you keep an open mind in this as e.g. the preparatory ecodesign studies develop. Finally I would like to thank you and the aluminium and steel industry as a whole for putting up the research and publication of appropriate LCI data that enabled us to prepare the Unit Indicator table and I hope that this important effort will continue e.g. in the context of the work of JRC in Ispra.

Best Regards, René Kemna

From: Kurt Buxmann (Alcan)  Sent: 14 October 2005 15:32  To: René Kemna (VHK).  Cc: André Brisaer (EC); Mr. Bayliss (World Aluminium); Juerg Gerber (Alcan); Kenneth Martchek (Alcoa); Michail Papadoyannakis (EC); Nordheim (EEA); Zeliha Topak (EC); Brykman Liliana; Catinat Michel; Clare Broadbent (Eurofer).

Dear Mr. Kemna, Thank you for these clarifications. This proves again that the treatment of metal recycling in your methodology report is based on the value choices of a consultant, what I have already stated in the workshop. Your value choice is based on the vision that in 15 years aluminium scrap will be abundant, because only a few people will buy aluminium products. As a consequence, in 15 years there will globally no primary aluminium production any more, and a part of the aluminium scrap has to be land-filled, because it has no use any more. But your personal vision does not only deal with aluminium, it deals with all metals. According to your vision there will be no blast furnaces for steel any more and no primary copper and zinc smelting, and a part of the scrap of all these metals will be for the land-fill. If the economy has not collapsed completely in 15 years, then the metals, according to your vision, must have been substituted by another "magic" material.

I cannot prove that you are wrong with your vision and value choice. The problem is only that you ask the Commission to introduce your (slightly exotic) value choice in political documents. This is only acceptable if a majority of the Commission shares your value choice which I definitely cannot believe.
Please note again that your approach - and the underlying value choice - is fundamentally different from the approach of the aluminium industry, see enclosure.

Best regards, K. Buxmann

From: René Kemna (VHK)  
Sent: Friday, October 7, 2005, 21.07h.  
To: Kurt Buxmann (Alcan).  
Cc: as below

Dear Mr. Buxmann,

Thank you for your reply and additional information. I have added some comments again to the attached document. Discussions have been and will be ongoing until the 15th of October when we have to finalize the draft final report.

I repeat that our approach is not very different: VHK assumes an almost closed loop recycling for castings and an open-loop recycling (with castings as the substitute use) for sheet metal. And instead of making this dependent on speculative end-of-life situations for e.g. the year 2020 (when many present new EuP will be discarded), we assume a fixed partitioning percentage for a new equilibrium situation we assume to take place in 2020.

Our differences are that we start from the actual equilibrium situation and project a new equilibrium situation, whereas you start from the theoretical recycling potential of aluminium in general. Furthermore, we distinguish between aluminium halfproducts (casting/sheet/profiles) because we think it is important for both secondary scrap supply and demand, whereas you speak of "aluminium" in general terms.

In this respect we think the ISO standard is ambiguous: It assumes that secondary scrap always displaces virgin material, independent of the demand for the secondary scrap (always assumed to be 100%). This is of course true for materials that have already been collected and recovered as "secondary scrap". But it is not true for recoverable aluminium "waste" that never reaches the stage of "secondary scrap", simply because there is not enough demand. There have been several scientists with a different view on this issue ever since the ISO standard was published in 2000.

In your last comment you propose to look into the end-of-life in more detail only for products where this is significant. I could imagine this to be a part of the sensitivity analysis, but if we propose this alternative view in the sensitivity analysis I would like to know whether the European foundry industry (e.g. CAEF) would support this.

Best Regards, René Kemna (VHK, MEEUP project leader)

Attachment: EAA. (final response VHK in blue & underscore)

From: Kurt Buxmann (Alcan).  
Sent: 07 October 2005 12:11  
To: René Kemna (VHK).  
Cc: André Brisaer (EC); Mr. Bayliss (World Aluminium); Juerg Gerber (Alcan); Kenneth Martchek (Alcoa); Michail Papadoyannakis (EC); Nordheim (EEA); Zeliha Topak (EC); Brykman Liliana; Catinat Michel; Clare Broadbent (Eurofer).

Dear Mr. Kemna,

Thank you for your letter where you explain your recycling approach in more detail. To make it short, I have added some comments in red. You can conclude from my comments that your method is not in line with the method as proposed in the IAI document "Key features how to treat aluminium in LCAs with special regard to recycling issues" (Appendix D of the Document "Life Cycle Assessment of Aluminium: Inventory Data for the Worldwide Primary Aluminium Industry"), as it clearly states under 4.6 that methods such like the recycled material content approach should be avoided.

I appreciate your willingness to keep the discussions on-going and to consider international standards, such as the ISO 14040 series. Please note that ISO 14041 is being revised, and the provisions how to treat recycling will be part of the superseding ISO 14044, for which the FDIS version has been worked out a few weeks ago. The provisions as formulated in ISO/FDIS 14044 are the following: Several allocation procedures are applicable for reuse and recycling. The application of some procedures is outlined conceptually in Figure 2 and is are distinguished in the following to illustrate how the above constraints can be addressed:

- a closed-loop allocation procedure applies to closed-loop product systems. It also applies to open-loop product systems, where no changes occur in the inherent properties of the recycled material. In such cases, the need for allocation is avoided since the use of secondary material displaces the use of virgin (primary) materials. However, the first use of virgin materials in applicable open-loop product systems may follow an open-loop allocation procedure outlined below;
- an open-loop allocation procedure applies to open-loop product systems where the material is recycled into other product systems and the material undergoes a change to its inherent properties.

The allocation procedures for the shared unit processes mentioned in 4.3.4.2 should use, as the basis for allocation in the following order as feasible:

- physical properties (e.g. mass);
• economic value (e.g. market value of the scrap material or recycled material in relation to market value of primary material); or
• the number of subsequent uses of the recycled material (see ISO/TR 14049).
A practical example about the substitution method in open-loop recycling of an aluminium sheet product is given in subclause 8.3.2 of ISO/TR 14049. I hope that, after these clarifications, there is still room for a consensus. Best regards, Kurt Buxmann

From: René Kemna (VHK)  Sent: Friday, October 5, 2005, 17.04h.  To: Kurt Buxmann (Alcan).  Cc: as below

Dear Mr. Buxmann, Thank you for your contribution to yesterday's meeting. I am sorry that time was still very short to explain our methodology in detail and also the report handles the subject of metals recycling in a relatively compact way, compared to e.g. the IAI LCA report that I am familiar with. Therefore I would like to take this opportunity to explain more in detail what we propose in the attached letter, showing that our approach is in line with what the IAI is saying.

I have copied also Ms. Broadbent of Eurofer, who has voiced a similar concern from the part of the steel industry.

Best Regards,
René Kemna, VHK, MEEuP project

From: Kurt Buxmann (Alcan).  Sent: 05 October 2005 15:34  
To: René Kemna (VHK).  Cc: André Brisaer (EC); Mr. Bayliss (World Aluminium); Juerg Gerber (Alcan); Kenneth Martchek (Alcoa); Michail Papadoyannakis (EC); Nordheim (EEA); Zeliha Topak (EC); Brykman Liliana; Catinat Michel; Clare Broadbent (Eurofer).

Dear Mr. Kemna, In the EuP workshop of yesterday which I attended as a representative of the European Aluminium Institute, you have mentioned a report of the International Aluminium Institute (IAI) on aluminium in automobiles, from which you have drawn the conclusion that IAI had the same position about recycling as you have laid down in the MEEuP interim report. I have commented in the workshop stating that

- the study which has been published by IAI has been performed before the publication of ISO 14041 and must be considered as "historical", and
- since the publication of the ISO 14040 series of standards IAI closely follows the guidance on treatment of recycling as laid down in ISO 14041, subclause 6.5.4.

A document of the IAI with global data on aluminium and a methodology document "Key features how to treat aluminium in LCAs with special regard to recycling issues" as Appendix D can be downloaded from the IAI website (http://www.world aluminium.org/iai/publications/documents/lca.pdf). This shows clearly that the positions of the EAA and the IAI on this issue are completely aligned.

In the special case of a wrought aluminium product which is used for an EuP and recycled via Shredder, sink-float and remelting to a casting alloy with a recycling rate of 95 %, the guidance document proposes a substitution approach with value correction of 10%, because the market value of the casting alloy is 10% lower than the market value of primary aluminium. This means that a recycling credit of 85 % should be given. This is much more than a recycling credit of zero. Please understand that we feel that aluminium is discriminated by your methodology.
However, we hope that such things can still be adapted when the EuP Process goes on.

Best regards, K. Buxmann
Dear Mr. Buxmann,

Thank you for your contribution to yesterday’s meeting. I am sorry that time was still very short to explain our methodology in detail and also the report handles the subject of metals recycling in a relatively compact way, compared to e.g. the report you have sent me.

Therefore I would like to take this opportunity to explain more in detail what we propose, also vis-a-vis the methodology report you have sent me, because I think our positions are not far apart.

As I told you in the meeting, we have taken the automotive study of the Aluminium Institute as one of the base documents. It distinguishes between the recycling credits for sheet and extrusions (range 5-10%) on one hand and the one for die-casts (ca. 65%) on the other. We believe that this still accurately describes the current situation regarding the recycling flows.

As I tried to explain in my last letter, the report of this study has to be taken as “historical”. After publication of ISO 14041, the IAI supports the substitution approach and clearly states under 4.6 that methods such like the recycled material content approach should be avoided. (see IAI report).

As mentioned during the presentation of 3 Oct., our assignment is not to make an LCA but to propose indicators. Furthermore, we take into account as much as possible, but do not restrict ourselves to the ISO 14040 series. The method has to fulfil also other boundary conditions (according to the directive) e.g. not leading to excessive administrative burden, distinguishing between subjects of higher and lower impact and reflecting real-life economics over a period that is relevant for achieving policy goals.

The reasons --as mentioned in the meeting-- behind the current flows of secondary scrap depend not only on the supply of secondary scrap, but also the demand for secondary scrap: The manufacturing technology for sheet/extrusions and the required surface quality of aluminium sheet/extrusions do not support higher recycling percentages. This is a case the IAI-report refers to as

"the recycling operations can lead to a significant change of the inherent properties of the recycled material compared with primary aluminium, for example by the presence of metallic impurities which are entrapped during the remelting operation of poorly sorted or contaminated scrap."

Also, the IAI-report says

“In the case of the open loop recycling approach, the substitution method can only be applied if the recycled raw material is similar enough to the primary raw material which it substitutes. In many instances however, there will be a difference between a recycled material and the primary material it may substitute. Strict interpretation of this rule hence limits the application of the substitution method only to special cases.”

In other words, the contaminated scrap –like the one coming from EuP where the aluminium fraction is relatively low amidst a high share of other highly diverse fractions17-- can only be added to a certain percentage.

The foundry products would support much higher recycled content (according to expert reports up to 85%) and we agree with you that for casting alloys the substitution method would almost fully apply. But the limiting factor here is the supply side which makes current recycled content ‘only’ around 65%.

17 Very different from packaging but also different from construction industry where the collecting and division of fractions is much easier.
From this pre-WEEE situation —e.g. with a recycled content overall of ca. 35%— we now move to a post-WEEE situation where we assume 95% of the metals from EuP will be recycled. As said in our presentation yesterday, we estimate this will ultimately lead to a growth of around 10% of the total secondary aluminium scrap, so 38% instead of 35%.

The question is, where will this extra scrap go? If we look at how the economy will function also after the WEEE-implementation, we think this extra scrap will go into foundry products.

This may be true for all EuPs where aluminium can only be recovered by shredding and sink-float sorting. However, wherever the scrap will go, it will substitute primary aluminium. If e.g. 250'000 tonnes of extra aluminium is recycled from EuPs, then there is no need for an extra aluminium smelter of 250’000 tonnes of annual production, (or an existing smelter has to be closed because of over-capacity). This means that recycled aluminium definitively substitutes primary aluminium.

I am content that we have the same view as to what will happen. From our discussions with the EuP-manufacturers we have concluded that EuP-recycling of metals will be shredder-based. The scenario is 4 or 5 large shredder/recycling plants, that will recycle all EuP at a recovery rate that is superior to that of manual disassembly. An exception may be electronics, which may be separated (if the separation can be done within 30-60 s.) and then follow an individual recycling route (also shredder-based, but more specialized). In short, what I said reflects that.

What you say about substituting primary aluminium is only partly true (and we take that into account for the part that is true), because a lot will depend on the economics of not only the supply of scrap but also the demand for scrap and the costs of running a recycling operation. If there is no demand for secondary scrap it may end up anywhere (now in landfill, in a post-WEEE era who knows), but not as a substitute for primary aluminium, unless there is a 100% subsidized operation with environmental impacts comparable to the primary route to purify secondary scrap to virgin-grade raw material.

The situation of ‘no demand’ is of course imaginary, but the relative (and sometimes absolute) demand for foundry products is declining and at the same time the recycling costs (even shredder-based) are going up, not in the least because of end-of-pipe environmental regulations. And this has led to the situation as with copper recycling where the recycling rate has dropped from 35% to around 30% in the last decade according to the USGS.

Therefore in our Unit Indicator table you will find a credit of 85% (not the current 65%) for aluminium die-casts. This comes as close as can be to a closed-loop recycling. You may argue that the data (also from global IAI studies) are too high and the JRC may supply better LCI data for aluminium diecasts in the future, but the principle is the one of (almost) closed loop recycling for foundry products.

Sorry, I do not argue in this direction. The comments of the aluminium industry (and as far as I know, also from the steel industry) are more fundamental. We argue - in accordance with the guidance of the ISO 14040 series - that "recycling credits" have to be based on the end-of-life recycling rate of a EuP, according to the substitution principle. The recycling operations between the sorting out of the end-of-life product and the acceptance of the recycled ingot are part of the product system under study. Comparing the quantity and quality of the recycled ingots with the primary ingots used for the product, recycling credits are given. If recycled metal enters the system, then the relevant environmental burdens of this metal will be part of the system. In the end-of-life recycling approach recycled metal usually does not enter a product system “free of charge” (details and examples see IAI document and the Annex to the EAA comment).

For ISO 14040, please see above. Also the ISO 14040 series clearly recognizes not only closed-loop recycling (I think the recycling “pool”would come closest to our mental model). I can understand that you want to maximize the credit for any piece of aluminium and would prefer to have a credit in the area of 140-150 MJ/kg on a the production of 193 MJ/kg (leaving only ca. 40 MJ/kg as impact), but this is not necessarily the priority of policy makers for whom we are making our proposal. And in our view this does not reflect what happens in real-life. It is a consequence of choosing the system boundaries in a rather theoretical way, assuming all ‘aluminium’ to be equal. In real-life, if a designer asks for 10 tonnes of aluminium reflector sheet, the primary plants will produce almost as much primary aluminium, completely independent on design, recycling efforts and the supply of secondary scrap. There is hardly a closed loop: reflector sheet cannot be economically recycled into reflector sheet. If the only aluminium product in the world would be reflector sheet, the maximum recycling rate would be 5 to 10% and probably in this case (given the optics application) less. Independent of ‘recyclability’.

However, for sheet material we assume that —until the theoretical case that the recycling reaches rates are so high they can no longer be absorbed by foundry products—the recycling flows will not change. In other words,
the recycling credit remains 11%. We think this is a fair representation of what will happen in real life in a shredder-based recycling scenario (which seems the one favoured by EuP-manufacturers).

*Again, the substitution principle based on the end-of-life recycling approach comes to a completely different result.*

We think this a fair way of handling aluminium and it is not being unrightfully discriminated: We handle other ferro- and non-ferro metals in the same way.

*The question is what "unrightfully" means. The MEEuP Document cannot claim that it sets rules what is right and what is wrong. The ISO Standards which are the result of an agreement of about 60 countries are much more appropriate to be consulted.*

My answer above was a reaction to your comment that aluminium was being discriminated. "Discrimination" literally means "making a difference" and this is what the directive is about. For ISO 14040 see above. The scope of the MEEuP project is to contribute to a methodology that provides necessary (according to the directive) and unbiased information to the Commission and the Consultation Forum to decide whether and to what extent EuP are eligible for implementing measures under the 2005/32/EC. Part of our task is to propose a methodology that reflects the environmental impact as good as can be expected from what has been written and said about the subject. VHK has no vested interest in any material's industry and no bias against aluminium or any other material.

*Even within the aluminium industry, the approach of the MEEuP Document leads to some strange conclusions:* If the producer has to make a choice between two designs of a housing of an EuP, design 1 with 200 kg of aluminium from sheet material and design 2 with 500 g of aluminium from castings, then according to the MEEuP Document approach the heavy solution with castings would be preferred. According to the substitution principle, the lighter housing from sheet material would be preferred, as far as the end-of-life recycling rates of both solutions are similar.

I think you mean 200 g and not 200 kg. Anyway, you are right: 500 g of castings would have less energy impact than 200 g of sheet material, because of the difference in recycling flow for both materials. Compare also to the previous example: If the only aluminium products were castings, the recycling rate could be 85% (not 5-10).

With respect of plastics, I even think that aluminium is handled even more than fair, because there are several methodologies that would give every plastic at least the benefit of its heating enthalpy. Which means that e.g. polypropylene would not be rated at e.g. 73 MJ/kg (as we do), but only at about a net impact of 13-20 MJ/kg.

*According to the end-of-life recycling approach (see also EN ISO 14041, Figure 1, where end-of-life recycling is included in the product system) the incineration of plastic waste has to be included in the product system. Only the energy flow in form of electricity or steam resulting from the incineration of polypropylene can be considered as a "recovery credit", i.e. the low calorific value of the scrap multiplied by a factor which characterises the average energy efficiency of the European incineration plants, which may have the order of magnitude of 20%.*

*If plastics are recycled, we could also agree that they get, as any other material, a recycling credit according to the criterion "market value of the scrap material or recycled material in relation to market value of primary material" as recommended by ISO/FDIS 14044.*

We don't do that, because we want to propose to the Commission a methodology that reflects true life and not go down a path of a virtual reality.

*I do not agree that a more detailed consideration of the end-of-life operations means "to go down a path of a virtual reality" Maybe you are not familiar with the present recycling studies, e.g. of Prof. Reuter and Prof. Boin of the University of Delft. They really describe what happens in reality. I would rather state that the cut-off-approach which disregards end-life recycling does not consider what happens in real life. Especially for EuPs which are characterised to be produced in series of more than 200'000 units, specific recycling studies should be made, including efforts aiming at design for recycling.*

*I think we agree to disagree on this. Design for disassembly is not the option proposed by the EuP industry, not only because of financial costs but also because it achieves a lower recovery rate and it has a higher environmental impact (e.g. exports to China, India & pollution there). Our office is based in Delft and I am familiar with the university (being in several boards and our office having a Scientific Council with Delft...*
university professors) and the fact that there are several opinions by several professors on how to handle recycling methodologically. Prof. Reuter is from the Earth Science department and his background is—I believe—in the recycling industry and specifically in cars. He also proposes shredder-based recycling, but specifically for cars—where steel and aluminium are used in large quantities for structural elements—he proposes an optimisation of the design e.g. for the type of joints and other issues. If you want a specialist for EuP-recycling, you would rather want to talk e.g. with prof. Ab Stevels, who is also a consultant for Philips and also closely involved in EuP (TV) recycling e.g. at Hoboken and he was a mentor of Jaco Huisman (QWERTY method).

Furthermore, I don’t recognize “a cut-off approach which disregards end-of-life recycling” in the methodology we are proposing to the Commission. We have given it a lot of thought, studied the many options available and have tried to come to a balanced proposal how to handle the issue in a realistic way. There is no “cut-off” and no “disregard of end-of-life recycling”.

Finally, in terms of impact on your sector I would like to stress that

a) EuP constitute around 5 to 7% of total EU consumption of metals, according to our preliminary estimates on the basis of 10 product cases (x factor 4 or 5), and

b) our approach is typical of EuP (small Al-fraction → contaminated) and not in itself transferable to other sectors like packaging or even the building industry where the level of contamination of secondary scrap can be (much) lower.

c) Foundry products (e.g. heat exchangers for certain boilers, motor housings, structural frame elements, some laptop housings, etc.) constitute the main aluminium products in terms of weight. Aluminium sheet/ pulltrusions will be used in lighting (reflectors, some lamppoles) and high-purity aluminium is important for the electronics industry (capacitors, heat diffusers), but constitute a relatively small part of the total with respect of diecast.

I agree that we can make a difference between EuPs with a small percentage of aluminium, where the aluminium components may be characterised by generic figures, and EuPs where housings, reflectors and heat exchangers are of importance, where aluminium needs a closer consideration. Sheet products for EuP are not of minor importance for our industry. My own company, Alcan, sells annually 15'000 tonnes of reflector sheet and 50'000 tonnes of sheet for heat exchangers.

This could be a way, e.g. to incorporate your approach (as a sort of stakeholder impact assessment for the materials industry) in the sensitivity analysis that is part of the information we propose to be offered to the European Commission, e.g. only in the case aluminium sheet is more than 10% of product weight or a similar criterion. But I would like to know how the aluminium foundries—that you also represent—think about this. Because—if I understand this correctly— in your approach sheet metal of any type would then be similar in impact as castings. Apart from the fact that I personally do not agree on that (see above), I wonder also whether the metal foundries would be in favour of such an approach—e.g. in a sensitivity analysis—-that is clearly to their disadvantage (risk of substitution of castings by deepdrawn sheet) and I hope you can provide 100% reassurance in this respect before we take this into consideration, e.g. involving also CAEF in this discussion. Regarding the reflectors and heat exchangers I am not concerned. In the holistic approach that we are proposing, the optical (reflector) and thermal (heat exchanger) properties for the use phase would be—in 99% of the EuP cases—far more important considerations than the production impact.

I hope this clarifies things. Please don’t hesitate to contact me for any remaining questions. I have copied also Eurofer on this issue, because it was also one of their questions and—as mentioned—steel/iron was handled in the same way.

Best Regards,

René Kemna, VHK
Project leader MEEuP
Between VHK and Eurofer (steel industry), represented by Ms. Clare Broadbent (Eurofer IPP manager).

From: René Kemna (VHK)  Sent: Friday, October 19, 2005 2:18 PM.  To: Clare Broadbent (Eurofer); Kurt Buxmann (Alcan).  Cc: as below

Dear Ms. Broadbent, Thank you for your message [see 14 Oct]. We can then only proceed with the proposed figures and ---as discussed on the phone-- propose that recycling credits should be taken into account at the sensitivity analysis as a variable (par. 7.8.3 ) if there is a significant (>10% of original product weight) material substitution of sheet products. Assuming a 35% overall recycling rate minus 5% for the recycling effort this would mean that the consultant in the preparatory study has to recalculate a particular ecodesign option with 25 (steel sheet) and/or 19% (aluminium sheet/extrusions) lower impacts. This would constitute an extra piece of information to the Commission and the Consultation Forum on how robust the environmental improvement from this particular ecodesign option is in the light of the different opinions on the attribution of recycling credits.

Best Regards,
René Kemna

From: Clare Broadbent (Eurofer)  Sent: 14 October 2005 11:49. To: René Kemna (VHK); Kurt Buxmann (Alcan)
Cc: André Brisaer (EC); Mr. Bayliss (World Aluminium); Jürg Gerber (Alcan); Kenneth Martchek (Alcoa); Michail Papadoyannakis (EC); Nordheim (EEA); Zeliha Topak (EC); Brykman Liliana; Catinat Michel

Dear Mr Kemna, Apologies for my delay in replying to you following our telephone conversation yesterday. Unfortunately, although we would like to emphasise that the figures in your methodology are incorrect and we object to you using a recycled content in your methodology, at this stage we do not have an agreement within the European Steel Industry on alternative figures for you to use.

As an industry we are still very concerned over our differing opinions regarding this project and the methodologies discussed and as such, will continue to follow its progress to ensure that the views of the steel industry are made clear to all involved, particularly in terms of end-of-life recyclability.

I am sorry I could not provide a more positive response as you would hope for.

With kind regards,
Clare Broadbent (IPP Project Manager, EUROFER)

From: René Kemna (VHK)  Sent: Friday, October 14, 2005 2:18 PM.  To: Clare Broadbent (Eurofer); Kurt Buxmann (Alcan).  Cc: as above

Dear Ms. Broadbent, I am a bit disappointed that you have not responded to my request to propose the figures that we should use in our Unit Indicator table for steel & iron. I think the discussion would become much clearer if you could do that.

Regarding your main concern, i.e. the optimisation of the recycling phase, I have to say that this is only one aspect of the methodology. Another --quantitatively more important-- aspect concerns the impact of the production phase of the materials where we have to give a realistic and fair indication of the impact of the various alternatives (steel vs. non-ferro vs. plastics, etc.).

This becomes even more so if --as you say-- the demand side of secondary steel scrap is never a problem and the supply side of steel scrap is not a problem that can significantly be influenced by eco-design measures (there might be a waste recovery problem, but not a design problem).

Regarding the recycling percentages. You mention some averages of large companies that cover a wide range of products and processes. In our table we do not do that, but we make a distinction between cold-rolled steel sheet of a surface quality that is used for casings, etc. (5% recycling credit), profiles/ tubes (50% recycling credit) and castings (normally 65% but because of post-WEEE effect set at 85% recycling credit). These are based on current practice but approximate, rounded figures. They could be in line with steel member company figures --this depends on the product mix assumed-- but if you propose more exact industry averages we would gladly take those into account in our final report if all stakeholders are behind it (including the foundries).

Kind Regards,
René Kemna (VHK, MEEUP project leader)
Dear Mr Kemna, Many thanks for your email and your comments. However, I feel that I may not have explained myself clearly enough. Therefore, rather than discussing all the issues previously raised at this late stage, I will concentrate on the main areas of concern.

The sustainable use of resources in product design is of utmost importance to the steel industry and in this case, our main concern is the selection of recycled content as a design criterion for steel within EuPs. As stated previously, the reasons behind the differing quantities of scrap within the production of steel is dependent on scrap availability, economics, blast furnace capabilities etc. Nevertheless, all available scrap is recycled and there is an excess demand for scrap which should be encouraged to be fulfilled.

You state that both recyclability and recycled content are important factors. I would be grateful if you could tell me the environmental benefit of encouraging the use of recycled material within the steel industry when there is simply not enough scrap steel available to meet the demand. The steel industry recycles all the scrap that is available, and if there was more scrap available, this would be recycled too. Therefore we advocate the recyclability of products to ensure that as much of a product as possible can be recycled. There is no environmental benefit to be gained from encouraging the use of a recycled material in an established recycling market where demand is greater than supply. Design for disassembly is one such measure that could help increase steel scrap availability: the more scrap that is collected and subsequently recycled (this will be partly influenced by the ease of disassembly), the more benefits there are to the environment. Therefore, recycling at the end-of-life should be used (Figure 6 of your report) to promote this aspect of recycling, and not at the production stage.

Our main objection does not specifically lie with the energy figures you have quoted, but more the principle behind the recycling aspects of the methodology and a concern that the steel industry should be allocated the correct value for scrap!

Steel is a sustainable material which is fully recyclable and can be recycled indefinitely. Indeed it is the most recycled material in the world and this can only be improved upon by encouraging recycling of the material at the end-of-life and not by trying to promote the recycled content of products! The industry has been operating steel scrap recycling systems on a large scale for more than 150 years and operates via a well-established market that has developed spontaneously without and public incentive.

I trust that this will be satisfactory for the purpose of your methodology report.

With kind regards, Clare Broadbent (IPP Project Manager, EUROFER)
Dear Mr Kemna,

In response to the previous emails from both yourself and Mr Buxmann, please find additional comments from the steel industry.

Among the criteria of the EuP directive (Annex I, section 1.3), it states that the use of materials issued from recycled materials should be used. However it also states that the recyclability of the products must be considered and that easily recyclable materials should be used. The use of this recyclable material needs to be quantified.

We assume (and give credit for) 95% recyclability of iron and steel; you may state that it is 99% (can be adjusted in the EuP EcoReport), but I would consider that to be in the same range. So there is no argument there.

Eurofer opposes any reference to a minimum recycled content as the criterion has no environmental relevance for steel. The steel demand cannot be satisfied solely by recycling. Using recycled content is not a good means of promoting sustainability, particularly when the focus is just on one product group. If a product is specified with a high recycled content then another product will contain less recycled material, simply because there is not enough scrap to make all new products.

We are taking the current economical and technological practice as a basis. This practice may change slightly (ca. 10% more scrap) following WEEE and other recycling promotion, but we agree with you (see later) that the influence of this will be limited.

A holistic view of the world should be taken in terms of policies and strategies in order to improve the environmental performance of products.

Agreed

This criteria will also limit the material choices of the manufacturer of the products.

Depending on the function to fulfill some preferential direction for materials can be expected.

The emphasis should be put on recyclability and not on recycled content.

We think both are important

The precise make-up of steel production is determined by economic factors and the global market in which the steel industry optimizes the use of iron resources.

I completely agree and this is the fact we base the proposed methodology on.

The raw materials used for a specific product cannot be influenced by individual customers.

This is where we have a different view. As the largest Australian steel manufacturer Bluescope (to name just one) puts it:

The factors that determine the extent to which steel is recycled are:
- The specifications of the final product;
- The ability of the recycled product to perform as a substitute;
- The costs of collection and smelting (which include energy, labour and capital costs); and
- Technical limitations.

http://www.bluescopesteel.com/corp/navajo/display.cfm/objectID-DD8766F2-D685-477A-AF3D7A8D82E58D7D

So, as any process specialist will also tell you, the specifications of the final product are of importance and this is almost the only factor that can be influenced by the individual customers/designer. For cold-rolled steel that is used for EuP-casings a certain surface quality is required, because the customers rightly do not accept flaws in the coating. For steel used in deep-drawn parts, also the alloy can be critical. That is one (important) reason
why—as with aluminium—if the current cold-rolled steel sheet/coil used in EuP would be the only steel product around, the recycled content would not be higher than 5 or 10% (you mentioned one factory with 15%, but I am not sure whether that would qualify as EuP-grade). Of course, if the EuP-designer would accept construction steel plate quality for the casings this would be different, but this is not the case.

On the other hand, foundry products are much less critical and there the cycle comes close to “closed loop recycling” if there would be enough scrap. That is why we have partitioned the credits for recycling to foundry products, because if/when the increased recovery rate of EuP becomes a reality they are—given all the factors concerned (see above)—simply the most economical route for an increased supply of scrap.

Indeed, in the case of steel, recycling is not downgrading of the quality of the product - it can mean 'upcycling' to a higher value product such as stainless steel.

I think it is economically and technologically incorrect to compare stainless steel production from scrap (see also our table, which states 63% recycled input for stainless steel) to normal secondary steel scrap recycling in foundries or as a mix-in with carbon steel products. Stainless steel trades at $ 1.60/kg (in a relatively slow market) The Nickel price (Ni accounting for 8% of 18/8 steel) is trading at around $ 12,-/kg and ferro-chromium at $ 1.60/kg. If you compare this to cold rolled galvanized sheet at below $ 0.70/kg you don’t need to be an economist to see the difference.

Regarding the technological side, the differences are also considerable. Stainless steel is almost always used uncoated (different surface requirements), but undergoes many surface treatments like descaling, passivation, pickling (often grinding and polishing) to form the chromium-based oxyde. If standard cold-rolled carbon steel would undergo such treatments it would be uneconomical to produce now and in the foreseeable future.

I understand that your assignment was not to make an LCA but to propose indicators. However, we fully disagree with an "indicator" which uses the percentage of scrap in a family of products. In fact, the indicator “proportion of steel produced out of scrap” does not at all correctly account for steel recycling (sustainability).

Every year the amount of steel that is being recycled is increasing and the end-of-life recovery rates of steel products for recycling are also increasing. Scrap steel is a valuable ($) commodity and this is the driver to recycle. To improve the situation further there should be a focus on designing new products so that they can be recycled or reused at end of life. The steel products life time is longer than it was in the past, which means that the “steel time in use phase” is increasing and it is therefore not available so soon for recycling. The steel scrap is traded on an international market and is in the hand of the scrap handlers, which is uncontrolled by the EuP producers: in 2004, 8 million tonnes of scrap left the EU borders, however one can be sure that all steel scrap that is exported is also recycled.

The fact that steel production is increasing but scrap availability is lower than it used to be means that today, “the proportion of steel produced out of scrap” (directly linked to the scrap available for recycling) will at World level stay low and will not grow. This is therefore not an appropriate use for an indicator. There will always be a demand for scrap and therefore the supply of scrap should be stimulated, i.e. the recyclability of products, and not the recycled content – it is therefore preferential to focus on recycling accounting at end-of-life (the second Figure 6 graph on page 36 of your report) and not at the production stage.

It would be more relevant to take as an indicator, the steel collecting + recycling rate at product end of life (for example beverage cans: 65%; vehicles: 98%; construction: 80 %). Such data are in development. It is foreseen to use those yields in the LCIA methodologies instead of the “proportion of steel produced out of scrap”. This reflects "real-life economics over a period that is relevant for achieving policy goals".

Although undeniably an increasing recovery of steel from waste is a Good Thing, there is very little the eco-designer of products can do about that; mostly it will be in the hands of recyclers and legislators (e.g. WEEE) to increase the recovery of waste for recycling. Once the waste has been collected the recycling—as you demonstrate by your example of cars—is independent of the design of the steel-containing products. There is hardly any added benefit for steel products to “Design-for-Disassembly” or similar measures.

Regarding the recovery rates mentioned, please see the last point.
Specific comments relating to statements in the letter to Mr Buxmann:

Paragraph §6 “The manufacturing technology for sheet/extrusions and the required surface quality of aluminium sheet/extrusions do not support higher recycling percentages”. This does not apply to the steel industry and is not one of the main criteria for steel production. All kinds of scrap are used to produce first choice steel products. For example, stainless steel is made solely out of scrap, preferably containing Nickel and Chrome. Those steel sheets are produced for all kinds of applications with high surface quality requirements. (see above)

§12 “The question is, where will this extra scrap go?” For the steel industry, the post-WEEE situation will be as it is today.

§14 “The scenario is 4 or 5 large shredder/recycling plants, that will recycle all EuP at a recovery rate that is superior to that of manual disassembly” I would like to state that a shredder is not recycling but is treating the waste so that it can be recycled. The melting activity in the furnace is recycling.

“Shredder-based” as opposed to “Design-for-disassembly”

§ 21- “Part of our task is to propose a methodology that reflects the environmental impact as good as can be expected from what has been written and said about the subject. “ The methodology should be applicable and accepted by all products, which means to the automotive, construction, packaging industries etc.

That was not our task.

§ 25- “Only the energy flow in form of electricity or steam resulting from the incineration of polypropylene can be considered as a "recovery credit", i.e. the low calorific value of the scrap multiplied by a factor which characterises the average energy efficiency of the European incineration plants, which may have the order of magnitude of 20%”. We agree with the Aluminium industry.

And finally, if there is some concern over giving too much credit for recycling - then I believe that this is not the case because it is likely that the environmental impact of the recycling process will improve with time and under this scenario, steel would receive a larger credit. In the substitution (closed material loop) methodology the focus is on today rather than making speculative predictions on the future that cannot be justified.

I am really curious what you would propose in terms of figures. We have taken the steel industry’s own LCI data and recycling rates to arrive at (energy only for reason of making the point) 5% recycling for cold rolled sheet (EuP-quality) \(\rightarrow\) 34 MJ/kg, 50% for profiles \(\rightarrow\) 17 MJ/kg, 63% for stainless steel \(\rightarrow\) 62 MJ/kg. Only in case of castings we did not take the current rate (close to 60-65%) but took into a surplus due to WEEE, namely 85% \(\rightarrow\) 10 MJ/kg. If you multiply these energy figures per kg with the number of kilograms produced/consumed you should get a figure (except for castings) that constitutes the total energy use of your sector.

So, what do you propose? Should we rate every product at only 5% of these amounts, e.g. at 2 or 3 MJ/kg, because eventually –once you recover all steel in all buildings/bridges/etc. of the world—it is all recyclable? Or should we split it up and rate every carbon steel product at 35 MJ/kg at the production phase and give a credit of 32 MJ/kg at the end-of-life [which is the same as giving 3 MJ/kg from the start]? And how would this be realistic for policy goals that are aimed at 2010 and 2020?

I truly feel you have to think this through in terms of how you would like us to change our unit indicator figures and how we are going to explain these new figures to the Commission. And I hope that in the end you will realize that this will not be easy..

With kind regards,

Clare Broadbent
APPENDIX IX. THANK YOU

VHK would like to thank the following stakeholder experts, reviewers, participants and many others for their interest and contributions:

**Stakeholder experts (Expert Meetings 26 Jan. and 28 April 2005)**

- Jennifer Hill (US Mission to the EU)
- Koichi Hirose (SHARP Europe)
- Reinhard Höhn (IBM)
- Saul Jamieson (Panasonic Mobile)
- Silke Hermanns (AMD Saxony LLC & Co KG)
- Constantin Herrmann (PE Europe)
- Marc Heude (ORGALIME, Fagorbrandt)
- Guzowski (Polish Ministry of Economic Affairs and Labour)
- Adrian Harris (ORGALIME)
- Bjorn Hedlung (VDMA)
- Mark Goedkoop (PRé)
- Constantin Herrmann (PE Europe)
- Rolf Frischknecht (ESU Services)
- Kiyoto Furuta (NV)
- Henk Douven (Océ)
- Franz Fiiaia (ON Consumer Council for ANEC)
- Giulio Halfon (Prtó)
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