Environmental Impacts of Products (EIPRO)

EU Stakeholder meeting
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Support the Oslo declaration on SCP at www.oslodeclaration.org
Register interest in a global SCP network at www.score-network.org (from mid-June)

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- Approaches chosen
  - Review of existing studies (pillar 1)
  - Developing a new IO based tool (pillar 2)
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Objectives

- Identify the products that have greatest environmental impact from a life cycle perspective to help the EC to select products that qualify for an assessment of their improvement potential.
- Our translation:
  - Impacts related to final demand in EU25
  - Identify then underlying products

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Overall setting

- EU Client Context
  - Initiation: Institute for Prospective Technological Studies (IPTS) of EC's Joint Research Centre (JRC) in consultation with DG ENV
  - Commissioned via: European Science and Technology Observatory (ESTO)
- Project team:
  - TNO
  - VITO
  - CML
  - TU Denmark
- Full project: (IPP Home Page) http://europa.eu.int/comm/environment/ipp/identifying.htm

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An introduction on methods (1)

- Approach 1: ‘Bottom-up’
  - Divide final expenditure in EU in categories (e.g. ‘Audiovisual equipment’)
  - Choose representative products per category (e.g. a TV)
  - Inventory existing or perform new LCA’s for such products
  - Extrapolate impacts of individual products to the full category on the basis of the ratio total expenditure / value of the example product(s)

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An introduction to methods (2)

- Approach 2: ‘Top-down’
  a) Use economic input-output tables. These give
     - Transaction volumes in Euros between industry sectors
     - Values per final consumption category
  b) These tables allow to calculate how much value each sector contributes to a final consumption category
     - For instance: Food products will consist of contributions of the Agricultural sector, Food processing industry, Packaging industry, Freight transport sector and some others
     - A standard approach used for decades by NSBs and economists
     - Developed by Leontief, who was awarded the Noble Prize for this
  c) Inventory then traditional sector emission and resource use data, per Euro turnover
  d) Combination of b) and c) gives the emissions per final consumption category

‘Lower financial costs means lower impacts’ (WBSCD) a1

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a1 check with WBSCD website but it is an often used industry quote
atr; 8/07/2005

An introduction on methods (3)

- A key feature of Top-down (Approach 2):
  - Re-distributes (rather robust) sector emission data over final consumption categories
  - And of course the law of conservation of mass must apply!

  - *[here I want to include an example of a IO matrix with 12 Coicop categories at the left, Agriculture and some other sectors on top, showing (high) agriculture emission data from EEA and asking the public where these data will likely to be allocated to. Answer must of course be 'food']*

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The structure of the EIPRO study

- Pillar 1: Review existing studies
- Pillar 2: CEDA EU25 Environmental IO Model (480 sectors)

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Pillar 1: Overview of studies

Authors	**Area**	Final demand	**Approach**	**Indicators**	**Resolu-tion**
Dall et al. (2002)	Denmark	Households	Bottom-up	Energy	25
Kok et al. (2003)	Cities in NL, UK, S, No	Households	Hybrid	Energy	14
Labouze et al. (2003)	EU15	Households	Bottom-up	LCIA +	34
Moll et al. (2005)	Germany	Households, government, exports	IO	LCIA, TMR	57
Nemry et al. (2003)	Belgium	Households	Bottom-up	LCIA	16
Nijdam and Wilting (2003)	Netherlands	Households	IO	LCIA	65
Weidema et al. (2005)	Denmark	Households, government	IO	LCIA	98

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Pillar 1: Methodologies

- Vary quite a lot:
  - Different basic approaches: bottom-up versus top down
  - Focus on final demand
    - in very different geographical areas
    - And different end-uses (consumers, government, abroad/export)
  - Hence different environmental data
  - Categorise final demand differently
  - Use different impact assessment approaches
- This reflects:
  - That such studies can be performed in different ways
  - Hence individually always can be criticised
  - But also that common hot spots across studies must be robust, since they show up despite methodological differences

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Pillar 1: Approach

- Bringing studies in a comparable framework
  - Using COICOP-related categories as the main entry
  - Comparing on comparable indicators only
  - Comparing in terms of % contribution to the total
- Compared on:
  - GWP
  - Acidification
  - Photochemical smog formation
  - Eutrophication
  - Resources
  - Land use
  - Water use
  - Energy use
  - Waste generation

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Pillar 1: Conclusions

- For almost all these environmental themes, agreement existed on the importance of
  - Transport
  - Food
  - Energy use in the house
  - The house as such

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Pillar 2: IO Model CEDA EU25

- Construction of Environmentally Extended IO Table for EU25
- Main data sources
  - OECD, 2002 (IOT for 5 EU countries, base year 1995, covering 70% of the total GDP of EU25; 35x35 sectors)
  - CEDA 3.0 (US environmental IOT, 480X480 with 1334 environmental inventory items)
  - Total EU emission and resource use data (van Oers et al., who combined sources such as EEA, EPER)
  - Some other sources for physical data
    - FAO, 2004 (Fertiliser usage by EU25) REPORT SAYS 1999
    - SOURCE ADAPTION OF ENERGY DATA NOT CLEAR
    - LCA database EcoInvent (use phase data)

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Pillar 2: Building the model (1)

Input-output table

1. Use the total production, intermediate consumption, and intermediate supply data from EU (35X35 OECD IOT)
2. Use the basic layout of economic structure from the US IOT (478x478).
3. Transform (or 'force') the structure of the US Table reflecting the EU structure at 35x35 level via the RAS method.

Comment:

- *At 35x35 level the table is hence European*
- *It is plausible that the production technologies used in the EU and US are very similar, and that hence 1 Euro production in a sector in the EU will require similar inputs from other sectors as in the US*
- *Of course absolute production volumes may differ, but that is no issue of discussion since true EU25 final demand data was used*

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Pillar 2: Building the model (2)

Environmental extensions

1. Use true total EU25 Normalisation data (emissions and resource use)
2. Distribute these over the 478 sectors on the basis of the existing distribution in CEDA 3.0
3. Revised individual cells carefully consulting FAO (2004 or 1999???) and EcoInvent2000 (where????) data.
4. Add dedicated emission data for the waste and use stage (e.g. using Eco-invent and other sources)
   - Emissions related to fuel use in households
   - Emissions related to car use
   - Etc.

Comment:

- *We hence use true European environmental data for production*
- *We modelled the use and waste phase via a dedicated effort*
- *There may be discussion about the distribution over sectors, but not the totals*

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Pillar 2: Building the model (3)

Final demand

5. Use final (household) demand as reported by Eurostat for EU15 per different COICOP category
   - Scale up to EU25 on the basis of PPP income (some 10% extra)
   - Scale up to include government expenditure on the basis of ratio consumer/government expenditure
6. Link COICOP categories to CEDA EU25 sectors

Some other issues

7. Imports assumed to be made with domestic technology
8. Output to capital goods allocated to sectors using them
9. Of the 478 sectors in the model some 280 produce for final consumption

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Pillar 2: Calculating results

Final demand per category in Euro (“COICOP”))

X

Contribution per sector per category in Euro (“IO Table”)

X

Emissions/resource use per Euro in a sector

=

Total emissions/resource use per COICOP category
(e.g. kg SO2, NOx)

…apply further Life cycle impact assessment -> transform results into e.g. GWP, Acidification, etc.

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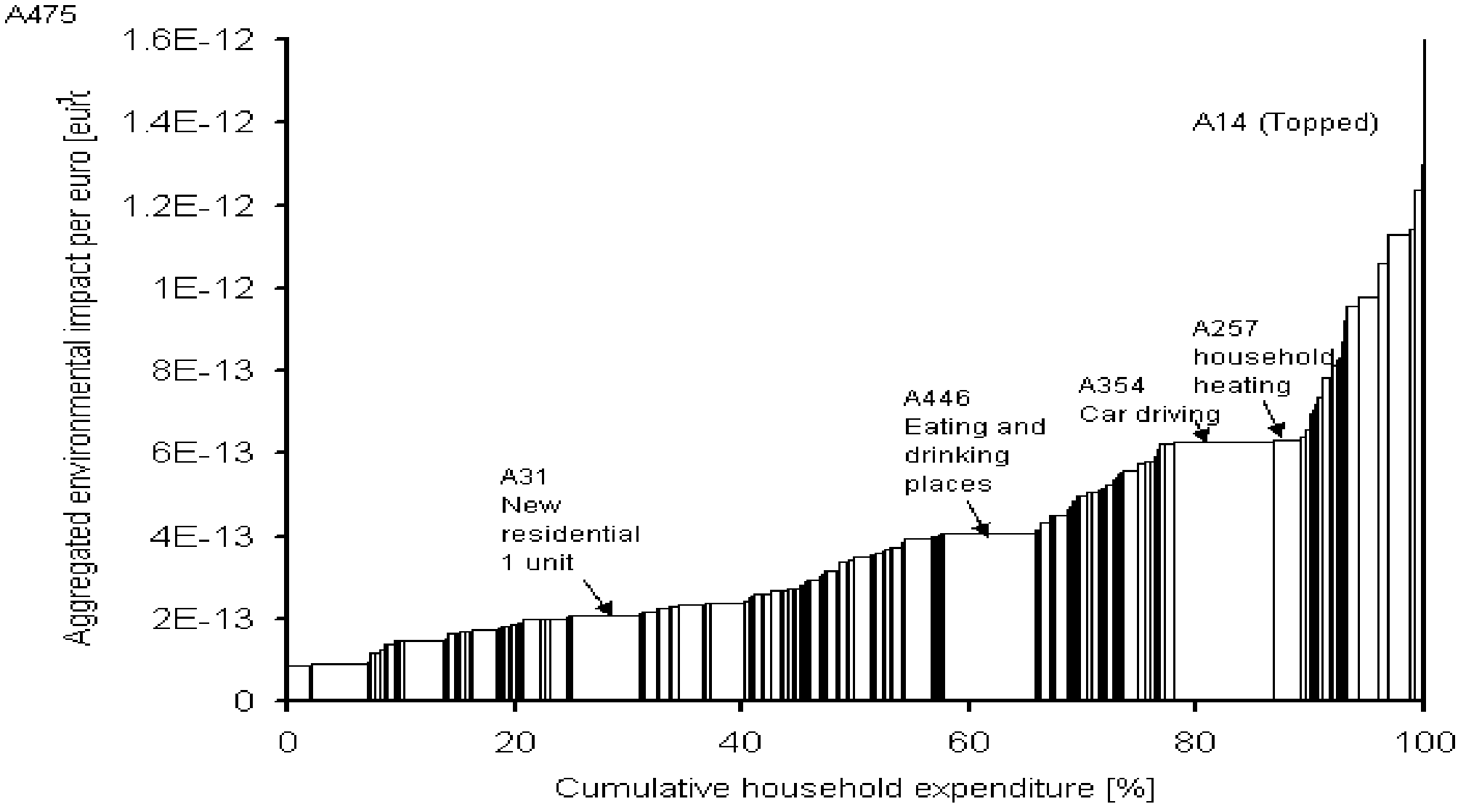
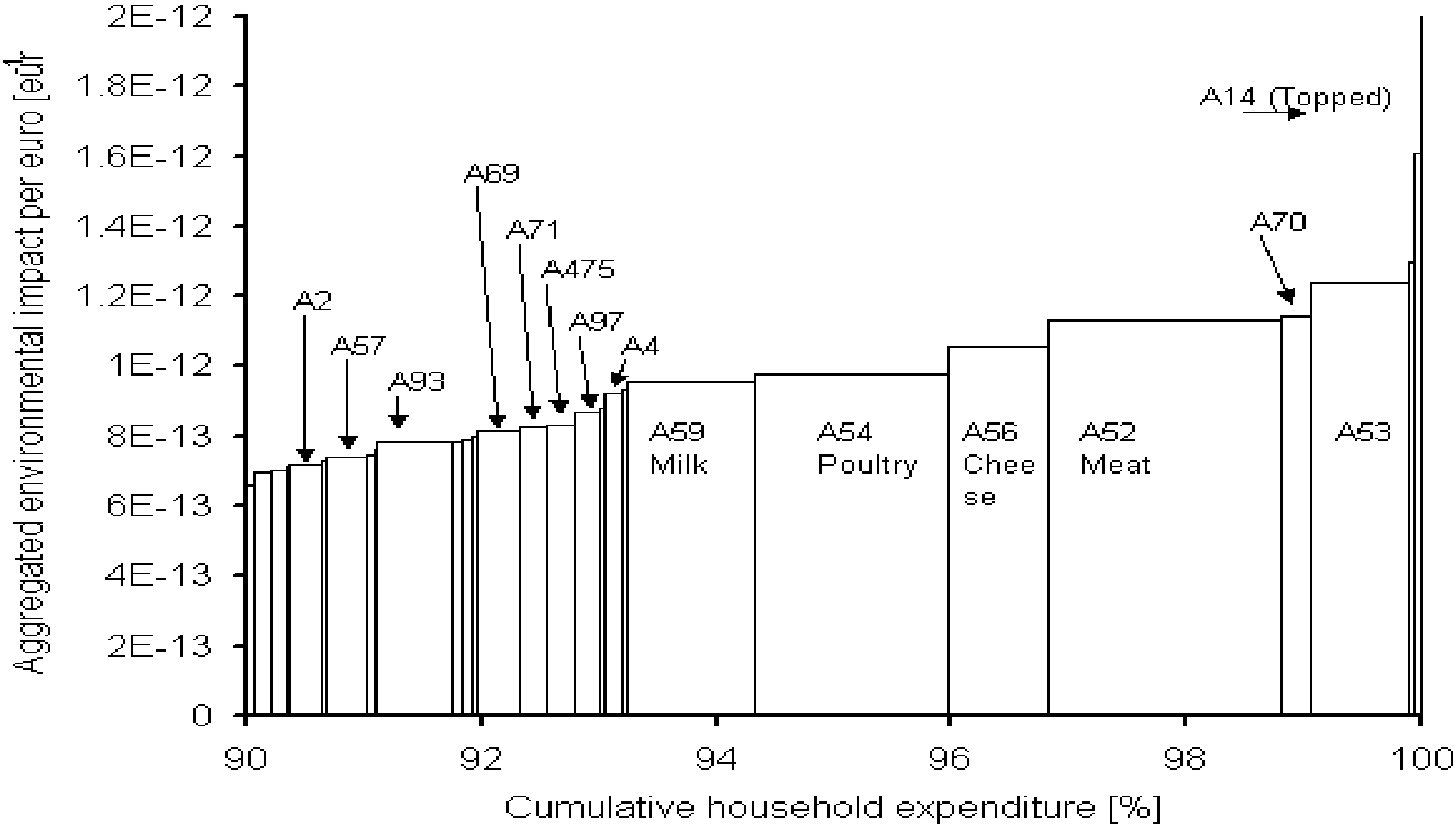
Results CEDA EU25: All products



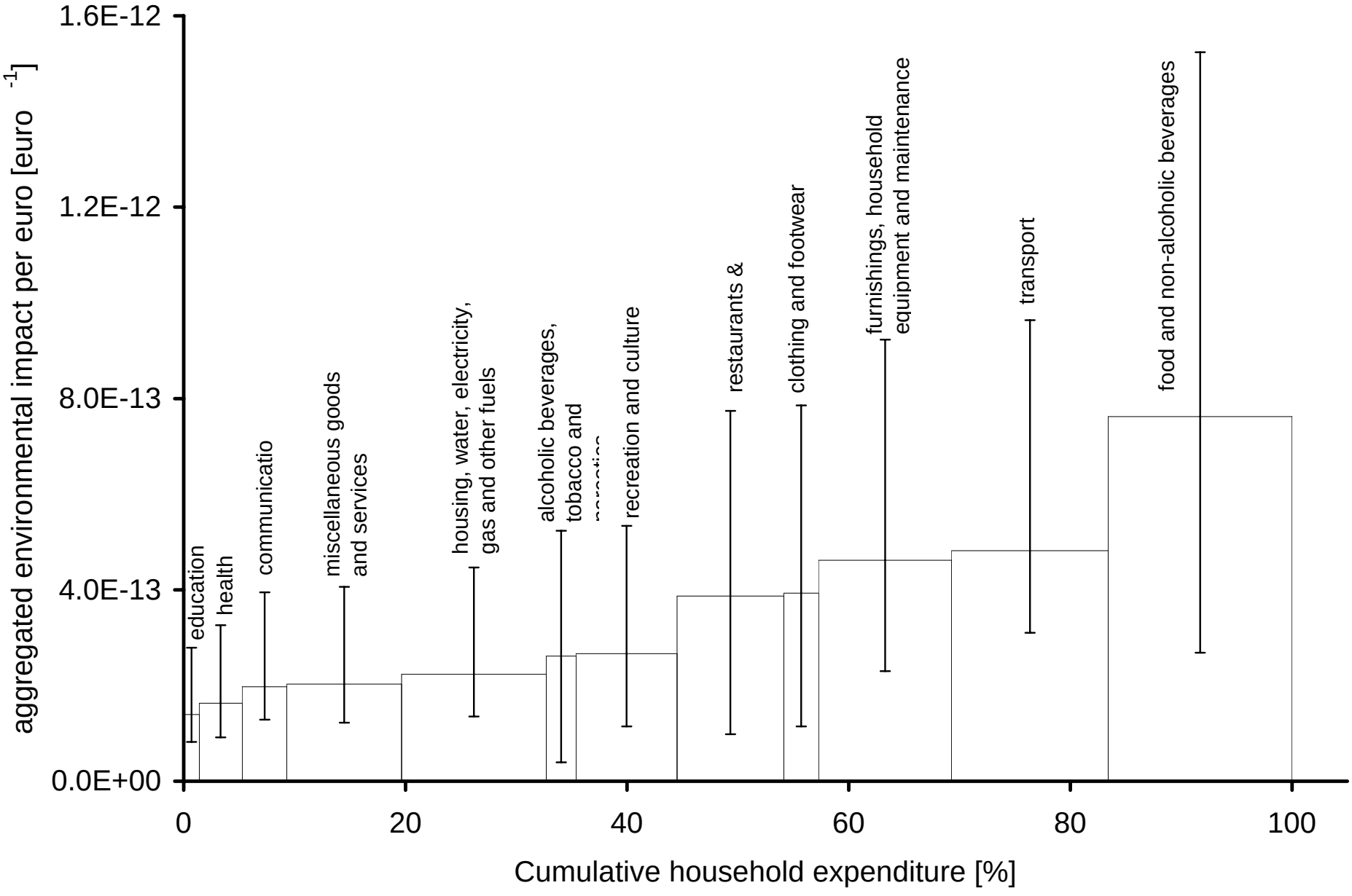
a2 we have here this aggregated impact. It is a nice figure, but isn't it better to forego it???? Or use GWP?? Gjalt, is such a GWP figure available????

atr; 8/07/2005

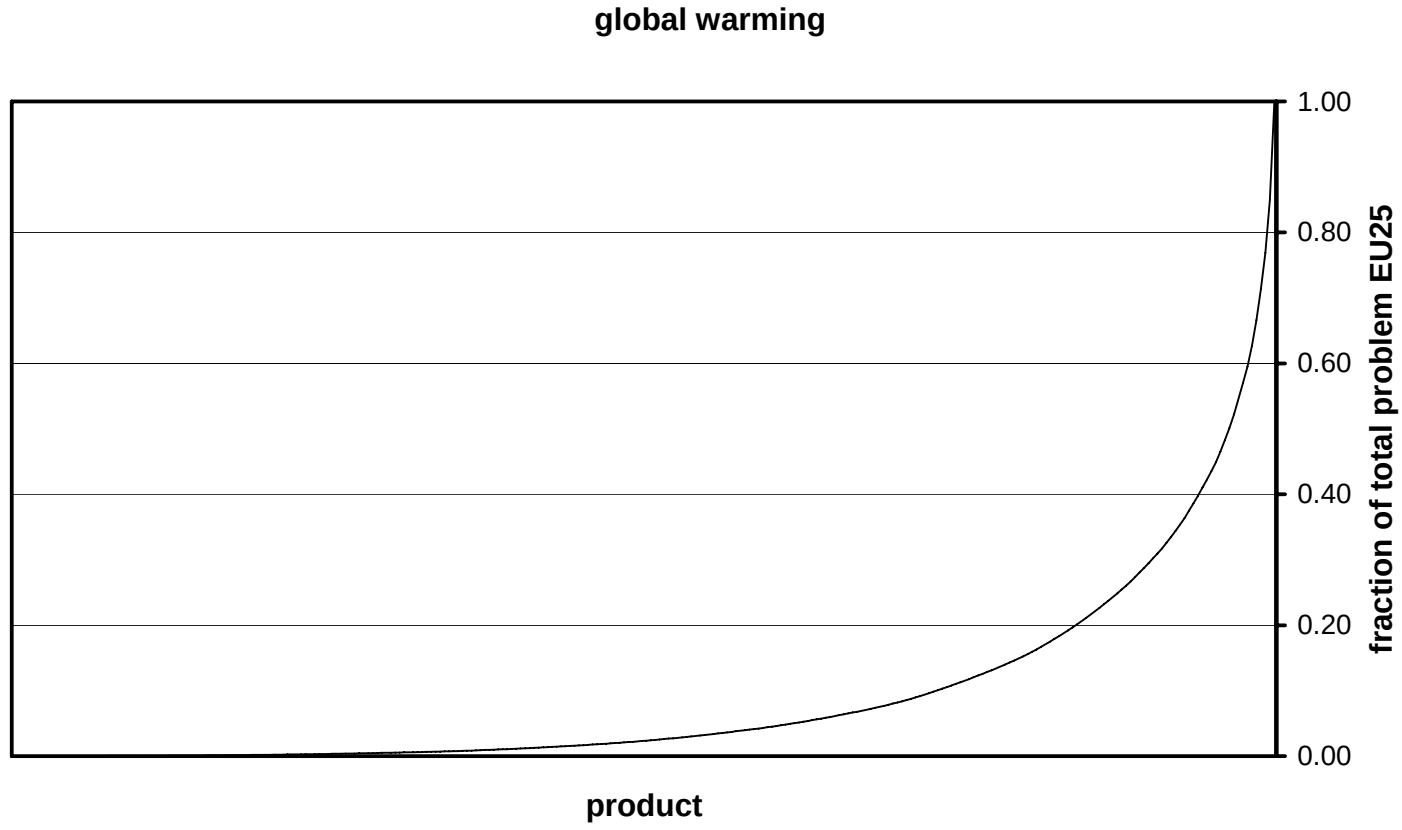
Results CEDA EU25: Top 25 per Euro



Results aggregate : COICOP level 1



Results CEDA EU25: 80-20 rule



- Some 80% of the 280 finally consumed product categories cause only 20% of the GWP problem

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Pillar 2: Conclusions

- An 80-20 rule seems to apply
- Main COICOP categories contributing to environmental impact:
  - Food
  - Housing
  - Transport
- More detailed level: we prefer to draw conclusions in conjunction with pillar 1

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Overall validation and conclusions

- Comparison and validation
  - The 7 studies and CEDA EU25 are very diverse
  - Common hot spots hence must be very robust
- We will present:
  - Quantitative comparison on % contribution to GWP/energy
    - Excluding Weidema: no totals in his report
    - Excluding Moll et al.: his totals include exports and hence a lot of intermediate products
  - Priorities below COICOP level 1
  - Potential missing items

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Comparison on GWP/energy

- Food, mobility, energy use in the house dominate (70 % of impacts)

COICOP	Study	Dall et al.	Kok et al.	Labouze et al.	Nemry et al.	Nijdam and Wilting	CEDA EU25
	Indicator	Energy	Energy	GWP	GWP	GWP	GWP
	Main approach	Bottom-up	Hybrid	Bottom-up	Bottom-up	IO	IO
CP01-02	Food	26,2%	13,0%	Incom-plete	NA	22,1%	31,0%
CP03	Clothing	1,3%	2,2%	3,3%	1,3%	6,5%	2,4%
CP04-05	Housing	40,8%	54,3%	58,8%	53,5%	33,4%	23,6%
CP06	Health		1,8%		0,3%	0,3%	1,6%
CP07	Transport	19,5%	18,3%	29,6%	32,9%	17,3%	18,5%
CP08	Communication			0,0%	2,9%	0,0%	2,1%
CP09	Recreation	7,2%	8,1%	0,0%		15,1%	6,0%
CP10	Education		1,8%			0,7%	0,5%
CP11	Restaurants					2,8%	9,1%
CP12	Miscellaneous	5,1%	0,4%	1,3%	8%	1,8%	5,2%
	TOTAL	100,0%	100,0%	100,0%	100,0%	100,0%	100,0%

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Comparison and Validation

- Priorities at sub-COICOP level 1 were identified by comparing detailed studies:
  - Nijdam and Wilting
  - Weidema et al.
  - CEDA EU25
- This exercise, backed up by plain logic shows that the following priorities are at stake
  - Mobility
    - Cars (dominant)
    - Air traffic
    - Other public transport
  - Food
    - Meat and meat products, including poultry
    - Milk, cheese, butter and related products
    - Other food products
    - Expenditures in restaurants as far as not covered above
  - Energy use in the house
    - Heating equipment, cooking equipment, and warm water generating equipment)
    - Energy using products
    - The house as such

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Slide 25

a3 Peter, this are robust priorities that we can defend against all comments. They are also responsible for (my estimate) 60% or more of the life cycle impacts of expenditure. Yet, the list is short. Is this a a problem??

atr; 8/07/2005

Potential false negatives

- There may be reasons why products consistently do not show up
  - ‘Invisible’ product categories
    - Products mainly used in a B2B context
    - Products part of other products (e.g. packaging)
  - ‘Invisible’ inventory and impact assessment
    - Slow leaching metals (e.g. from metal products in use in society or in landfills) and similar substances (e.g. plasticised products)
    - Local toxicity (e.g. consumer products)
    - Dedicated impacts (fish, wood resources)
    - Emissions that are consistently under-reported in formal statistics (e.g. international air traffic and sea traffic)

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Conclusions and discussion

- Hot spots (at aggregated level) are hence rather unambiguously identified
- Yet, an improved data situation is desirable
  - Single automated model that
    - Allows for easy contribution analyses
    - Allows for easy updates with regard to new information about sector emission and resource use data
    - Has a reasonable level of detail
  - And is as well a ‘background’ data source for LCAs and related improvement analyses made at firm level
- How to organise this is not part of EIPRO nor today’s discussion, but our experience suggests
  - The top-down approach has some important advantages
    - Relation with regular economic accounts, which are regularly updated
    - Promotes automatically a high degree of consistency
    - Relatively Easily updatable
  - Apart from a data gathering job, there is also a standardisation job
    - Inclusion of capital goods (investment = allocated to secor or not)?
    - How to include imports (import = domestic vs modelling) ?
    - What is final demand (household, government, export) ?
    - Sector classifications (NACE, COICOP – not consistent)
    - Impacts included (very different ranges – MJ, CO2, GWP)

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Slide 27

a4 Peter, we could forego this slide alltogether - the meeting is about hot spots. I'd appreciate your opinion on this
atr; 8/07/2005

Closing remark

- The full report is available at http://europa.eu.int/comm/environment/ipp/identifying.htm also for public comments.
- Journal of Industrial Ecology will publish a special issue on these studies (Spring 2006)

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