Household metabolism and social practices. A model for assessing and changing household consumption

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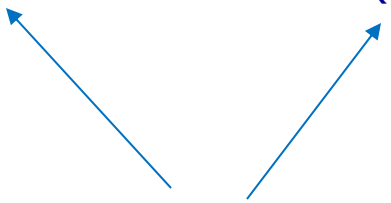
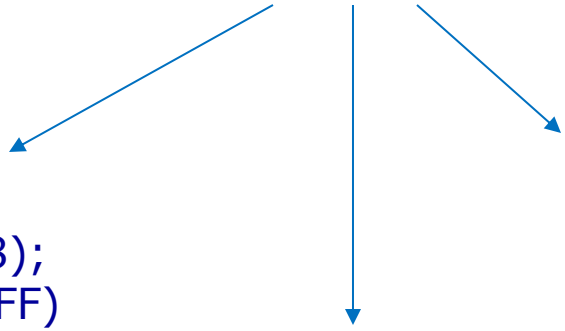
- In recent decades the evaluation of energy consumption patterns is becoming a central issue in social sciences.
- Sociology of consumption needs tools for the evaluation of the environmental impact of the way people consume.
- Several consumption patterns are claimed to be sustainable but evaluation of different consumption scenarios from an environmental point of view is quite difficult to achieve and suitable tools are required.

METHODS BASED ON MATERIAL FLOWS
Material Flow Analysis
Wuppertal Institut, IFF, 2000

METHODS WITH AREA/SURFACE
Environmental space (Opshoor, 1995)
Productive surface,
Ecological footprint
(Rees, Wackernagel, 1996)



ENVIRONMENTAL ASSESSMENT METHODS



METHODS BASED ON ENERGY
eMergy (Odum, 1996);
exergy (Jorgensen,1998);
Energy Flow Analysis (IFF)

METHODS BASED ON PRODUCTION
NPP (Vitousek, 1986)
HANPP (IFF Austria)

METHODS BASED ON EMISSIONS
LCA (Odum, 1996);
(Carbon Footprint)

- Sociologists of consumption have dealt mostly the so-called conspicuous, luxury and brand consumption, which represents only a small part of the enormous matter, energy and labour consumption behind the daily consumption.
- Metabolic approach takes into account the constellations of practices that tacitly consume natural resources, bio-capacity and eco-system services, composing and decomposing them at the analytical level to remove the veil of opacity that makes them appear neutral.

- Household Metabolism model estimates the energetic burden of at least all items of consumption, which are composed mainly by ordinary items such as food and drink, transports, leisure, direct and indirect energy, household appliances, electronic stuff.
- It focuses on social and domestic practices of consumption.
- It provides good insight for the analysis of practices of consumption, which implies the whole lifecycle of the stuff consumed, the way in which it is consumed.
- In this model the location of consumption is the household, not the singular individual.
- In this perspective households are social entities with internal and external interactions (metabolism), which represent an opposed approach to the atomic consumer one (Spangenberg and Lorek, 2002).

- The household metabolism allows to identify different types of aggregation and categorization of consumption (Benders et al., 2006), providing a model for understanding the stratification of consumption.
- This stratification model is based both on family size and some qualitative characteristics (income, title study, professions) that in sociological research are considered to be the main structural variables.
- It allows identifying the structures of everyday practices of consumption, by which to reconstruct the *physiology* of the socio-economic system (Röpke, 2009).

- Metabolism approach engenders some redefinitions of sociology of consumption.
- It enables the reincorporation of the “material” in consumption investigation.
- It provides indicators to evaluate the environmental impact of practices of consumption.
- It enables the reconstruction of practices entailed in the consumption process.
- It allows to pinpoint what activities consume more resources and what patterns of resource use are at work.
- It enables to discover the significance of consumption practices as the principal activators of social metabolism and the key drivers for future changes.
- It reassembles production and consumption for a more useful socio-environmental perspective.

European Commission
Joint Research Centre

Tukker A, Huppes G, Guinée J, Heijungs R, de Koning A, van Oers L, et al. Environmental impact of products (EIPRO): Analysis of the life cycle environmental impacts related to the total final consumption of the EU25. IPTS/ESTO, European Commission Joint Research Centre, Brussels; 2005

Category	Env-Impact in EU-25
Food and drink, tobacco and narcotics	20-50%
Clothing	2-10 %
Housing, furniture, equipment and utility use	20-35 %
Healthcare	???
Transport	15-35 %
Communication	< 5 %
Recreation	5-20 %
Education	< 5 %
Restaurants, hotels	5-20 %

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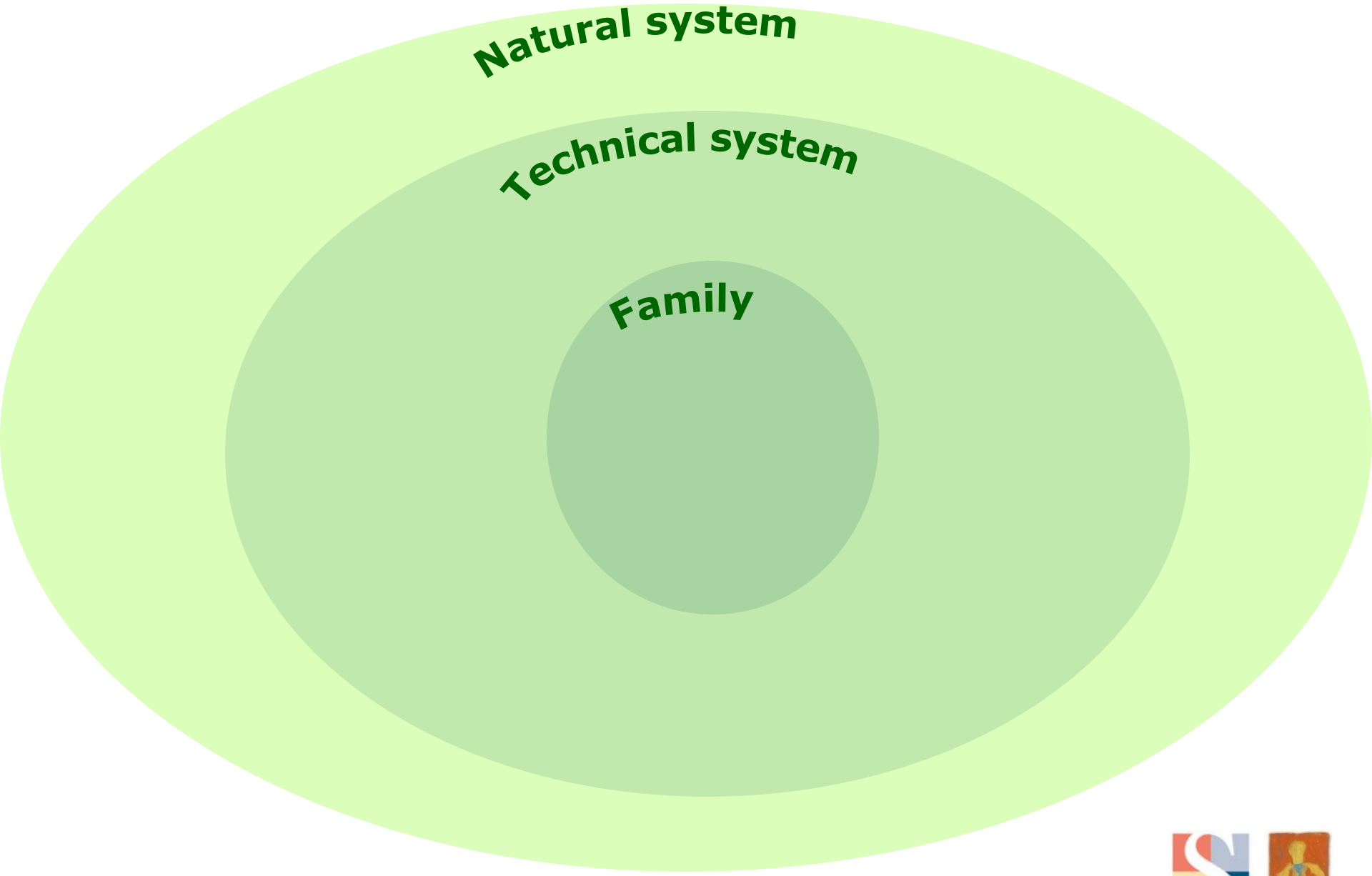
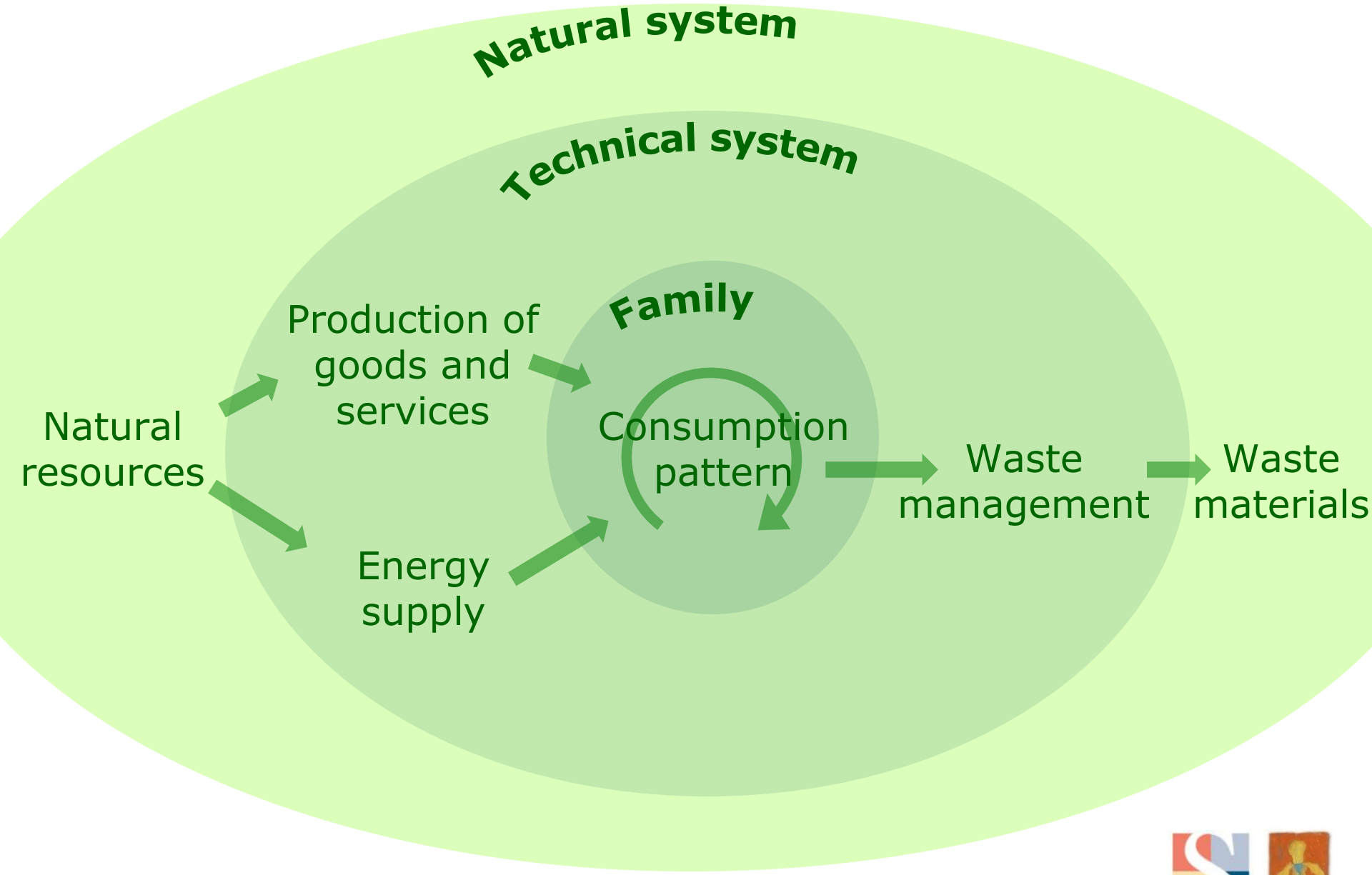
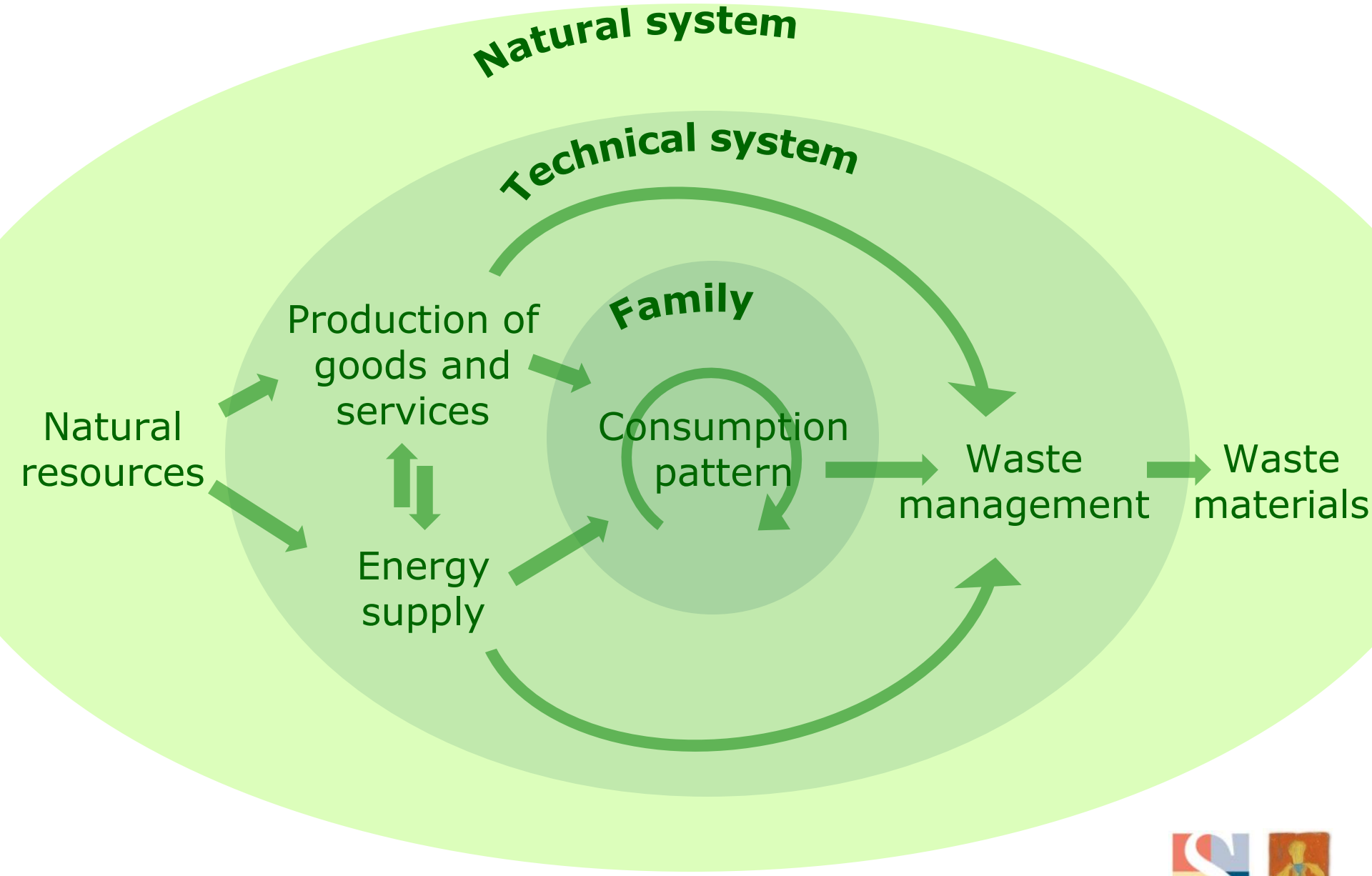
The current state of research identifies products in the following three areas as having the greatest impact:

- food and drink
- private transport
- housing

Together they are responsible for 70 – 80 % of the environmental impact of consumption, and account for about 60 % of consumption expenditure.


Natural system
Technical system
Family


Natural system
Technical system
Family
Production of goods and services
Natural resources
Energy supply
Consumption pattern
Waste management
Waste materials


Natural system
Technical system
Family
Production of goods and services
Natural resources
Consumption pattern
Waste management
Waste materials
Energy supply

Bottom-up studies *- LCA*

→ *Resource use*

→ *Emissions to air, water and soil*

Energy consumption, Carbon equivalent emissions

- As for household consumption the greatest environmental impacts take place within complex supply chains of goods and services rather than directly from fuel and/or energy consumption (Tukker et al., 2006), an assessment derived from fuel and electricity consumption alone is inadequate.
- In order to assess GHG emissions and energy consumption, most agencies use ‘bottom-up’ approaches, summing estimates of emissions associated with specific goods and resources used during the productive process, thorough a process-based LCA to estimate the impacts across an inventory of activities and purchases.
- Nevertheless, a number of authors (e.g. Wilting, 1996; Kok et al., 2003) highlight that this approach suffers from ‘truncation error’, and when applied in household consumption, it leads to serious underestimation of the total impacts.
- The truncation arises from the inevitable omission of steps and processes in order to make the task manageable. An LCA defines the system it is describing as a finite number of steps and in most cases these provide an adequate estimation (Baumann and Tillman, 2004); however, whit this method it will never be possible to consider a “total economy scenario”.

- On the other hand, there are top down analyses, which use Input–Output Analysis (IOA) and are able to locate emissions to different sectors considering the total economy of the Country.
- Thus this approach has the benefit of not underestimating global figures, but the calculations are only made for economic sectors and not for certain products.
- This means that the IOA gives cruder estimates than an LCA does, but on the other hand the accounting is more comprehensive.
- Furthermore, IOA indicates an emission factor per Euro consumed in a certain sector.
- This is considered a very useful task, even if it could lead to the 'aggregation error' as the input–output coefficients for each industry are averages derived from the comprehensive natural summation of all the related, but not identical production processes.
- However, as the individual processes are not individually discernable, it lacks the potential for specificity of the bottom-up approach (e.g. Wiedmann, 2009)
- Therefore, a number of hybrid models that combine the LCA and IOA have been developed to describe the consumption systems from a energetic point of view, in an attempt to benefit both from the completeness of EIOA and from LCA's potential for specificity (Hertwich, 2011).

Bottom-up studies - *LCA*

- Market-oriented LCAs are utilized in order to arrive at the environmental interventions associated with a certain product grouping.
- The bottom-up approach begins with an individual product and conducts a life cycle assessment (LCA) of it.
- The results for this particular product are then assumed to be representative for a wider range of products and so are extrapolated to a much larger grouping of products.
- Combined with other LCAs for representative products, it is possible to put together a picture of the whole economy.

Bottom-up studies *- LCA*

The main weak points of the bottom-up approach are:

(1) they are based on LCAs that cut off process trees so that the coverage of environmental impacts is incomplete;

(2) the assumption of representativeness of specific products for the larger grouping of products is difficult to justify in many cases;

(3) the LCAs for the different products often use different databases, which limits the comparability of the results for different products;

(4) a conventional LCA process analysis can be a rather time and data-intensive process, if process-specific data are available at all.

Top-down studies - *IOA*

Environmentally extended input-output analysis (IOA) are used to estimate the environmental interventions associated with the purchase of a certain amount of products (goods or services).

The top-down approach begins with input- output tables produced, in most cases, by statistical agencies. These tables, in the form of matrices, describe production activities in terms of the purchases of products of each industrial sector from all other sectors.

They cover the entire economy. If they also contain data about the emissions and resource use of each sector, this information can then be used to calculate the environmental impacts of products covering the full production chains. Input-output analysis is relatively fast to conduct, but provides rather aggregated results compared to (LCA) process analysis.

Top-down studies *- IOA*

The main weak points of the top-down approach are:

(1) the availability of suitable input-output tables including the required environmental information is rather limited;

(2) the products in available input-output tables are typically rather highly aggregated;

(3) standard input-output tables require specific adaptations to appropriately include the use and waste management phases of the product life cycles.

Energy Analysis Program

Kok et al. (2003): Household metabolism in European countries and cities. Centre for Energy and Environmental Studies. University of Groningen, the Netherlands

university of groningen

The Energy Analysis Program is a mix of input-output analysis, and direct LCA-type analysis of products (goods or services) that could not be covered by input-output.

EAP was used as assessment tool for comparison of family consumption in some European countries within the ToolSust Project, but no complete applications have been conducted jet in Italy.

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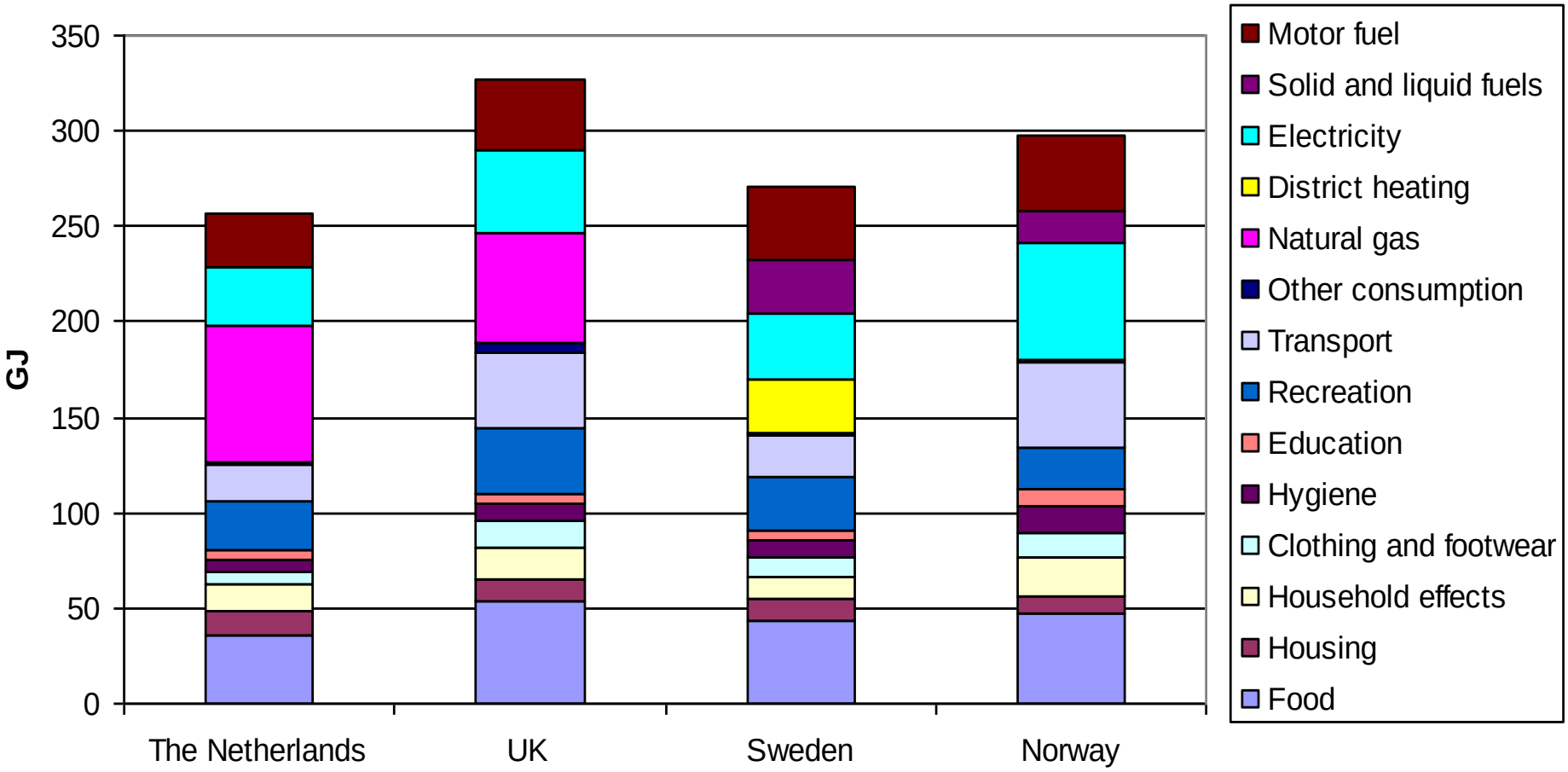
This tool quantifies the total energy demand of households as a proxy for environmental pressure related to household consumption for a given population (that can be a city, a region or a country in according to the survey).

The total energy is the sum of the direct energy demand, which refers to the energy that is literally consumed by households (natural gas for heating and hot water production, electricity and motor fuels) and the indirect energy demand, which refers to the energy embodied in consumer items and services.

Energy Analysis Program



Total annual energy requirements and energy requirement per budget category for an average household in the different countries

Energy Analysis Program

Kok et al. (2003): Household metabolism in European countries and cities. Centre for Energy and Environmental Studies. University of Groningen, the Netherlands

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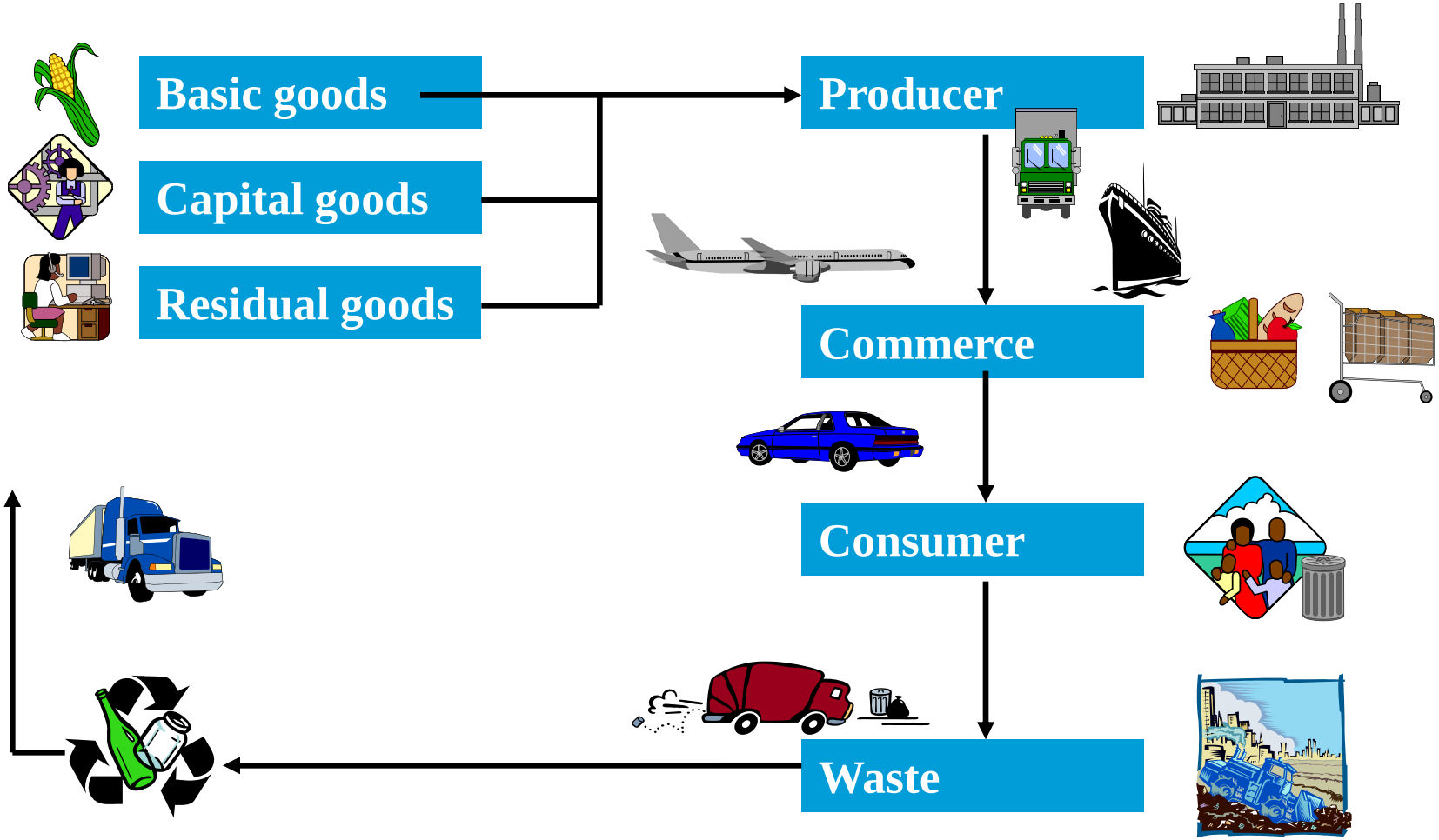
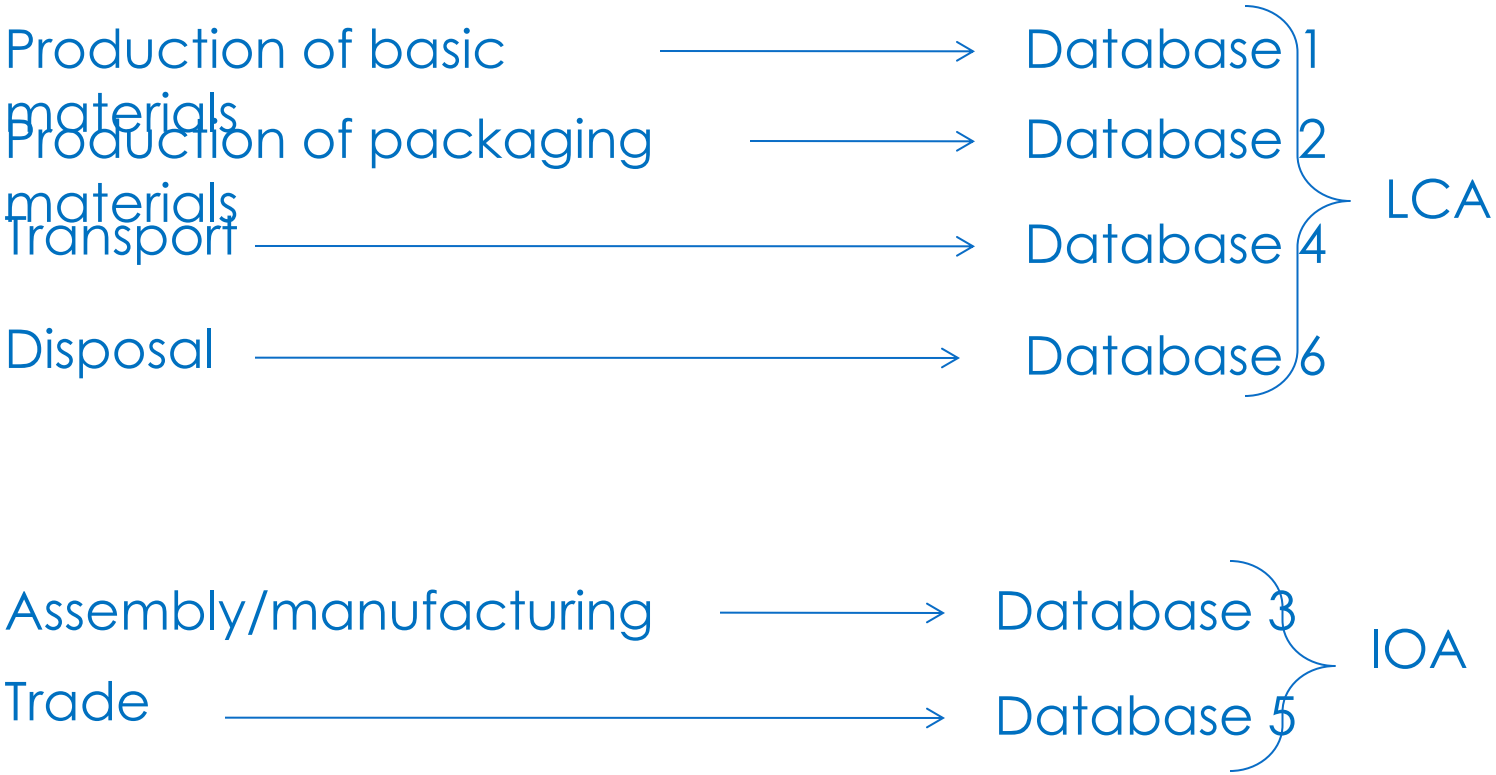
› Standard	208
› Standard production included	1
› Input-output analysis	8
› Combination	48
› Average	19
› Similar	20
› Special (fruit, vegetables and flowers)	28
› Other (e.g. holidays)	27
› Corrections	10
› **Total**	**369**

Energy Analysis Program

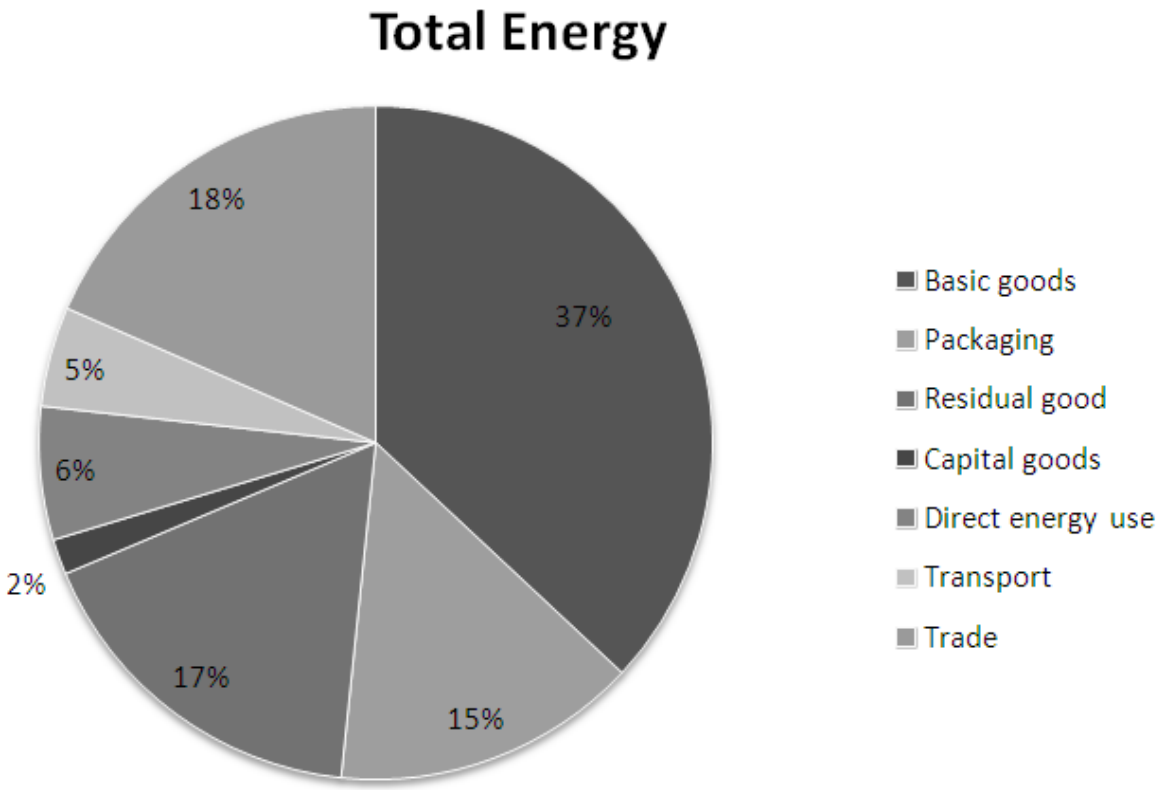


Energy Analysis Program

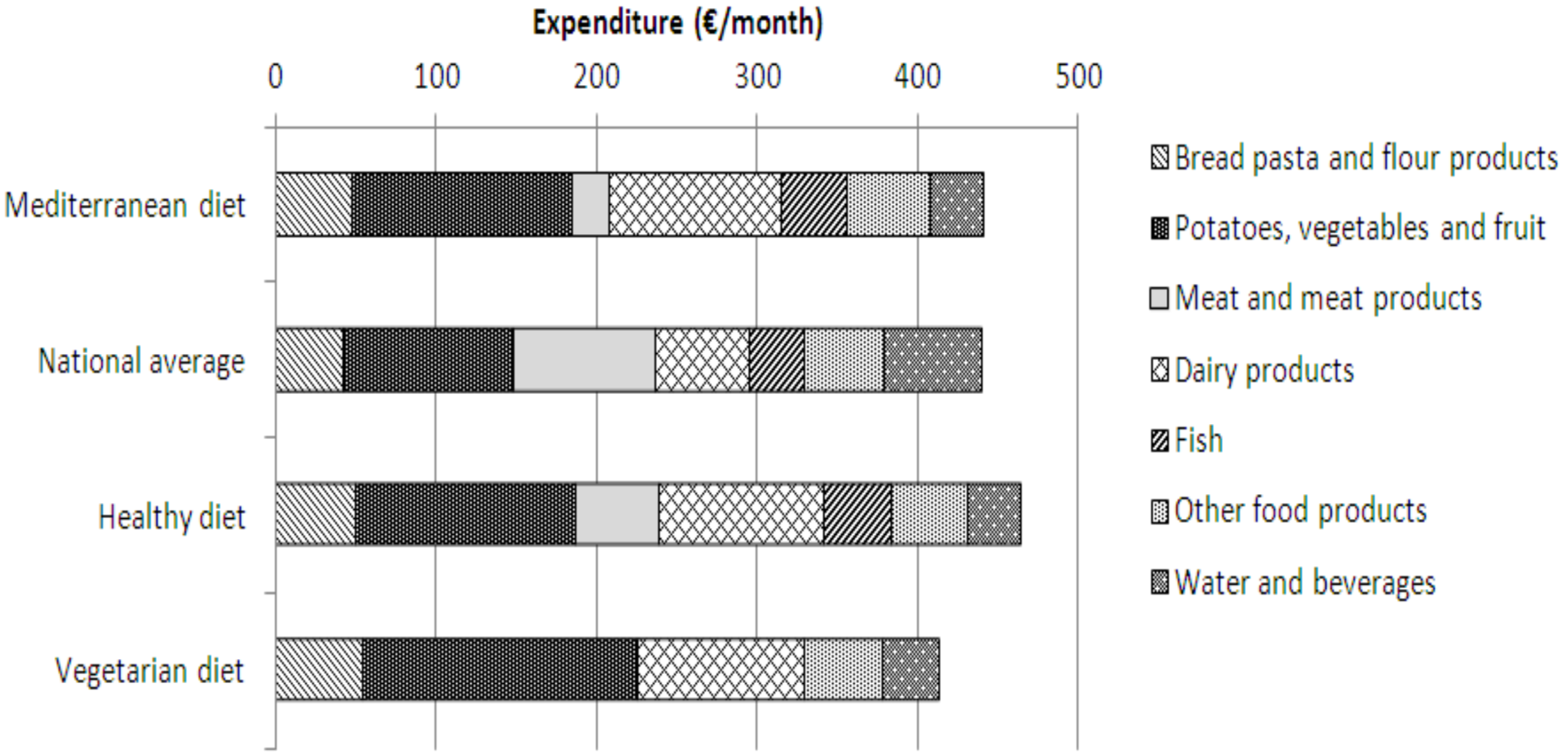


Results

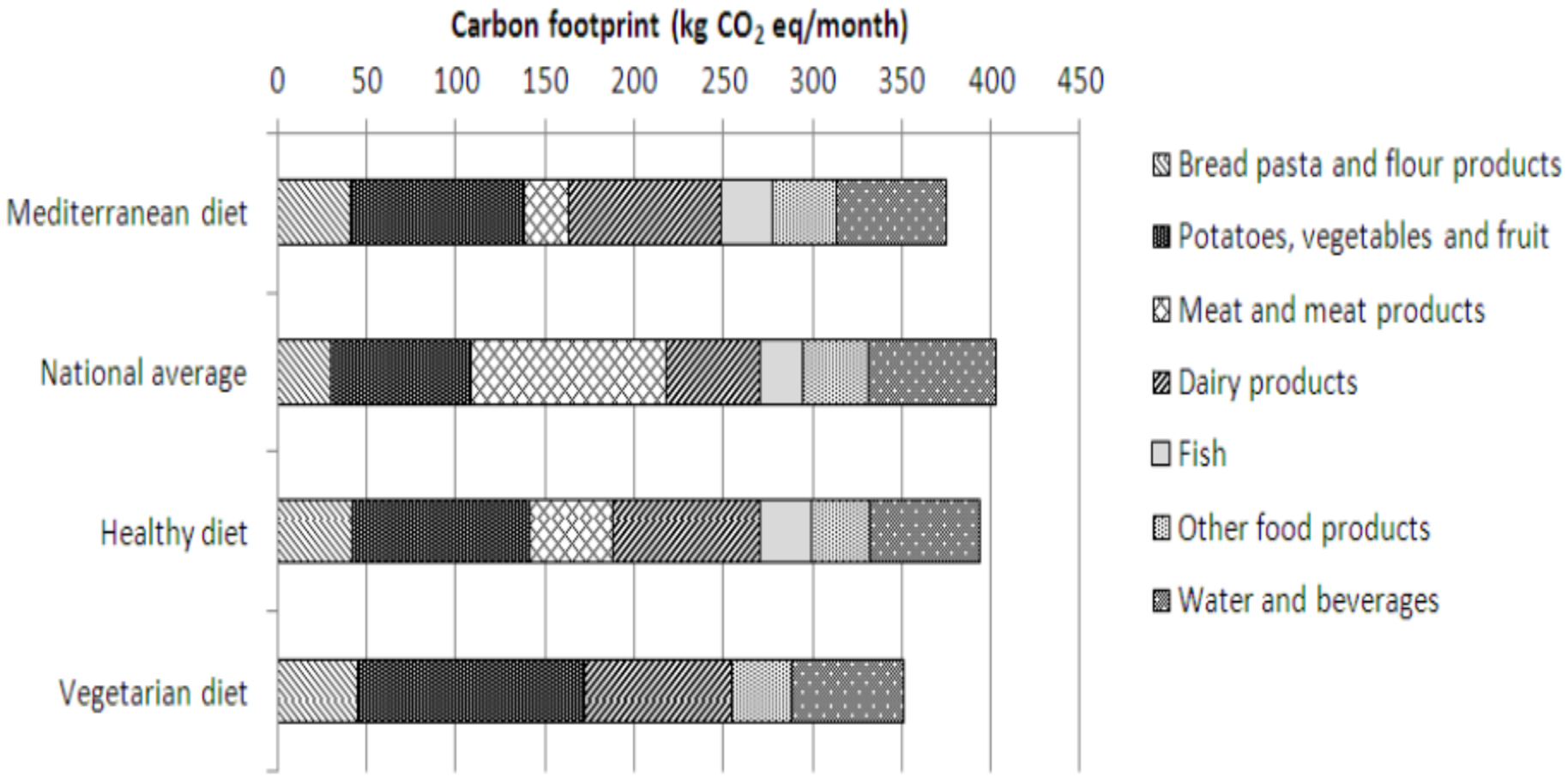
Energy consumption for food in the Italian family was assessed as 4511 MJ per average family, with a main contribution of basic goods (1665 MJ), trade (831 MJ) and residual goods (767 MJ).



Results


Expenditure (€/month)
0
100
200
300
400
500
Mediterranean diet
National average
Healthy diet
Vegetarian diet
Bread pasta and flour products
Potatoes, vegetables and fruit
Meat and meat products
Dairy products
Fish
Other food products
Water and beverages

Results


Carbon footprint (kg CO_2 eq/month)
0
50
100
150
200
250
300
350
400
450
Mediterranean diet
National average
Healthy diet
Vegetarian diet
Bread pasta and flour products
Potatoes, vegetables and fruit
Meat and meat products
Dairy products
Fish
Other food products
Water and beverages

1. Household Metabolism doesn't base its vision on a top-down metric of evaluation (for example from the national level down to the regional or communal one), but it gives preference to the bottom-up approach moving from micro (household) to macro (different scales of social aggregation) (even though it uses a IOA that is by definition a top-down assessing method).
2. Household Metabolism blends better than other ones production and consumption realms, looking at consumption as the key to understand the social system metabolic profile.
3. Household metabolism is focused on household behaviour and thus it can help to change old and unsustainable practices.
4. Household Metabolism is focused mainly on ordinary consumption, that part of consumption often relegated on the fringe of consumption study.
5. Household Metabolism deals with social practices of consumption, the principal activators of societal metabolism.
6. Household Metabolism allows to set-up scenarios of transition toward sustainability, starting from household daily practices to go back to the overall size of the system by verifying the plausibility and effectiveness of transition practices.