

Strategic Consumption and GHG-reduction potentials for households



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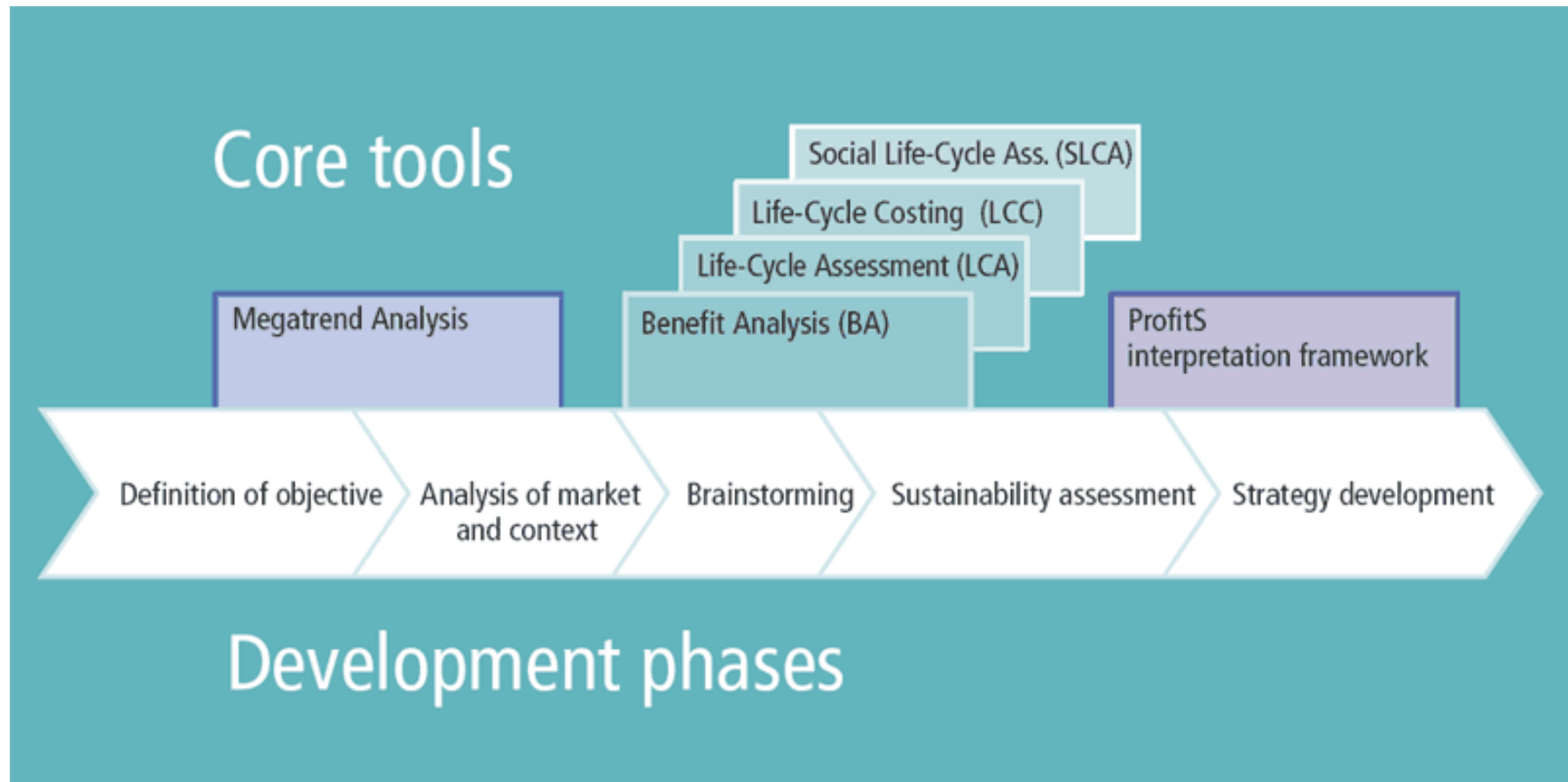
Work of the Oeko-Institute relating to consumption

Field of work: Product Development, Product Assessment, Product Policy (Ecodesign, RoHS, REACH, Labelling), Consumer Campaign EcoTopTen (www.ecotopten.de)

Methods that are being used:

- sustainability analysis PROSA
- life cycle assessments
- product carbon footprints
- Ecotox Risk Assessment
- life cycle costing
- material flow analyses
- benefit analyses
- consumer research

PROSA – Product Sustainability Assessment



Project TOP 100

- In the project the 100 most important energy-relevant product groups are considered from the perspective of the consumer.
- LCAs, benefit analyses and life cycle costing are carried out for 70 product groups.
- On this basis, award criteria are derived for the German eco-label "Blue Angel".



Top 100 – Examples of analysed products (1)

- Desktop computers
- Bread machines
- Office machines with printing function
- Car sharing
- Data carrier destructors
- Digital cordless phones
- Digital projectors (beamers)
- Kitchen hoods
- DVD recorders, DVD players, Blu-ray disc players
- Electric ovens for domestic use
- Electronic ballasts for fluorescent lamps
- Low-emission and energy-saving gas condensing boilers
- Energy and water-saving handheld and shower heads
- Energy-aware data center operation
- Energy services with energy saving warranty agreements
- Home power meters
- Energy-saving hand dryers
- Energy-efficient heat pumps with electrically driven compressors
- Energy-saving hot water tank
- High-pressure espresso machines / coffee machines
- External hard drives
- TV-Sets
- Gas stoves and gas-fired cooking stoves for domestic use
- Dishwashers
- Hair dryers
- Wood pellet and woodchip heating boilers
- Wood pellet stoves
- Interactive Whiteboards

Top 100 – Examples of analysed Products (2)

Small CHPs for liquid fuels
Small CHPs for gaseous fuels
Small block heating plants
Doorbell and intercom systems and related power supply
Compact HiFi equipment
Cooling and freezing appliances
Lighting
Low-noise and fuel-efficient motor-vehicle tyres
Master-slave connector strips
Microwaves
Monitors
Photovoltaic inverters
Photovoltaic products
Programmable radiator thermostats
Routers
Solar collectors

Solar-operating products and mechanical watches
Socket strips and socket adapters with automatic switch-off
Keyboards
Kiln-dried woodchips / wood pellets
Toasters
Portable computers
Portable small-size computers
Home soda makers
Voice over IP - telephones
External composite thermal insulation systems
Washing machines
Dryers
Launderettes
Electric kettle
Rechargeable batteries in standard size

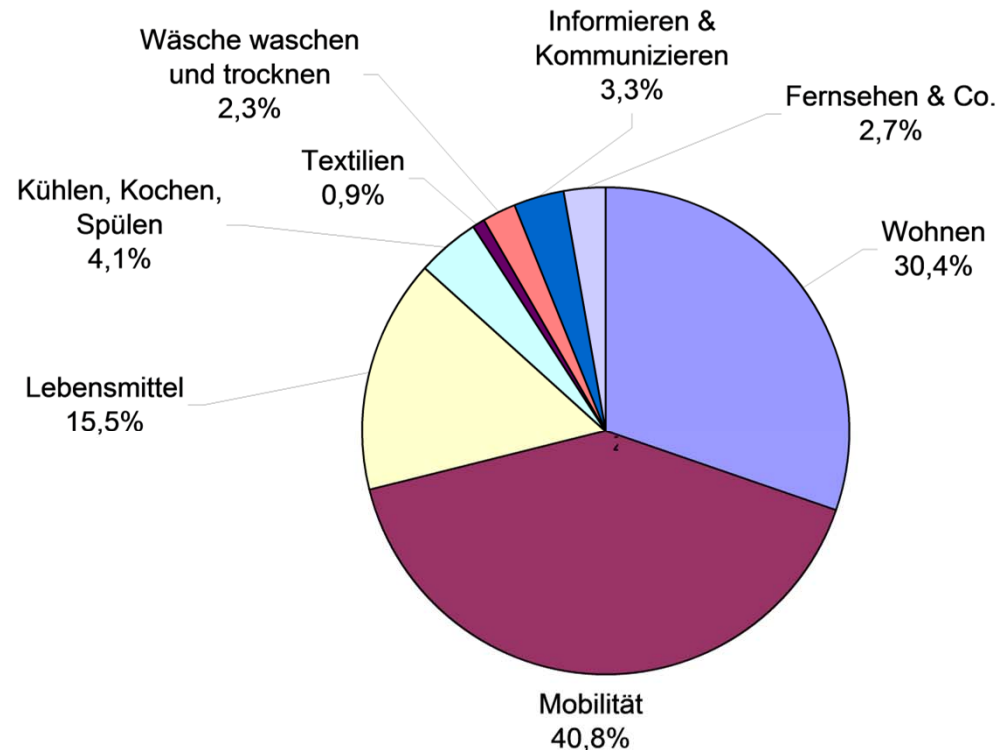
New insights relating to methodology

- Pollutants and other impacts play a major role for many products. They are, however not adequately covered by typical life cycle assessments (e.g. mercury, allergenic nickel, nanosilver, exposure to radiation, noise...)
- Detailed benefit analyses and life cycle costing are of vital importance for a comprehensive understanding of the products and for the analysis of policy options.
- Due to energy savings in the use phase the importance of production for large appliances increases in relative terms (though not necessarily in absolute terms).
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Contribution of production and disposal phase in overall greenhouse gas potential

Products	Contribution of production and disposal phase in overall greenhouse gas potential (GWP)
Electric kettle	1 %
Master-slaves	1 %
Gas stove	3 %
Automatic espresso machine (inefficient)	2 %
Automatic espresso machine (energy-efficient)	6 %
Automatic capsule espresso machine (inefficient)	2 %
Automatic capsule espresso machine (efficient)	4 %
Refrigerator 150 l without freezing compartment (EEC A+)	11 %
Fridge-freezer combination (200 l/90 l; A+)	11 %
Upright Freezer (A+)	10 %
Chest Freezer (A+)	11 %
Washing mashines (A)	20 %
Conv. tumble dryer (B)	6 %
Conv. condensation dryer (B)	8 %
Heat-pump tumble-dryer (A)	20 %
DVD hard drive recorder with quick-start function without automatic power down function	8 %
DVD hard drive recorder with quick-start function and with automatic power down function (energy-efficient)	16 %
Blue ray disk player hard drive recorder with quick-start function without automatic power down function	10 %
Blue ray disk player hard drive recorder with quick-start function and with automatic power down function (energy-efficient)	22 %
LCD television (32 inch)	14 %
Plasma television (42 inch)	12 %
Notebooks	28 %
Netbooks	43 %

Material flow analysis / combined LCA: the ten core areas for consumers (EcoTopTen)



These 10 areas correspond with app. 65% of the energy consumption and app. 65% of the GHG-emission per capita.

The diagram shows the results in „Umweltzielbelastungspunkten“ (UZBP/Ecograde).

To a large extent, impacts of energy use, greenhouse gases and further environmental impacts take place simultaneously. A major exception is the area of food.

Example LCA of cars within EcoTopTen:

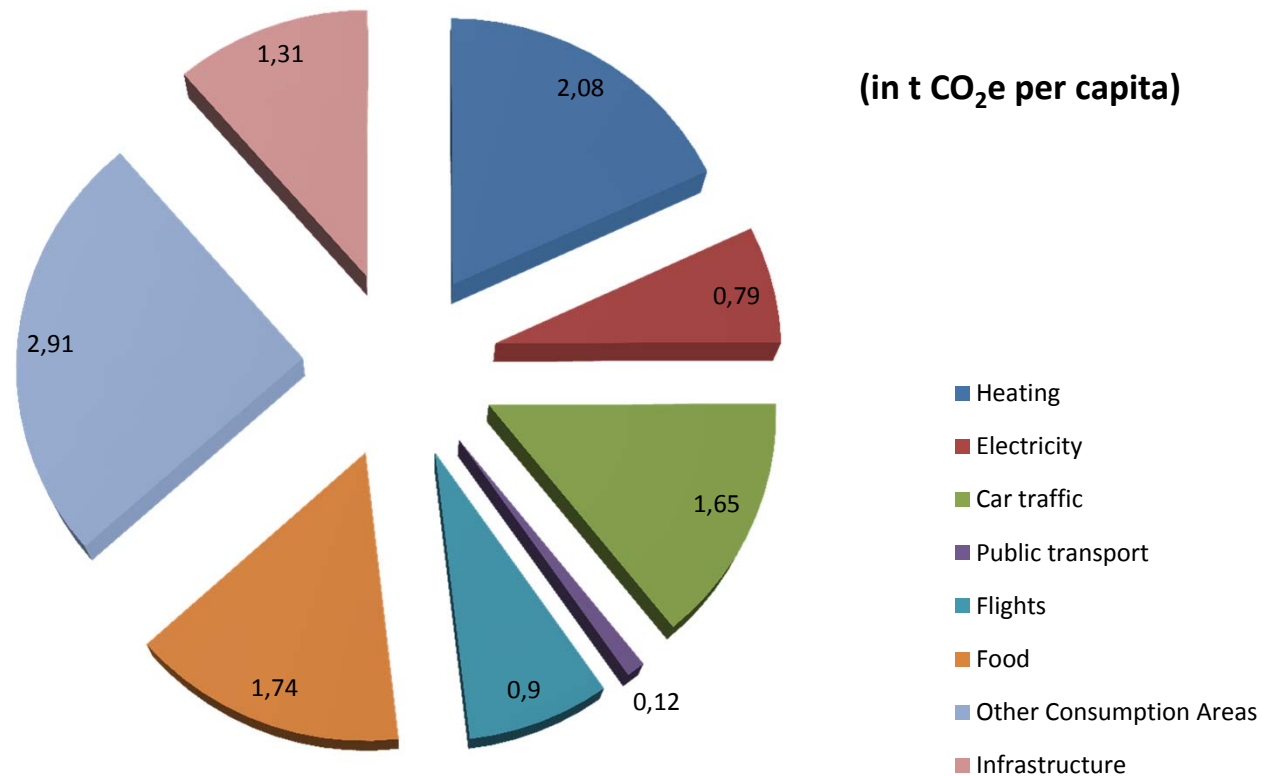
- CO₂e-emissions per car for existing car fleet (2005):

	Direct emissions CO ₂ e (g/vkm)	Extra charge upstream processes fuel CO ₂ e (g/vkm)	Extra charge vehicle manufacture CO ₂ e (g/vkm)	Extra charge disposal CO ₂ e (g/vkm)	Emissions CO ₂ e (g/vkm) (share of upstream and downstream processes)
Otto small	156.1	31.9	29.6	2.70	219.1 (29 %)
Otto medium	199.5	40.8	29.8	2.72	271.3 (26 %)
Otto large	264.1	54.3	38.1	3.48	358.3 (26 %)
Diesel small	107.9	16.1	33.7	3.08	160.0 (33 %)
Diesel medium	157.3	23.6	23.0	2.10	204.8 (23 %)
Diesel large	216.2	32.5	30.7	2.81	280.6 (23 %)

BEWARE! Unfortunately, the emission values for new cars in accordance with legal provision (g CO₂ /km) do **NOT** include :

- other greenhouse gases apart from CO₂
- greenhouse gas emissions for the production and disposal of cars
- greenhouse gas emissions for the provision of fuels
- higher values actually in reality than the assumed driving cycle

Greenhouse gases per Capita (german households)



Source: IFEU 2007, extrapolated to 2008

different results?

- Be careful with different methods of accounting:
- Emissions as defined in the Kyoto Protocol only include the emissions produced within a country – precursor products and exports are hence not covered, meaning that there is no accounting throughout the life cycle of the product (in contradiction to the EcoTopTen-analysis)!
- In Germany, “greenhouse gases of precursors/imports and greenhouse gases attributed to exports more or less offset each other (because Germany is very export-oriented!).“
- This statement, however, only applies to the aggregated emissions, not to the emissions of individual sectors.

GHG Reduction Potentials / german Households

- buying existing energy efficient products, with less costs, no change of lifestyle: **app. 35 - 40%**
- buying existing energy efficient products, with less costs, moderate change of lifestyle (e.g. carsharing, less living space, less flights): **app. 50%**

Examples for detailed analysis (following):

- energy efficient car: **up to 57%** GHG-savings (depending on the size of the car)
- power consumption: **67%** GHG-savings

Saving potentials of an energy-efficient car (2009)

Stated in g CO ₂ per vehicle kilometre	Small vehicle	Mid-size vehicle	Large vehicle
Best vehicle EcoTopTen (2009)	99	109	104
Average new car registrations diesel vehicle	119	156	212
Average new car registrations of Otto combustion	144	176	243
Saving potentials	17 - 31%	30 - 38%	51 - 57%

Power consumption in private households (Germany)

Households with	Average annual electricity consumption per household	Average annual electricity consumption per household member
1 person	2,050 kWh	2,050 kWh
2 persons	3,440 kWh	1,720 kWh
3 persons	4,050 kWh	1,350 kWh
4 and more persons	4,940 kWh	1,235 kWh (and less)

- Note: The significance of the electricity sector varies a lot according to the country and depending on the share of renewable energy and nuclear power.
- In addition, there are significant differences in electricity prices throughout Europe: Bulgaria 8.0 cents, Germany 22.9 cents, Denmark 25.5 cents, EU average 16.5 cents.

Analysis of electricity consumption trend (decrease)

Electricity consumption is expected to decrease due to the following impacts:

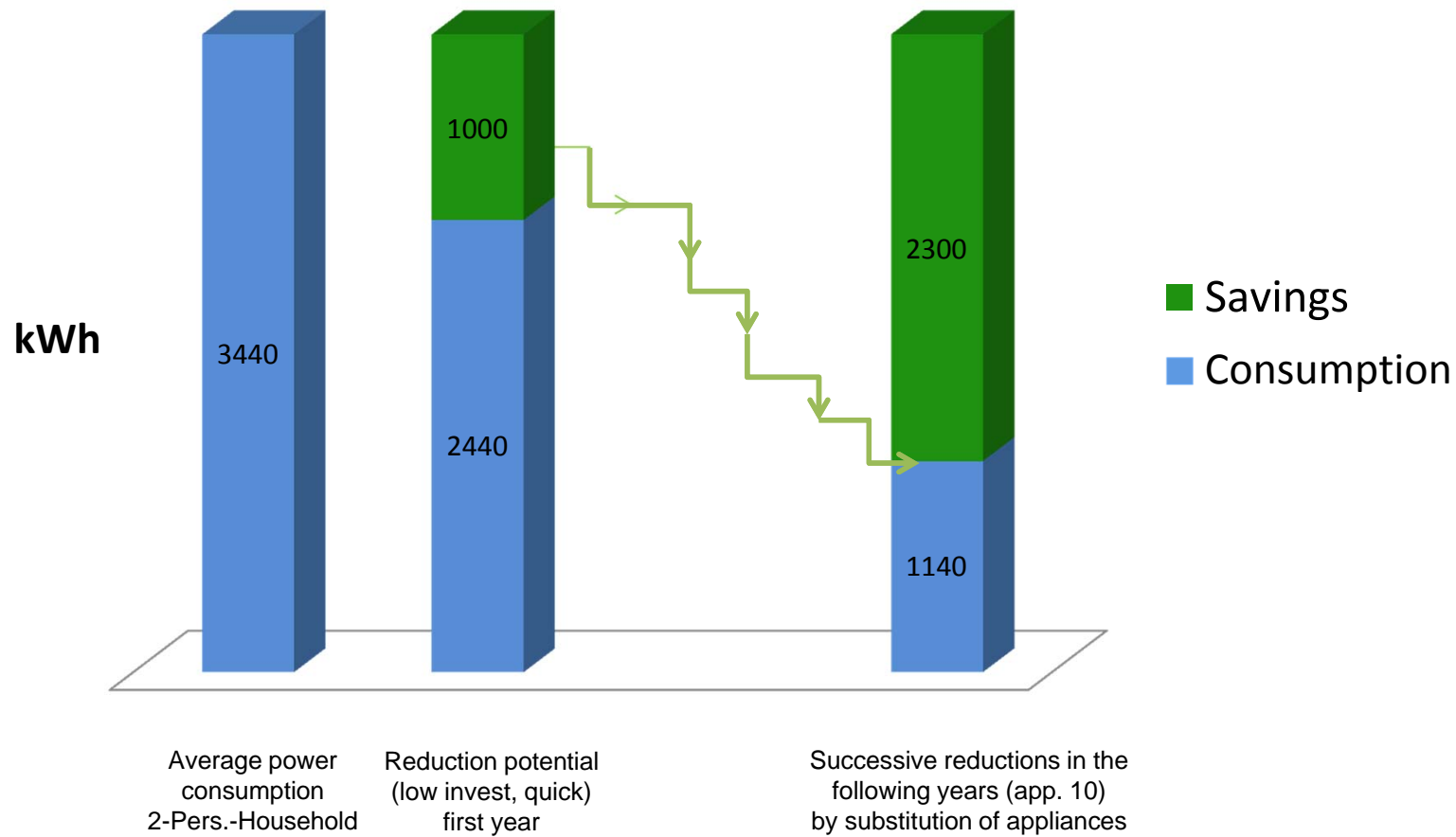
- Great extent of inventory saturation and reduction of specific energy consumption in large domestic appliances (**white goods**) due to development on the market and eco-design regulations for cooling and freezing devices, washing machines and dishwashers;
- **Device integration** (e.g. satellite receiver in TVs;) use of smart phones as mobile phone, camera, film camera, MP3 player, GPS, mini computer);
- Trend toward **smaller devices and miniaturization** (see, for example, the series of PC, notebook, netbook, PDA, smart phone;) audio-home systems such as large stereo systems, compact audio systems and mobile MP3 players);
- Substitution due to **technical alternatives** implying a significantly reduced electricity consumption (e.g. heating pumps by efficiency pumps; electric light bulbs by energy saving / LED lamps, tube monitors by LCD monitors);
- Reduction of the "**classic**" **standby and off mode losses** (Ecodesign Reg.)
- Increasing use of **energy-saving lamps and LED lamps** (Ecodesign Reg.)
- Decrease of consumption with **external power supplies** (Ecodesign-R.)
- Reduction in power consumption: **circulation pumps / water pumps** (Ecodesign)

Analysis of electricity consumption trend (increase)

Electricity consumption is expected to rise due to the following impacts:

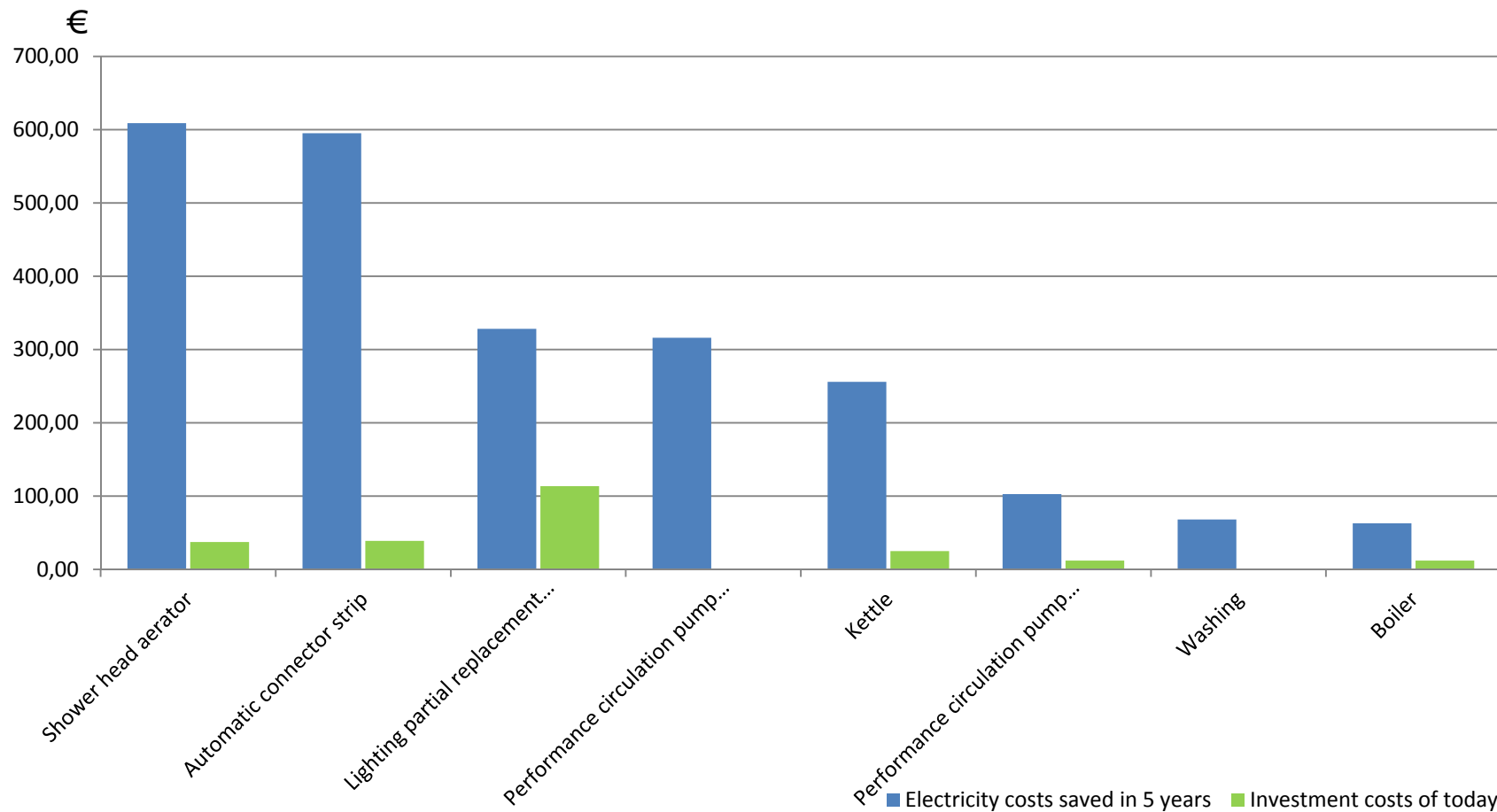
- Increase in **number of households** (due to smaller and growing number of households);
- Trend toward **larger devices**, especially with TVs, partially also with cooling and freezing appliances
- Increase in **number of small devices with high energy consumption**, however: e.g. espresso machines, digital photo frames, wellness equipment, infrastructure devices, kitchen equipment such as bread machines etc.
- **New ICT appliances** without functional substitution of other devices (e.g. tablet PCs);
- **Increase of ready-to-use standby or network standby;**
- **Higher demands:** e.g. air conditioners, all-around lighting, lifts.

Power saving potential of an average german household



Step 1: Saving 1,000 kWh/a (quick action, low invest)

Electricity costs saved in 5 years vs. investment costs of today



The energy efficient EcoTopTen-Household (two persons)

Devices	Annual consumption (in kWh)	Energy efficiency classes of devices and usage patterns
Fridge-freezers	160	A+++ (171 l/41 l)
Cooking (induction) stove	160	
Automatic espresso machine	42	1 litre or 6 cups/day or 2190 cups/a; EcoTopTen
Electric kettle	40	1 litre per day
Dishwasher	100	A+++; 150 rinsing cycles at 50 degrees; 0,67 kWh per rinsing cycle
Washing machine	60	A+++; 5,5 kg drum; 511 kg laundry; 23 x at 60 degrees, 63 x at 40 degrees
Tumble dryer	127	A class; 511 kg laundry
Lighting	80	Energy saving lamp or LED lamps
TV 117 cm /Net-TV / integrated receiver	43	A+ / Blue Angel / 2h per day
Blue ray disk player	35	2h online, 4h quick start mode, 18h standby per day
Telephone/router/W-LAN	45	WLAN/router 4W=36 kWh/telephone 1 W=9kWh
Gamer notebook	40	4h/d
Inkjet printer	10	
Compact HiFi system	20	
High-efficiency pump for heating	47	Heating pump according to www.topten.ch
Other appliances (vacuum cleaner, toaster, steam iron, chargers, other small appliances)	136	toaster=25 kWh; 8 slices/d; vacuum cleaner=48 kWh, 1.000 W, 48 h, 75 m ² ; solar chargers; iron=38 kWh, 75 h/a; others = 25 kWh
	1,145	

product policy proposals

Oeko-Institute recommends a mix of instruments and support programs with following elements:

- strengthening of the ecodesign directive and its implementing measures, modification of the hereby used concept of Least Life Cycle Costs procedure
- a registration procedure for new energy using products
- an ambitious implementation of the new energy efficiency regulation and white certificates
- the voluntary or obligatory declaration of the electricity costs in the use phase of appliances
- a general support program for consumers with grants for energy efficient products
- three target group specific programs for realizing power reductions with low investment costs

Contact and further information

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- **Thank you for your attention!**

Benefit Analysis

- In PROSA the benefit is analysed more intensively because it ultimately determines consumers' purchase and use decisions
- The benefit analysis is used to analyse and evaluate the utility of products and services from the perspective of users (consumers, commercial users, the public administration) or from the perspective of product policy
- If higher social or ecological risks are involved, the assessment has to be reasoned and answered for in terms of product policy in view of relevant legislation (cf. also the socio-economic benefit analysis in the EU's REACH initiative and Eco-Design Directive).
- PROSA analyses three different types of utility:

Checklist for practical utility

- performance (core requirements)
- additional performance
- meets needs
- durability
- functional reliability
- safety/security of supply
- service/reparability/spare parts
- convenience/time
- good consumer information
- availability

Checklist for symbolic utility

- External appearance /design/ taste/ feel/sound etc.
- Prestige/status
- Identity/autonomy/development
- Expertise
- Safety/precaution/care for others
- Privacy
- Social contact/fostering community
- Enjoyment/pleasure/joy/experience
- Compensation/reward
- Consonance with societal, religious or ethical meta-preferences

Checklist for societal utility

- Poverty reduction
- Basic need: food
- Basic need: housing
- Basic need: health
- Information and education
- Peace and security
- Climate protection
- Biodiversity
- Qualified jobs
- Societal stability