

## Evaluation and Monitoring for the EU Directive on Energy End-Use Efficiency and Energy Services

# Top-down evaluation methods for monitoring energy savings

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## What are top-down evaluation methods?

- What the Directive says: “**Top-down methods** mean that the amount of energy savings or energy efficiency progress are calculated using national or aggregated sectoral levels of energy savings as the starting point”
- Top-down methods rely on ‘energy efficiency indicators’ calculated from national statistics ( also called “top-down indicators) (e.g. ODYSSEE indicators )
- ESD Directive refers to ODYSSEE indicators, in particular ODEX, as follows: : “In developing the top-down calculation method used in this harmonised calculation model, the Committee shall base its work, to the extent possible, on existing methodologies such as the ODEX model”.



## Top-down evaluation method: what the directive says about the savings to be considered?

- **Industry to exclude ETS** establishments: need to adapt the industrial consumption (statistical issue not methodological one)
- **“Adjustments to be made for extraneous factors, such as degree-days, structural changes, product mix, etc. to derive a measure that gives a fair indication of total energy efficiency improvement”**
  - ✓ already made in ODYSSEE
  - ✓ some improvements could be made for **“hidden structure effects”**, but often constrained by data availability in a sufficient number of countries
- **“Energy savings target of 9 % ... to be reached by way of energy services and other energy efficiency improvement measures”**
  - ✓ ODYSSEE calculate total energy savings → how to only get savings linked to energy services and policy measures?
  - ✓ In other words, how indicators should be cleaned from factors not linked to energy services and measures?



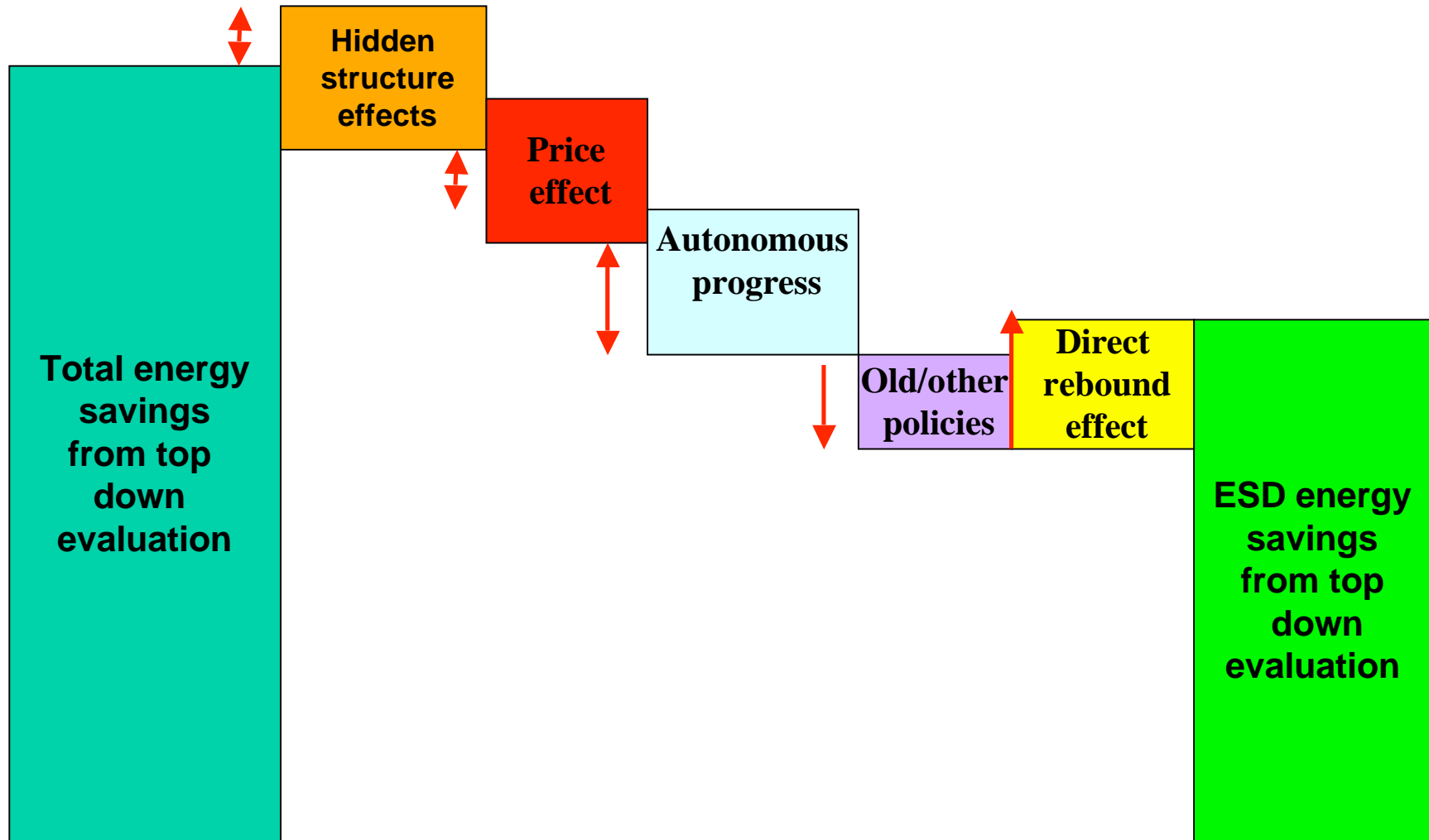
# Calculation of energy savings according to ESD with top-down methods (1/2)

- **In top-down methods**, total energy savings are calculated from statistical indicators, by removing the influence of factors that are not linked to energy efficiency
  - ➔ case of ODYSSEE with unit energy consumption
  
- The measurement of **energy savings according to ESD** definition is then carried out by removing from total energy savings, the energy savings linked to **other factors** than eligible policy measures
  
- **What other factors?**
  - residual hidden structure effects
  - autonomous energy efficiency progress
  - price-induced energy efficiency progress
  - direct rebound effects (cars and households?)
  - others:
    - ✓ economic rebound ➔ **will be neglected**
    - ✓ earlier policy
    - ✓ other policies



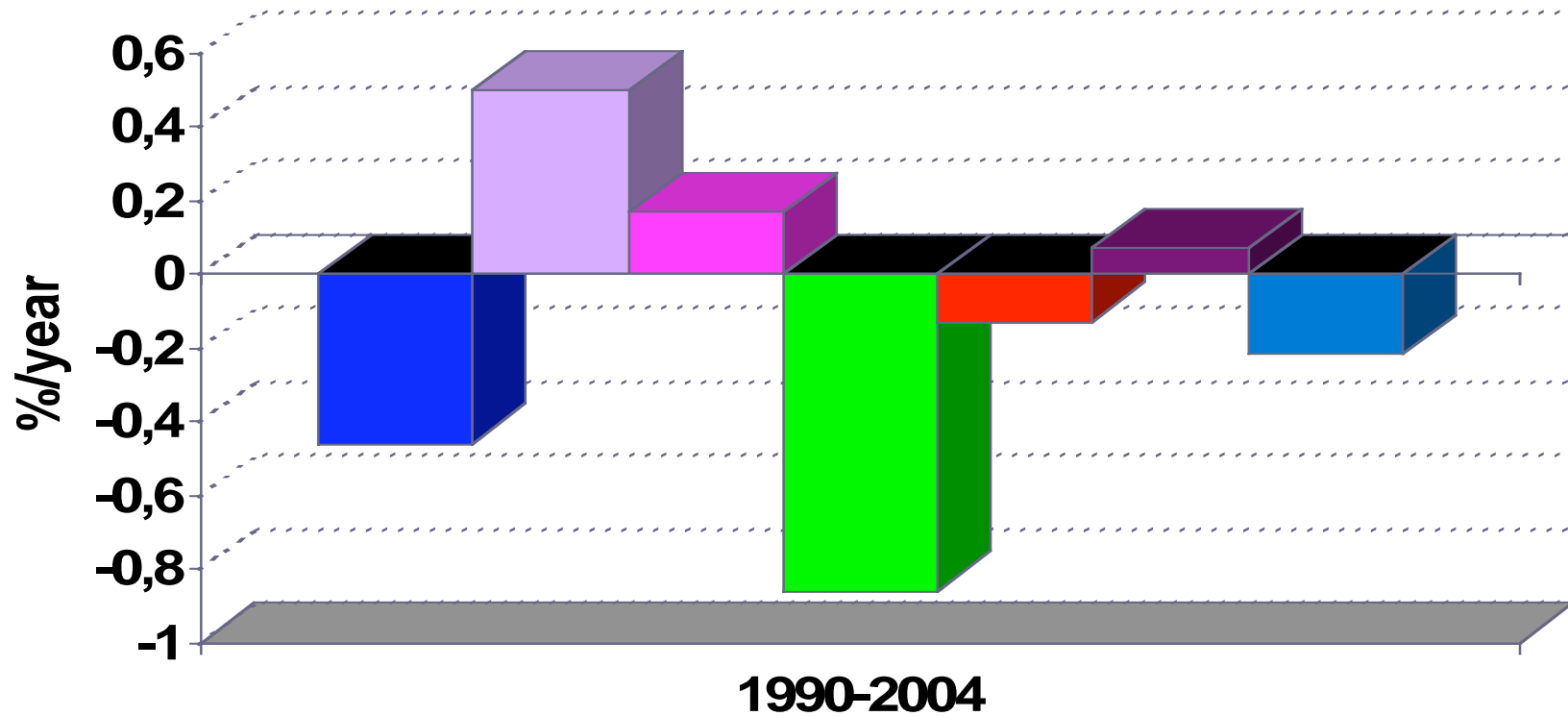


# Summary of effects to be cleaned from total energy savings and not linked to ESD eligible measures





# Examples of structural effects that can be cleaned from energy savings: case of households sector



- variation
- diffusion of central heating
- substitution
- other factors
- size effect
- efficiency
- heating behaviour



# Calculation of energy savings according to ESD with top-down methods (2/2)

- Need to be **pragmatic**
  - Rely on what is feasible and/or actually corrected in existing top down method
  - Have an answer **function** of the end uses
  - Final decision, as to the exact boundaries of the eligible energy savings and therefore of the necessary corrections, will eventually need to be taken by the European Commission and endorsed by the ESD Committee.



# Conditions of harmonisation

## ➤ Harmonisation of definition

- Definition of sectors and energy consumption harmonised across countries.
- Eurostat already takes this question into account for its energy statistics;
- However still relevant, for countries who will rely on their own data

## ➤ Harmonisation of method

- Harmonisation of data
- Same level of disaggregation: what end-uses to be considered? How many types of vehicles?
- Same indicators to measure energy savings: e.g. for cars (toe/car, toe/passenger-km and litres/100km);
- Same calculation methods (e.g. reference years, use of 3 years moving average versus actual values, use of climatic corrections or 5 years average or actual values, same method of climatic corrections)

## ➤ Risk is to harmonise to the situation of countries with the poorest data



## Methods to clean top-down energy savings from other factors not linked to policy (1/2)

- Autonomous trend and price effect can be measured in two ways: through econometric regression analysis or from literature survey.
- The assessment of the direct rebound effect can rely on estimates, such as the estimate done in ODYSSEE (see above technical ODEX) or literature survey.
- Literature survey will rely on:
  - - Studies carried out in European countries;
  - - Member countries submissions to the top down methods actually used
  - - Results of WP2



## Methods to clean top-down energy savings from other factors not linked to policy (2/2)

### ➤ Econometric analysis:

- Energy savings is explained by different variables:

- ✓ one of which will be the time, to capture the trend
- ✓ and another one the energy price.
- ✓ A typical regression can be as follows:

$$\text{Ln ES} = a + b T + c \text{Ln P} + d \text{Ln A} + e \text{Ln ES} - 1$$

with : ES : energy saving indicator, b: trend, T: time

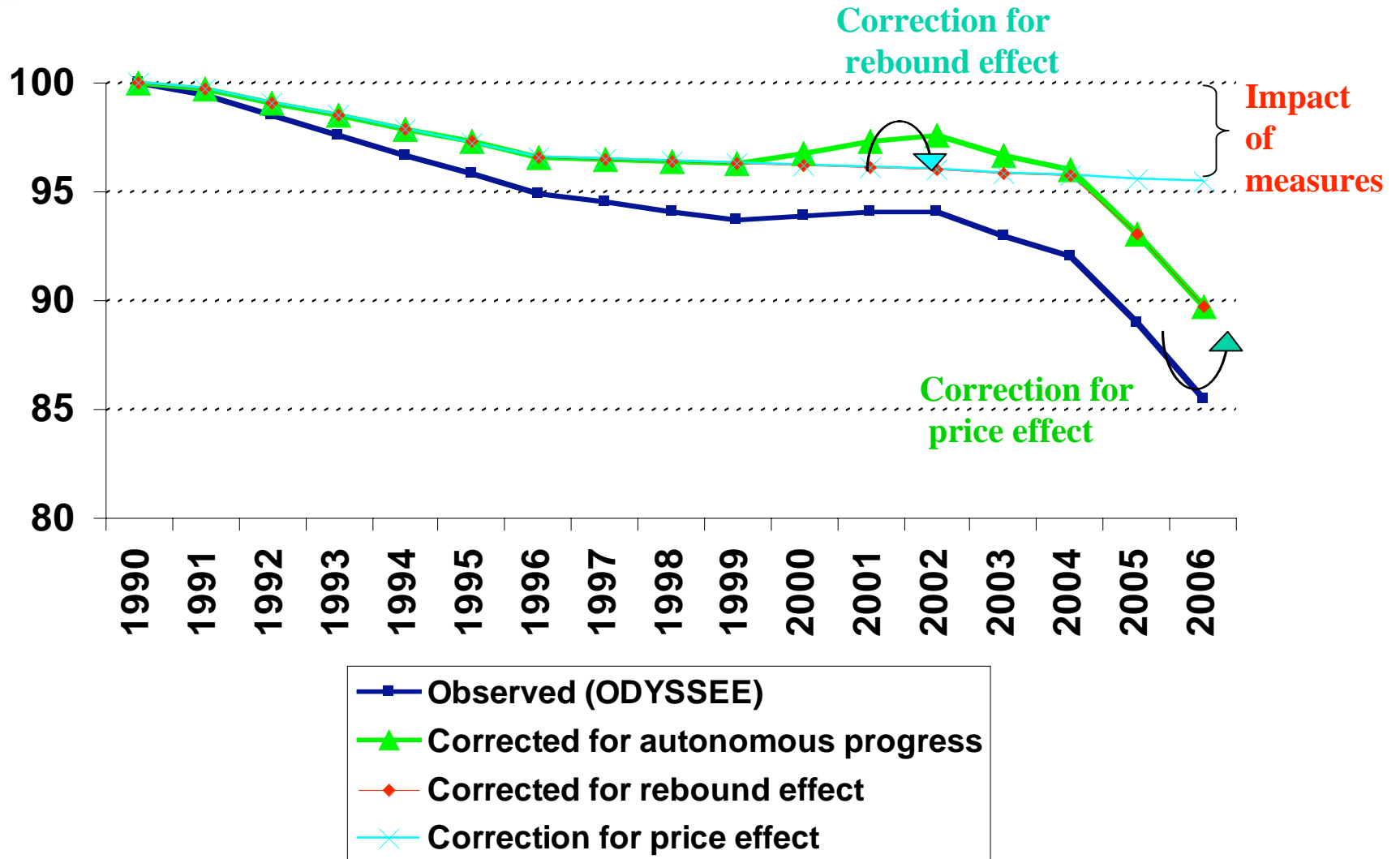
P : energy price (2 components: ex-tax price and tax),

c : price elasticity, A: macro economic variable (e.g. GDP) to capture impact of business cycles, d : elasticity to GDP

- Estimate of the regression coefficient made over a period ending before the effects of measures will have to be assessed (e.g. before 1995).
- Then using the coefficient, the impact of the different effects will be removed over the recent period on which we will calculate the ESD savings



# Accounting of **corrections** to clean from different effects not linked to measures





# Process to develop a harmonised top-down evaluation method (1/2)

## ➤ Harmonisation of methods:

- Do we need to have the same level of disaggregation? If yes how to adapt it compared to ODYSSEE (i.e. what end-uses to be considered? how many types of vehicles?)
- Validate the indicators to measure energy savings by sub-sector: mode of expression... i.e. select or modify from ODYSSEE
- Validate on the basis of ODYSSEE the calculation methods for each end use
- Use of a reference years or annual calculation
- Use of 3 years moving average versus actual values
- Method of climatic corrections
- Method of calculation of energy savings (by sub-sector) (ODEX)
- Additional adjustments to be made



## Process to develop a harmonised top-down evaluation method (2/2)

- **Selection of disturbing effects to be cleaned of (on the basis of proposals from section 3) by sub-sector or end-use:**
  - **Autonomous trend**
  - **Price**
  - **Direct rebound effect**
  - **Other policies**
  - **Others?**
- **Validation of methods for the adjustment for the different types of disturbing effects**



# Possible adjustments according to sector or end-uses

Sector/end-use	Autonomous	Price	Rebound effect (direct)	Other policies/ Old policies
<b>Households</b>				
Heating				
New	No/small	Yes	Yes	Standards <1995 Boiler efficiency
Existing	Yes	Yes	Yes	
Water heating	No	Negligible	?	
Cooking	No/	Negligible	No	
Elec appliances	yes, if pre-1995 data are available	Negligible	No	
Lighting	?	?	Yes	Yes (CFL policy <1995)
<b>Transport</b>				
Cars				
New	Yes/no	Yes	Yes	
Existing	No	Yes	No	
Trucks	Yes	Yes	No	?
Buses	?	Yes	No	
<b>Industry</b>	Yes	Yes	No	?
<b>Services</b>	?	Yes	No	?



# Development of methods for up to 15 end-uses

- **Objective:** to develop method(s) for evaluating energy savings from policy measures for up to 15 end-uses ( 4 in household sector, 2 in services , 3 in industry, 4 in transport and 2 related to general policy instruments ( horizontal measures)
- **Selection based on Annex 3 of the ESD**
- **Evaluation of energy savings not linked to an individual policy measure (not possible) → evaluation of savings linked to **measure packages** acting on a given end-use**



## List of selected case studies (1/2)

### ➤ Residential sector

- (i) Building shell and heating systems (energy consumption indicator)
- (ii) Household electricity use excluding thermal uses (ie electric appliances as a whole including lighting) (energy consumption indicator)
- (iii) Specific white goods (e.g. cold appliances, dryers) (market diffusion indicator)
- (iv) Solar thermal collectors (market diffusion indicator)

### ➤ Transport sector

- (i) New cars (energy consumption indicator)
- (ii) Improvement of the car, bus and truck stock (energy consumption indicator)
- (iii) Modal shift in passenger transport (energy consumption indicator/ modal split indicator)
- (iv) Modal shift in goods transport (energy consumption indicator/ modal split indicator)



## List of selected case studies(2/2)

### ➤ **Industry sector**

- (i) Industrial thermal energy use (excluding electricity) (energy consumption indicator)
- (ii) Industrial electricity consumption (energy consumption indicator)
- (iii) Industrial CHP (market diffusion indicator)

### ➤ **Tertiary sector**

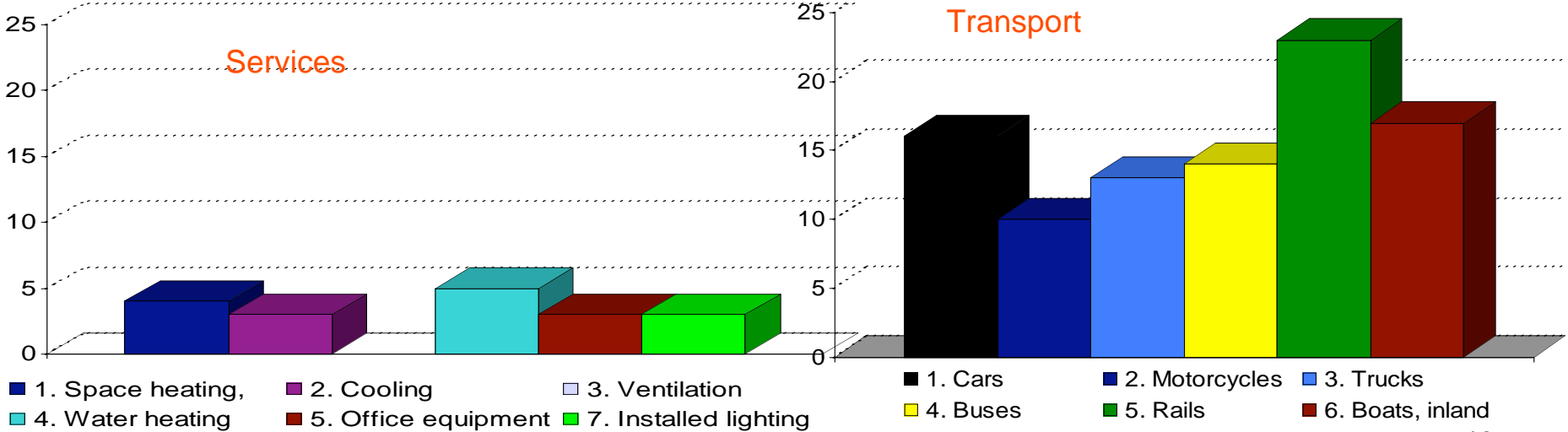
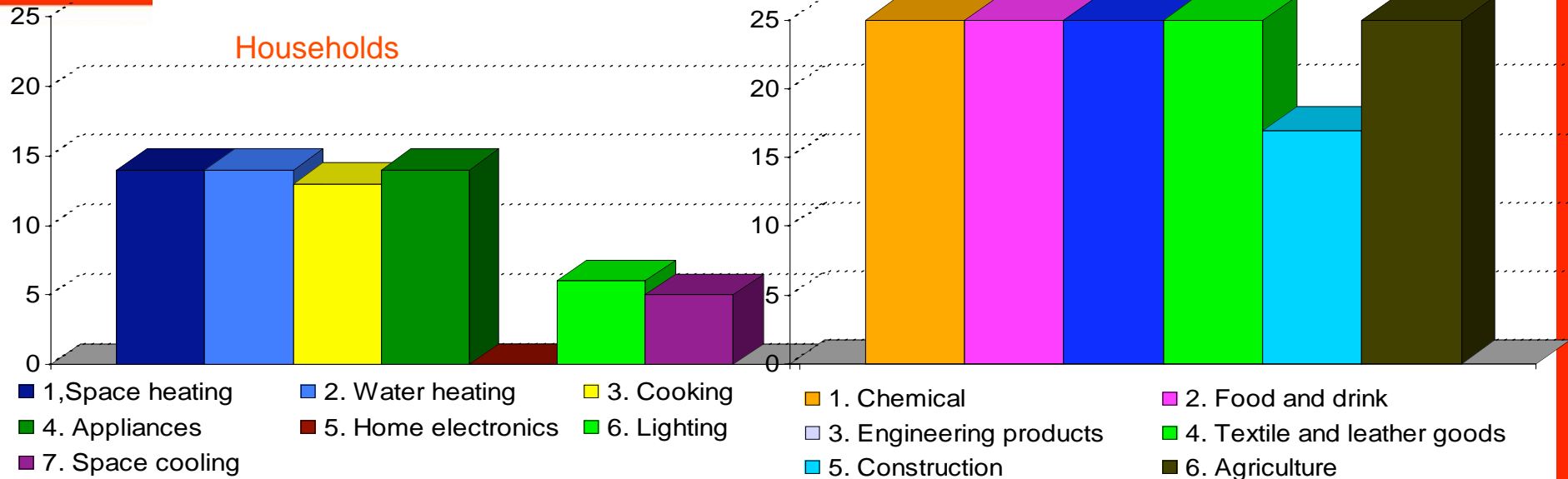
- (i) Building shell and heating systems (energy consumption indicator)
- (ii) Electricity end- uses excluding thermal uses

### ➤ **General policy instruments**

- (i) Energy taxation
- (ii) Focused information campaigns with high impact



# Number of countries with indicators in ODYSSEE (EU-25)





# Availability of data by end-use for the household and service sectors in ODYSSEE

	AT	BE	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	SE	SI	SK	UK
<b>Households</b>																									
Space heating, water heating, cooking	█				█	█		█	█	█	█			█	█				█			█	█		█
Electricity consumption for electrical appliances and lighting	█				█	█		█	█	█	█			█	█				█			█	█		█
Electricity consumption by electrical appliance	█				█	█		█	█	█	█			█	█				█			█	█		█
Electricity consumption for lighting	█				█	█		█	█	█	█			█	█				█			█	█		█
<b>Services</b>																									
Space Heating					█	█				█	█														
Cooling					█	█				█	█								█						█
Ventilation					█	█				█	█								█						█
Water heating					█	█				█	█								█						█
Office equipment					█	█				█	█								█						█
Installed lighting					█	█				█	█								█						█



# Availability of data by sub-sector in industry and by mode for transport in ODYSSEE

	AT	BE	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	SE	SI	SK	UK	
<b>Industry</b>																										
Chemical																										
Food and drink																										
Engineering products																										
Textile / leather goods																										
Construction																										
Agriculture																										

	AT	BE	CY	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	SE	SI	SK	UK	
Cars																										
Motorcycles																										
Trucks																										
Buses																										
Rail																										
Boats, inland																										

No rail transport in Malta and Cyprus