

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

Top-down methods for the evaluation of energy savings

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Calculation of energy savings with Top-Down methods (1/2)

- **ESD Annex IV**

*“A top-down calculation method means that the amount of energy savings is calculated using the **national** or larger-scale aggregated sectoral levels of energy savings as the starting point”.*

“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”.

- In other words, top-down methods rely on **energy efficiency indicators** calculated from national **statistics**, ie from statistical indicators (also called “top-down” indicators)

Calculation of energy savings with Top-Down methods (2/2)

- For instance, the energy savings of a given appliance (e.g. refrigerators) are derived from the **reduction** in the average unit energy consumption of that appliance (kWh/year) ; if this unit consumption is reduced by 100 kWh over 10 years and that the stock of refrigerators is 1 million units the total savings is equal to 100 GWh.
- In some sectors or end-uses, the influence of factors that are not linked to energy efficiency is removed (effect of structural changes in industry, of changes in the size of dwellings...) → case of ODYSSEE indicators

www.odyssee.indicators.org

Calculation of energy savings according to ESD with top-down methods (1/3)

- **ESD Annex IV**

“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” (ESD Annex IV)

- This statement has led to divergent interpretations that can be summarised as follows:
 - In the minimalist viewpoint **only the adjustments for extraneous factors** explicitly mentioned in the Annex IV should be made
 - In the maximalist viewpoint , additional adjustments (**etc..**) should be made so as **to only measure savings linked to policy measures** → energy savings according to ESD definition is then carried out by removing from total energy savings, the energy savings linked to **all “other factors”** than energy efficiency improvement measures

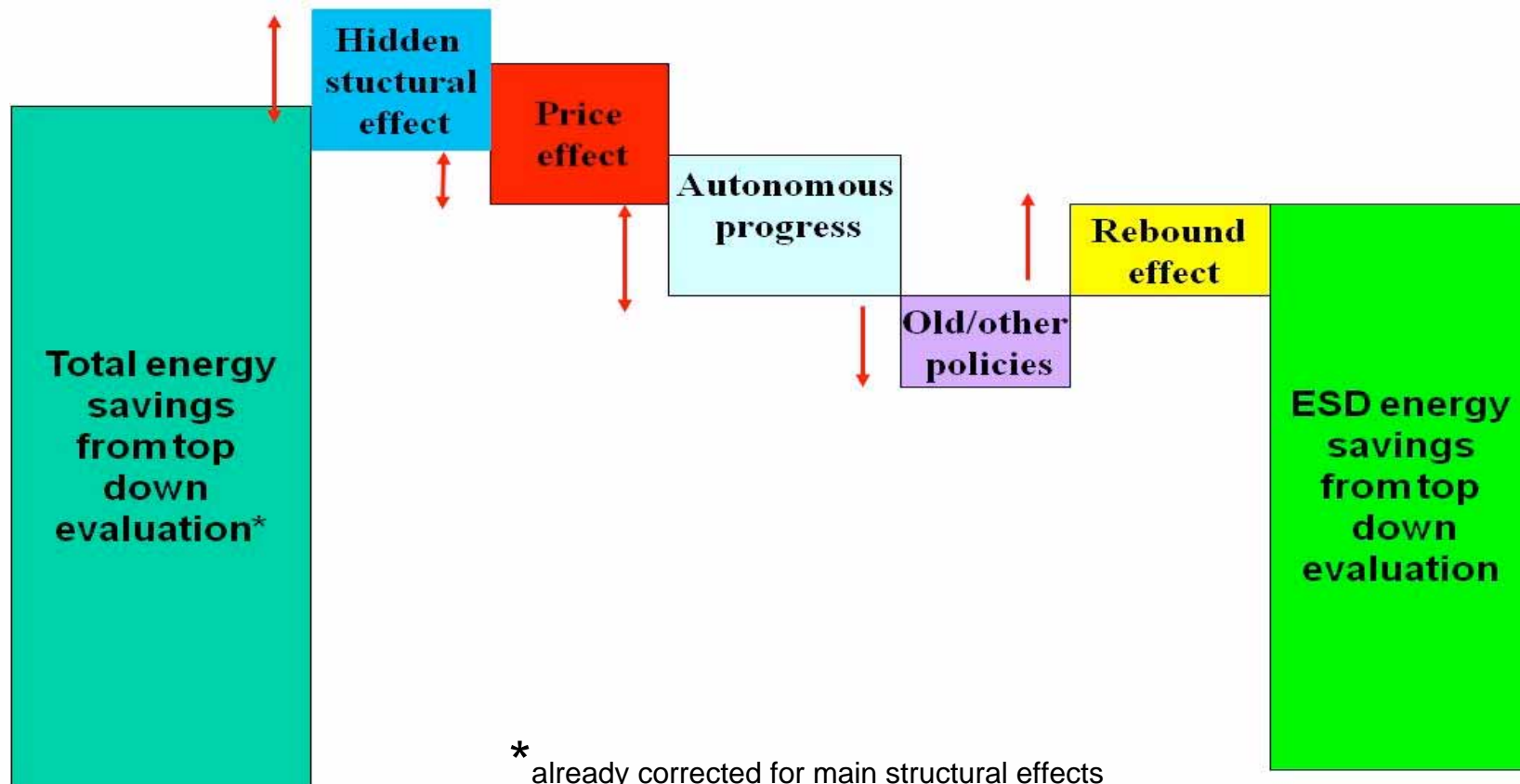
Calculation of energy savings according to ESD with top-down methods (2/3)

- **In principle**, the effect of the following “**other factors**” could be considered for correction:
 - Other residual hidden structure effects, not yet corrected in the indicators used to calculate the total energy savings.
 - Price-induced energy efficiency progress linked to increase in international market prices (tax component can be generally linked to policy measures).
 - Autonomous energy efficiency progress (e.g. autonomous technical trends that would take place even in the absence of EEI measures).
 - others: earlier policies, other policies and direct rebound effects (mainly for cars and households).
- ➔ Objective of the EMEEES project was to explore the feasibility of such corrections

- **In practice**, corrections will depend on what is feasible, from a statistical view point, and on decision of the Commission and /or ESD Committee

Calculation of energy savings according to ESD with top-down methods (3/3):

Possible effects to be cleaned from total energy savings and not linked to energy efficiency improvement measures



Classification of top-down methods in EMEEES

- **Methods can be classified according to the statistical indicator used to calculate the energy savings:**

Type of method	Example of existing indicator
Monitoring of market diffusion indicator of energy saving technology or transport mode	Modal share for transport of goods or passengers; stock of solar water heaters (ODYSSEE indicators)
Monitoring of specific energy consumption indicator of an equipment	New cars, electricity consumption per appliance (kWh/year) (ODYSSEE indicators)
Monitoring of unit energy consumption indicator of a sub-sector (e.g. thermal uses, electricity uses in household, industry or services)	Electricity consumption per employee in service, heating fuel consumption per household (kWh/year) (ODYSSEE indicators)
Total energy consumption (econometric modelling)	Evaluation of the effects of energy taxation (e.g., DE, SE)

Top-down case studies in EMEEES (1/2)

- **Residential sector**

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

- **Transport sector**

- (i) New cars (specific energy consumption indicator)**
- (ii) Improvement of the car, bus and truck stock (unit energy consumption indicator)
- (iii) Modal shift in passenger transport (market diffusion indicator)
- (iv) Modal shift in goods transport (market diffusion indicator)**

Top-down case studies in EMEEES (2/2)

- **Industry sector**

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

- **Tertiary sector**

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

- **General policy instruments**

- (i) Energy taxation

Methods to clean total top-down energy savings from other factors (1/3)

- **In developing the methods for the case studies, total energy savings have finally be cleaned from two different factors:**
 - the autonomous trend
 - market price increases

- **Econometric analysis was used to quantify the impact of these two factors**

- **ESD savings are calculated by difference between total energy savings and savings linked to these two factors**

Methods to clean total top-down energy savings from other factors (2/3)

$$\ln ES = a + b T + c \ln P + d \ln A + e \ln ES_{-1} + K$$

with:

ES : energy saving indicator

b: trend, **T**: time,

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

d: elasticity to macro economic variable **A** (e.g. GDP) to capture the impact of business cycles

- **Estimation of the regression coefficients** (in blue) is made over a period up to the most recent year before the effects of EEI measures are visible.
- Then, the impact of the different effects is removed using the regression coefficients over the period on which ESD savings are calculated (e.g. 2008-2016)

Methods to clean top-down energy savings from other factors - example (3/3)

Estimation of energy savings in year t (e.g. 2012)

