Sensitivity analysis for calculating the ESD energy savings target with the top down method: the French experience of NEEAP2

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1 – Introduction :

2 – Five sensity analyses for TD energy saving calculations based on the french case

4 – Conclusions/recommendations : A political choice based on scientific knowledge

Theory and practices
What are top-down evaluation methods?

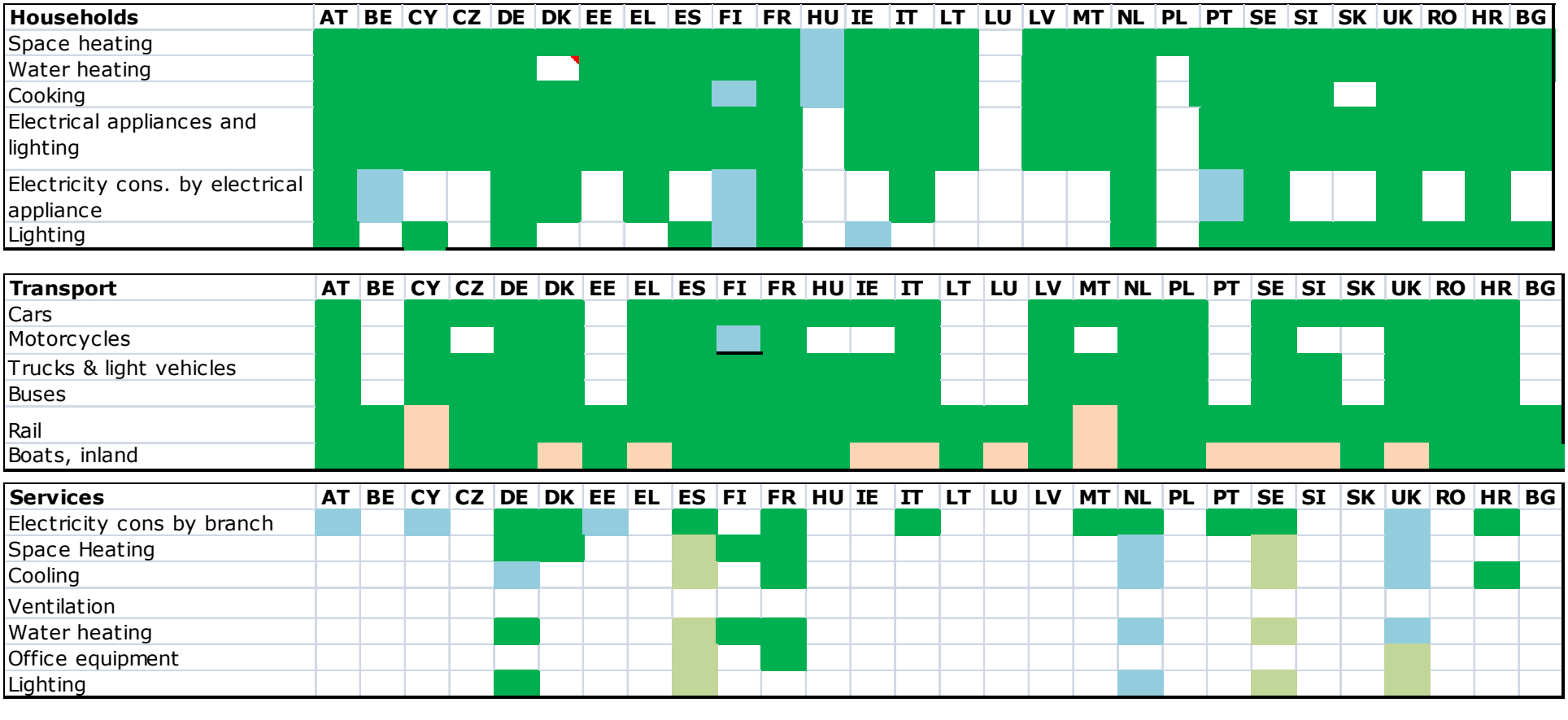
- **What the Directive says: "*Top-down methods* *mean that the amount of energy savings or energy efficiency progress are calculated using national or aggregated sectoral levels of energy savings as the starting point*"**
- **Top-down methods rely on 'energy efficiency indicators' calculated from national statistics (also called "top-down indicators) (e.g. ODYSSEE indicators)**
- **Theoretical Backgroung : "Technico-economic" analysis or "decomposition analysis of energy demand changes" LBNL/AIE (Shipper); FHG (Jochem); Grenoble university (Chateau & Lapillonne)**
- **Implementation : ADEME (Datamed); ODYSSEE; EMEES**
- **Broadly implemented also in DCs (ex Tunisia, Medener, India (BEE), UN/ADEME in Mercosur countries)**

The top down approach
Differentiated practices according to MS in NEEAP2

- Over 3/4 of countries have used more or less the TD method for the calculation of ESD target;
- Most countries have reported both TD and BU assessments;
- There is a minority of countries that have used only one of the two methods (i.e., Belgium and Poland for TD and Finland and UK for BU);
- There is a rather marked preference for the use of TD for transport, high in buildings and lower in industry. This is certainly linked to the fact that BU assessments are particularly limited in transport;
- There are different practices on the use of PIs (Preferred Indicators) and MIs (Minimum Indicators) often sector dependent (i.e. MIs in the service sector).
- **France has carried out a full coverage with TD and some BU (WhCs)**
- **The 2010 intermediate target for France should amount 5 Mtoe (in final energy). After 2 years (2009), TD calculation demonstrates that France has reached the intermediate energy saving target (5,1 Mtoe)**

Data availability by country (ODYSSEE)

Even if improvement, many countries still with important data gap for households consumption by end-use, road transport consumption by mode and in services ➔ the project is developing some methods to help countries with missing data to do estimates on the basis of the methodology of countries with data



Sensitivity analyses for TD calculation

1. **Influence of the type of indicator on the TD calculation of energy savings.**
2. **The impact of the level of disaggregation: case of the service sector**
3. **Impact of the sector coverage: case of industry**
4. **The issue of the re-aggregation: how to calculate total energy savings for the target**
5. **The issue of the yearly variation of TD savings.**

Impact of the choice of indicators in the energy savings of the housing sector (France 2007-2009).

Code ESD	Energy efficiency indicators	Indicator units	2007-2008 savings (ktoe)	2007-2009 savings (ktoe)
M1	Non electric consumption per dwelling (climate adjusted)	toe/dw	2 200	3 566
M2	Electricity consumption per dwelling	kWh/dw	-403	-481
	Total 1 with Minimum Indicators		**2 200**	**3 566**
P1	Space heating consumption per m² (climate adjusted)	koe/m²	1 785	2 972
P2	Space cooling consumption per m² (climate adjusted)	koe/m²	0	0
P3	Unit consumption for water heating per inhabitant	toe/inhab	23	13
P4	Specific electricity consumption per appliance	kWh/yr		
	Refrigerators		11	23
	Freezers		7	14
	Washing machine		0	0
	Dish washers		0	0
	TV		0	0
	Dryers		0	4
P5	Electricity consumption for lighting per dwelling	kWh/dw	16	35
	Total 2 with Preferred Indicators		**1 842**	**3 061**

Energy savings are positive Source: MEDDTL 2011, and authors of French NEEAP2.

Impact of the choice of indicators on the energy savings for the transport sector (France 2007-2009)

CODE ESD	Energy efficiency indicators	Indicator units	2007-2008 savings (ktoe)	2007-2009 savings (ktoe)
M5	Energy consumption of road vehicles per car equivalent	toe/eq car	1374	2574
M6	Energy consumption of rail transport in grams of oil equivalent	toe/tkbr	-2	-68
M7	Energy consumption of domestic water transport	toe/tkm	0	0
	Total 1 energy savings (Minimum)		**1374**	**2574**
P8	Energy consumption of car per passenger km	toe/pkm	67	167
A1 FOR P8	Energy consumption of car	l/100km	-4	116
P9	Energy consumption of trucks and light vehicles per ton-km	toe/tkm	-107	-1368
A2 FOR P9	Energy consumption of trucks and light vehicles per vehicle	toe/veh	831	1763
P10	Energy consumption of passenger rail transport	toe/pkm	-1	-46
P11	Energy consumption of rail transport per gross ton-km	toe/tkbr	-6	-170
P12	Share of public transport in total passenger transport	%	153	132
P13	Share of rail, water transport in total freight transport	%	26	-75
	Total 2 with preferred indicators		**250**	**630**

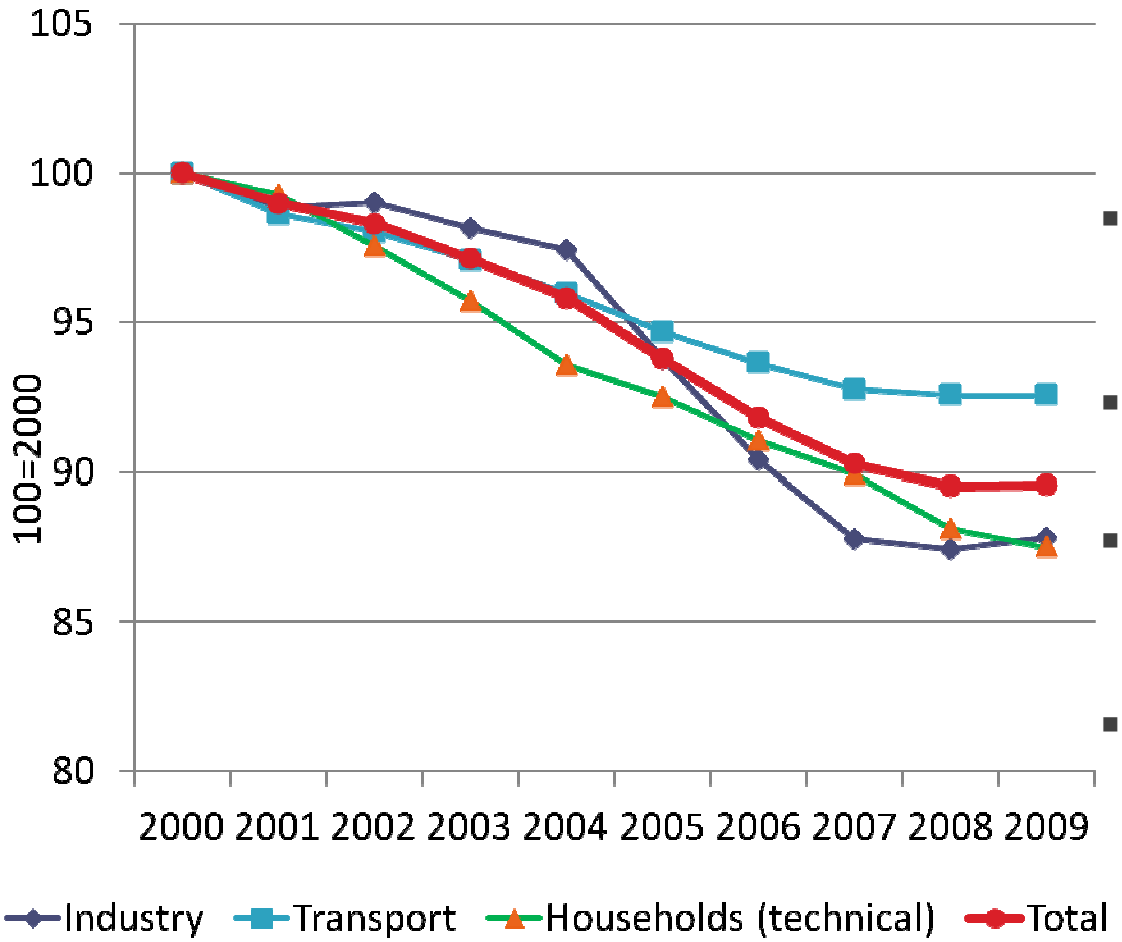
The impact of the level of disaggregation: case of the service sector (France 2007-2009)

			2007-2008 savings	2007-2009 savings
	Energy efficiency indicators	Indicator units	ktoe	ktoe
M3	Non electric consumption per employee (climate adjusted)	toe/employee	281	429
M4	Total unit consumption of electricity per employee	kWh/emp	-223	-438
	Total 1 bis with minimum indicators*		**281**	**429**
P6	**Non electricity consumption of sub sector per employee**			
	Hotel, restaurants	toe/emp	69	80
	Health and social action	toe/emp	97	212
	Education, research	toe/emp	15	2
	Offices and administration	toe/emp	-13	24
	Trade (wholesale and retail)	toe/emp	56	98
	Total 2 with preferred indicators (non electricity)		**237**	**415**
P7	**Total unit consumption of electricity by per employee**			
	Hotel, restaurants	kWh/emp	-21	-38
	Health and social action	kWh/emp	-24	-42
	Education, research	kWh/emp	-17	-25
	Offices and administration	kWh/emp	-109	-224
	Trade (wholesale and retail)	kWh/emp	-53	-94
	Total 2 bis with preferred indicators*		**237**	**415**

Impact of ETS consumption on energy savings assessment in industry (France 2007-2009).

			2007-2009 With ETS	2007-2009 Without ETS
	Energy consumption per unit of production index	Units	ktoe	ktoe
P14	Chemical (NACE 24)	ktoe/IPI	1064	532
P14	non-ferrous metals	ktoe/IPI	-129	-13
P14	iron and steel	ktoe/IPI	-1	0
P14	Non metallic minerals (NACE 26)	ktoe/IPI	-52	-5
P14	Wood (NACE 20)	ktoe/IPI	-559	-476
P14	Paper Printing (NACE 21-22)	ktoe/IPI	206	51
P14	Food (NACE13-14)	ktoe/IPI	211	225
P14	Textile (NACE 17-19)	ktoe/IPI	-14	-12
P14	Machinery (NACE 28-32)	ktoe/IPI	-285	-242
P14	Transport equipment (NACE 34-35)	ktoe/IPI	-19	-16
P15	Construction (NACE 45)	ktoe/IPI	288	-359
P14	Others	ktoe/IPI	-399	245
	Total with preferred indicators (excluding industrial branches without savings)		**1839**	**1053**
	Total with preferred indicators (including branches without savings)		**311**	**-70**

Energy efficiency index (ODEX) for final consumers (EU)

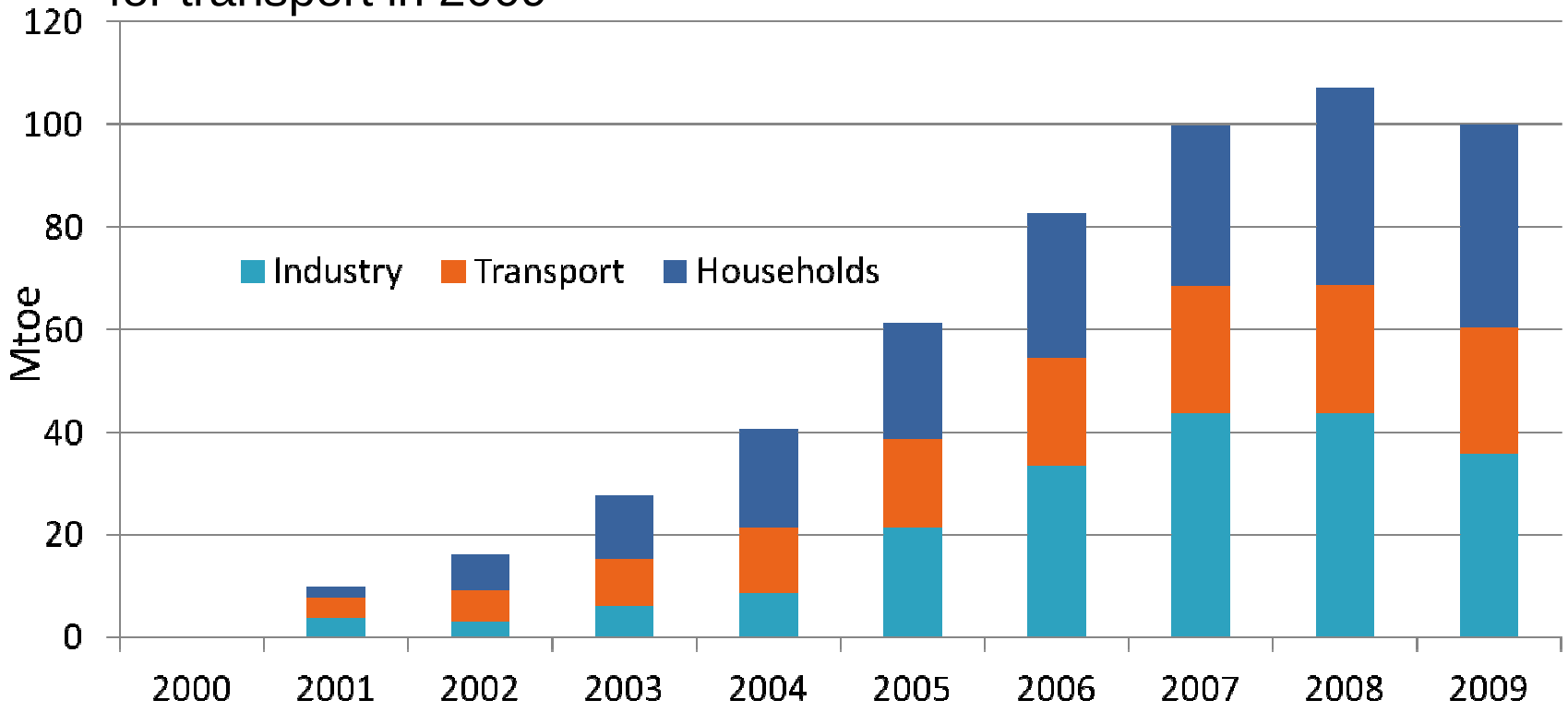


- ODEX= 90 in 2009 ➔ 10% energy efficiency improvement between 2000 and 2009 (or 1.2%/year).
- No real progress since 2007, because of transport and industry.
- Larger gains for industry until 2007
- Over 2000-2009, similar achievements for households (and industry (~1.5%/year).
- Lower progress for transport (0.9%/year)

ODEX is calculated as a 3 years moving average to avoid short term fluctuations (imperfect climatic corrections, behavioural factors, business cycles)….

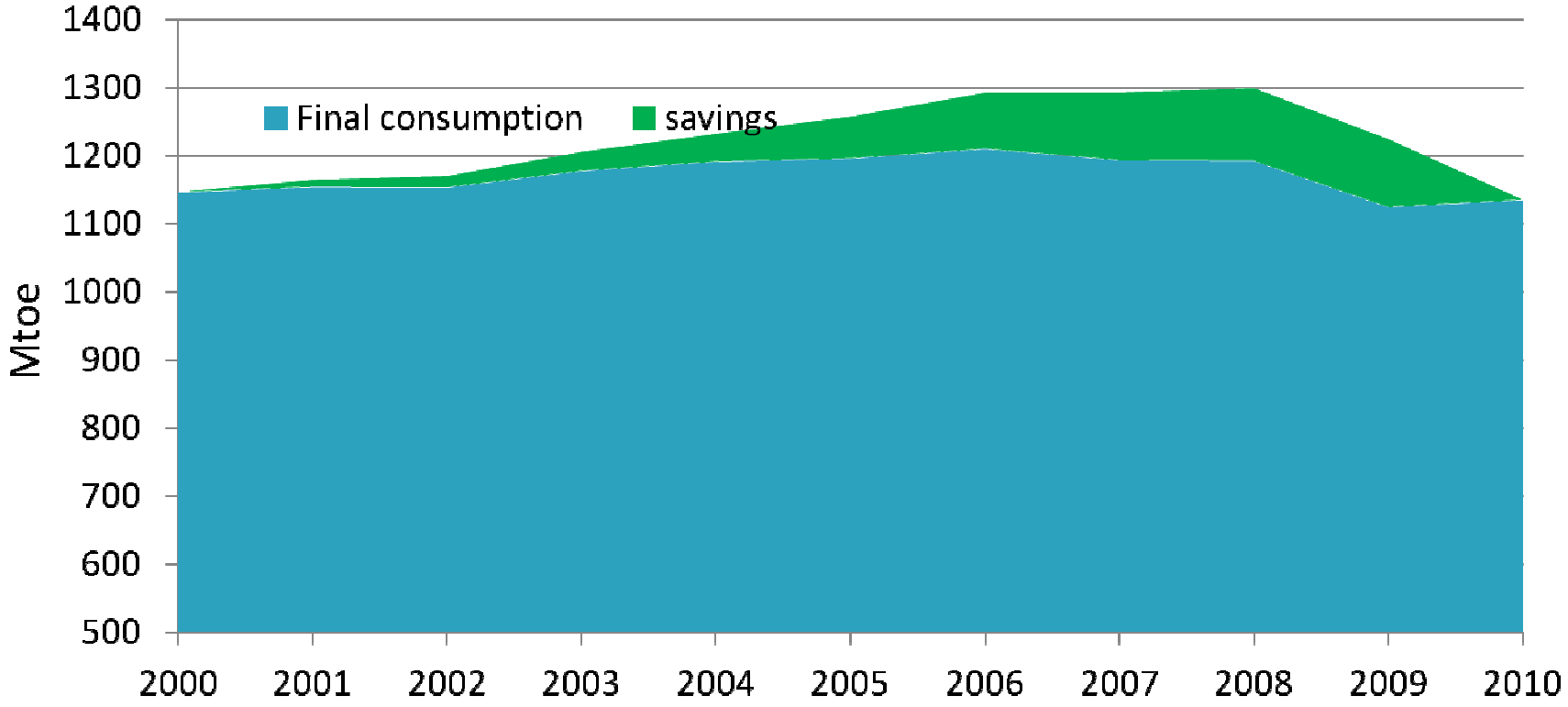
Evaluation of energy savings (EU)

- About 100 Mtoe cumulated energy savings since 2000 (i.e. 10% of final energy consumption).
- Around 40% of total savings in households, 35% for industry, 24% for transport in 2009



Final consumption and energy savings (EU)

Without energy savings the final energy consumption would have been100 Mtoe higher in 2009 (10%)



Re-agregation of TD savings : the “A la carte” case of the French NEEAP

Mtoe	Industry (a)	Industry (b)	Household	Services	Transport	Total (c)
ESD savings (minimum)		1053	3566	429	2574	**7622**
ESD savings (preferred)	1839	1053	3061	415	630	**5159**
Total savings (minimum)		-70	3085	-9	2506	**5512**
Total savings (preferred)	311	-70	3061	-8	-1368	**1915**

Re-agregation of TD savings : the “A la carte” case of the Danish NEEAP

Accumulated savings	2008	2009	2010	2010
assessed using the TD method	PJ	PJ	PJ	%
M2 Households’ electricity minus electricity for space	0.3	1.3	2.0	7%
P1 Households’ space heating incl. hot water per	2.9	8.8	13.3	48%
P7 Service sector electricity per square metre	0.3	2.2	3.2	12%
M3 Service sector excl. electricity per square metre	1.1	4.1	6.2	22%
M5/P8 Transport passenger road per vehicle km	-0.3	1.7	2.6	9%
P9 Transport freight road per ton-kilometre	3.7	0.1	0.2	1%
M6 Transport train per gross kilometre	-0.1	-0.2	-0.3	-1%
M8 Transport air per passenger kilometre	0.0	0.0	0.0	0%
P12 Transport passenger switch to public transtation	0.1	0.1	0.1	0%
P13 Transport freight switch to trains and ships	0.2	0.4	0.6	2%
Total excl. industry	8.2	18.5	27.8	100%
ESD obligations incl. Industry	6.3	12.6	18.8	

Source DEA/Odyssee

Conclusion (1/4) :For a better transparency of the methodology used

- France has an efficient statistical system that allows for a comprehensive implementation of the TD methodology proposed by the Commission.
- The TD calculation of energy savings reported in the French NEEAP2 shows that France has exceeded the interim target set by the ESD: 5.2 Mtoe in 2 years for a 3 years target (2008-2010) of 5 Mtoe.
- The presentation of results is quite transparent since it indicates the various optional calculations depending on the type of indicators (PIs, MIs or AIs) and the type of aggregation by end-use.
- TD will be more effective as far as the statistics will improve. In that respect, Eurostat should be the entity able to provide such results in the European countries.

Conclusion (2/4): TD approach implementation relies on political choices based on scientific knowledge

- The French government has followed three principles for the methodological choices:
  - 1) preference for PIs when data permitted,
  - 2) summing only positive energy savings
  - 3) no evaluation based on national indicators.
- The ESD has clearly boosted the knowledge of the French administration in monitoring energy savings with TD.

Conclusions (3/4) : Recomendations

We discussed the robustness of the results from five sensitivity analyzes that show significant differences depending on the options chosen. To minimize these differences that can lead to controversy, our analysis suggests some recommendations to be followed when reporting TD savings :

1. The same methodological choices must be kept throughout the reporting period (With respect to either the choice between preferred and minimum indicators and as to the integration or not of negative savings in the total by sector.
2. The TD method should not be understood as a default method compared to BU, but as the method that gives the image the more statistically representative of total energy savings.

Conclusions (4/4) : Recommandations

1. We must try to disaggregate as much as possible to come close to the actual energy efficiency improvements in promoting enhanced statistics in key areas This goes in favor of using preferred instead of minimum indicators and to go into more detail with these preferred indicators, for instance by separating savings in existing and new buildings.
2. The use of PIs is much better even though it may generate fewer savings than MIs or AIs under specific conditions.
3. It is recommended to take into account positive and negative savings, especially for electrical vs. thermal end-uses.
4. In transportation, MIs provide results which seem far from the reality of energy savings. It would be better to convince MS to survey their consumption per vehicle, which would allow calculating the PIs
5. To avoid erratic results when too rapid changes occurs (crisis), it seems preferable to calculate yearly savings based on the concept of 3 years moving average.

Thank you for your attention !
Good luck for NEEAP3

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