Stakeholders' Meeting on Energy Data Analysis in Thailand

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International practice and experience in energy efficiency indicators development

Bruno Lapillonne, Vice President, Enerdata

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Outline

1. Why energy efficiency indicators?
2. International experience with indicators
3. Experience with ODYSSEE indicators in Europe
4. Use of indicators for policy making
5. Conclusions

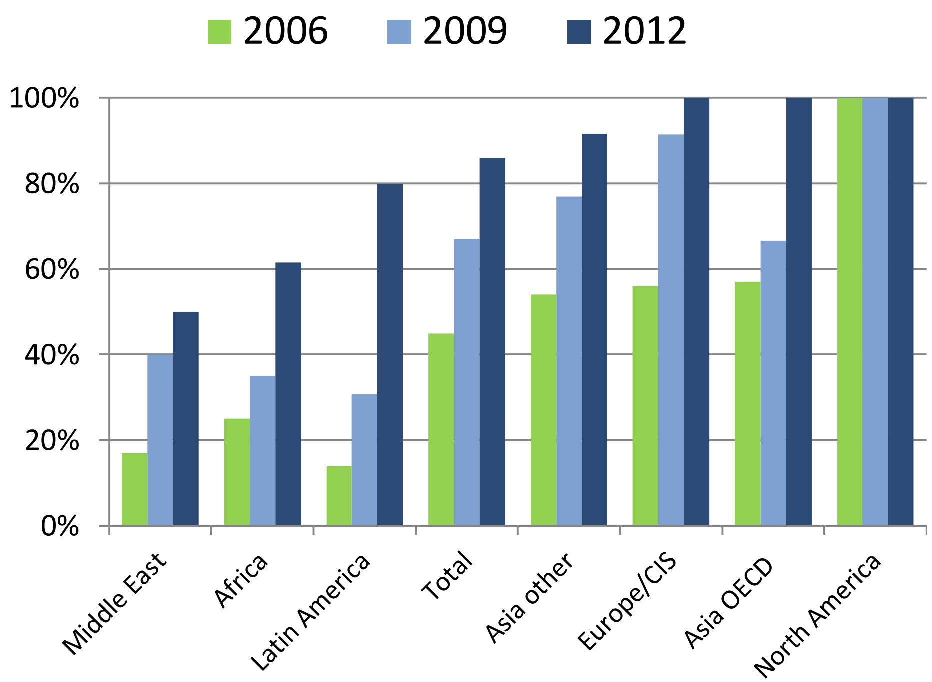
From soft commitments on energy efficiency improvement to more quantified targets

- Previously very general and qualitative objectives were adopted to raise energy efficiency.

- Now quantitative targets are set:
  - That are more constraining and ambitious;
  - That are increasingly integrated within energy laws;
  - That are defined both at the level of the total consumption but also by sector or end-use ("sectoral targets");
  - That often require yearly monitoring, and even reporting obligations

Increasing number of countries with energy efficiency targets

Energy efficiency programmes with quantitative targets



Source: WEC/ADEME surveys

- Most countries in the world now have quantitative energy efficiency targets: 72 countries, twice more than 6 years ago, according to WEC-ADEME surveys

- With even multiple targets: 5 countries with more than 10 targets, and 48 with 3 to 10 targets.

What are energy efficiency indicators?

- Energy efficiency indicators can range:
  - From simple energy intensities to GDP or Value Added (eg kWh or toe/$) ...
  - To physical indicators of specific consumption (e.g. kWh/m2 or toe/t)...
  - To more complex indicators used as a proxy for energy savings or energy efficiency improvements and cleaned from different factors (climate fluctuations, structural changes)

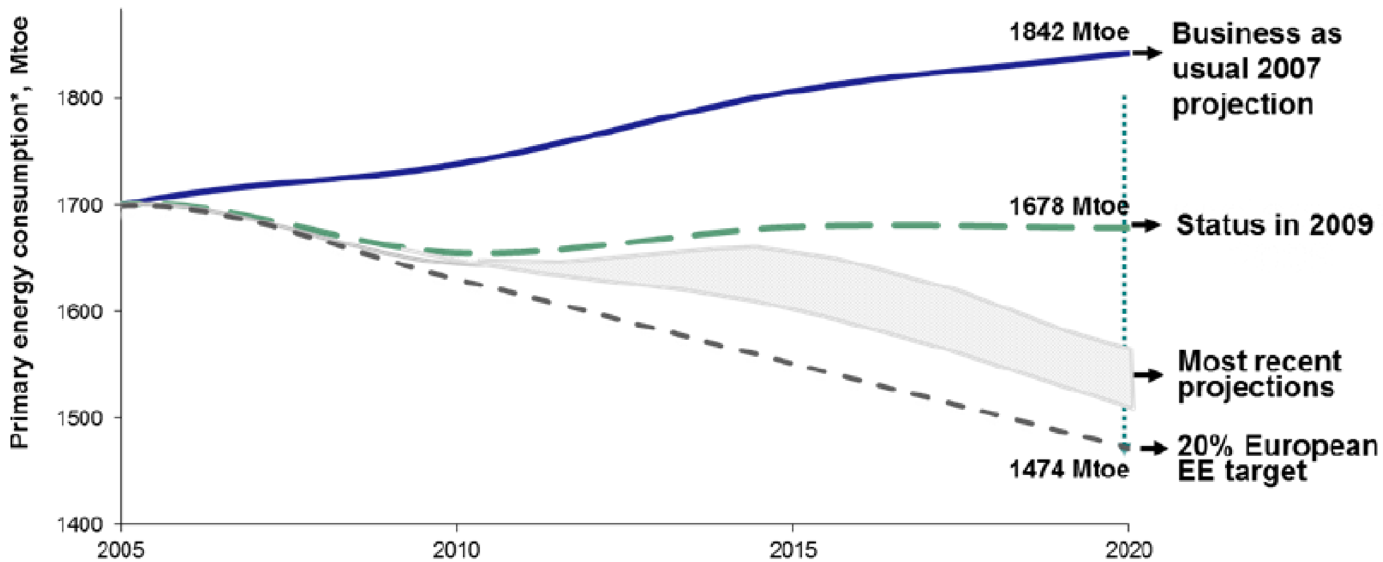
- Energy efficiency indicators can be based on:
  - On national statistics of energy use and activity; in that case, they are often referred to "top-down" indicators" ;
  - On data collected at a micro level, from reporting or surveys (i.e. at building or factory level); they are referred to as "bottom-up" indicators; such indicators are usually used to assess the impact of a specific energy efficiency programme.

Energy efficiency indicators are also a tool to asses energy savings potentials

- Directly by benchmarking a given country with cuntries with better the energy efficiency performances or with best practice;

- By evaluating the long term potential for energy efficiency improvement with end-use models (e.g. MEDEE, MAED, LEAP or MURE), as the key data required are energy efficiency indicators

EU 20% for energy efficiency improvement in 2020



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2. **International experience with indicators**
3. Experience with ODYSSEE indicators in Europe
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ODYSSEE in Europe the precursor with energy efficiency indicators : experience spreading now worldwide

- ODYSSEE indicators were introduced more than 20 years ago and cover all EU countries (around 200 indicators y country) ;

- Experience transferred to the World Energy Council who has since 1995 a data base containing around 40 indicators and covering 90 countries and 10 regions worldwide;

- IEA has also developed its own energy indicators for OECD countries, in collaboration with ODYSSEE for European countries;

- The ODYSSEE experience has been transferred and adapted in:
  - Mediterranean countries (Algeria, Lebanon, Morocco and Tunisia) (MEDENER)
  - Latin American countries with UN/ECLAC (BIEE project)

ODYSSEE indicators and methodologies are becoming increasingly official

- In EU countries:
  - ODYSSEE indicators have been directly adopted by the European Commission to calculate energy savings for the monitoring of a Directive;
  - A European standard on energy savings has been adopted by the European Standardisation Organization (CEN) relying on the experience with ODYSSEE indicators for top-down calculation;

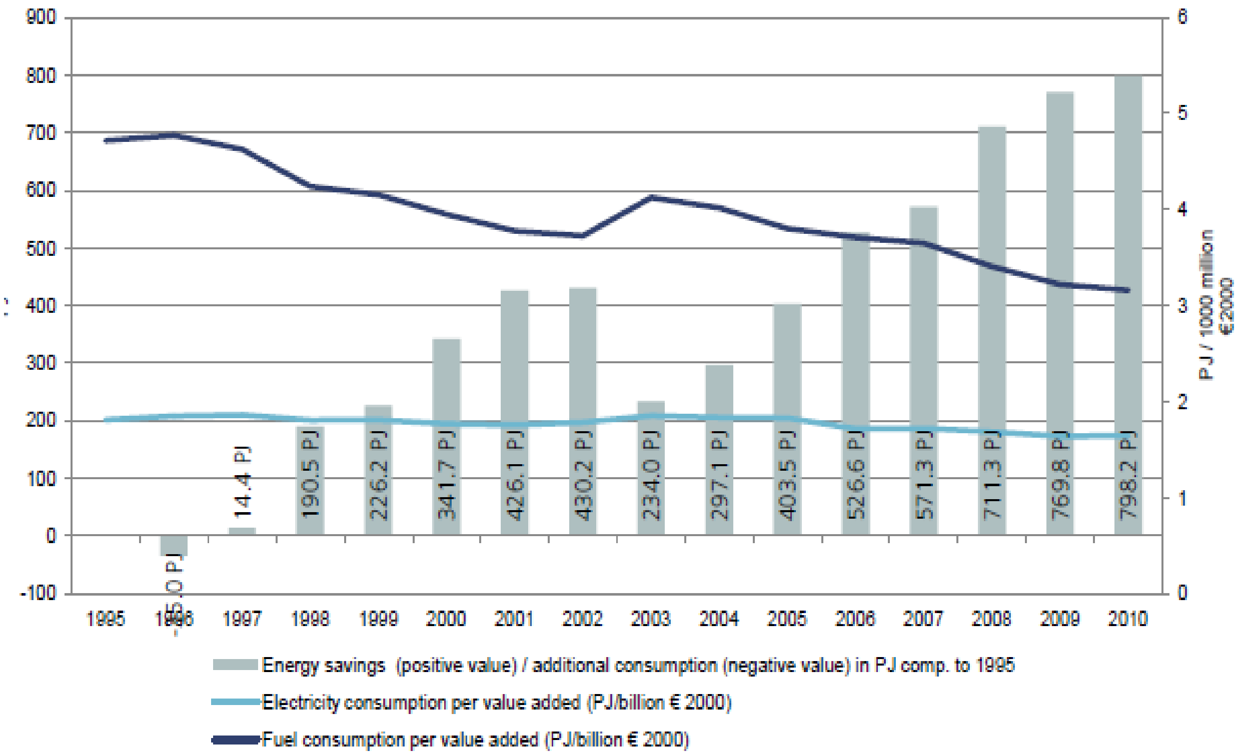
- At World level an ISO standard is under consultation process and relies on the European standard.

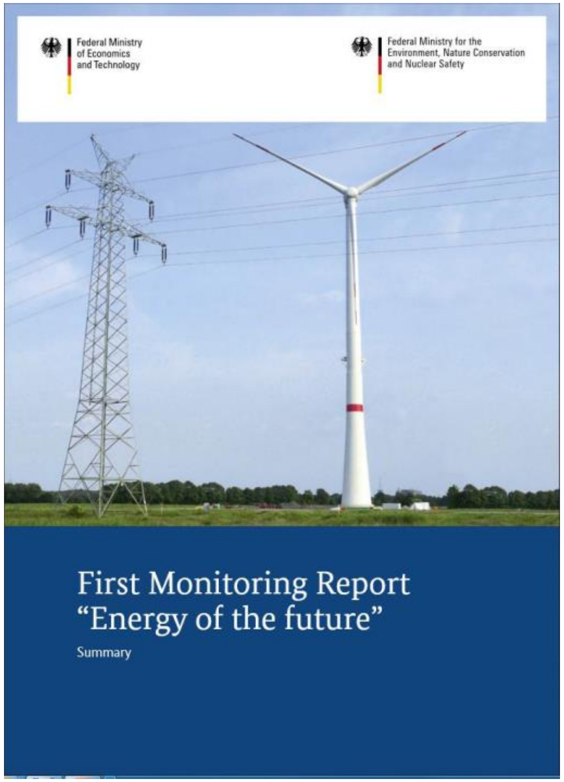
- In several countries indicators from ODYSSEE are officially used for monitoring the progress achieved (e.g. France, Germany, Tunisia)

Monitoring of official targets in the field of energy efficiency: Germany

- Germany ("Energiewende") : definition of 49 Indicators monitored by independent members of Expert Commission

Energy savings and energy intensities in Germany





Monitoring of official targets in the field of energy efficiency: European Commission

- The Energy Service Directive Directive (ESD) has set a target of 9% energy savings in 2016 compared to 2008 for each of the 28 EU member countries, with reporting obligation :
  - on actions undertaken;
  - on energy savings achieved;

- For the calculation of energy savings, harmonised calculation using top-down and/or bottom-up methods are recommended;

- For top-down method, selection of a set of about 25 indicators to calculate energy savings, directly taken from ODYSSEE indicators.

- For second reporting in June 2011 , ~ ¾ of EU countries used Top-Down methods (i.e. indicators) to report their energy savings over 2008-2010;

Outline

What is ODYSSEE?

Supported by INTELLIGENT ENERGY EUROPE

- ODYSSEE is part of the ODYSSEE-MURE project , coordinated by ADEME and supported by Intelligent Energy Europe (European Commission); it gathers 32 organisations (mainly energy efficiency agencies) of 28 countries.

- The project relies on two data bases:
  - ODYSSEE on energy efficiency indicators www.odyssee-indicators.org
  - MURE, on policy measures : www.muredatabase.org

- The project has 2 main objectives:
  - Evaluate and compare energy efficiency progress, and energy consumption trends;
  - Evaluate energy efficiency policy measures;

- The project has produced various reports (available on ODYSSEE web site)

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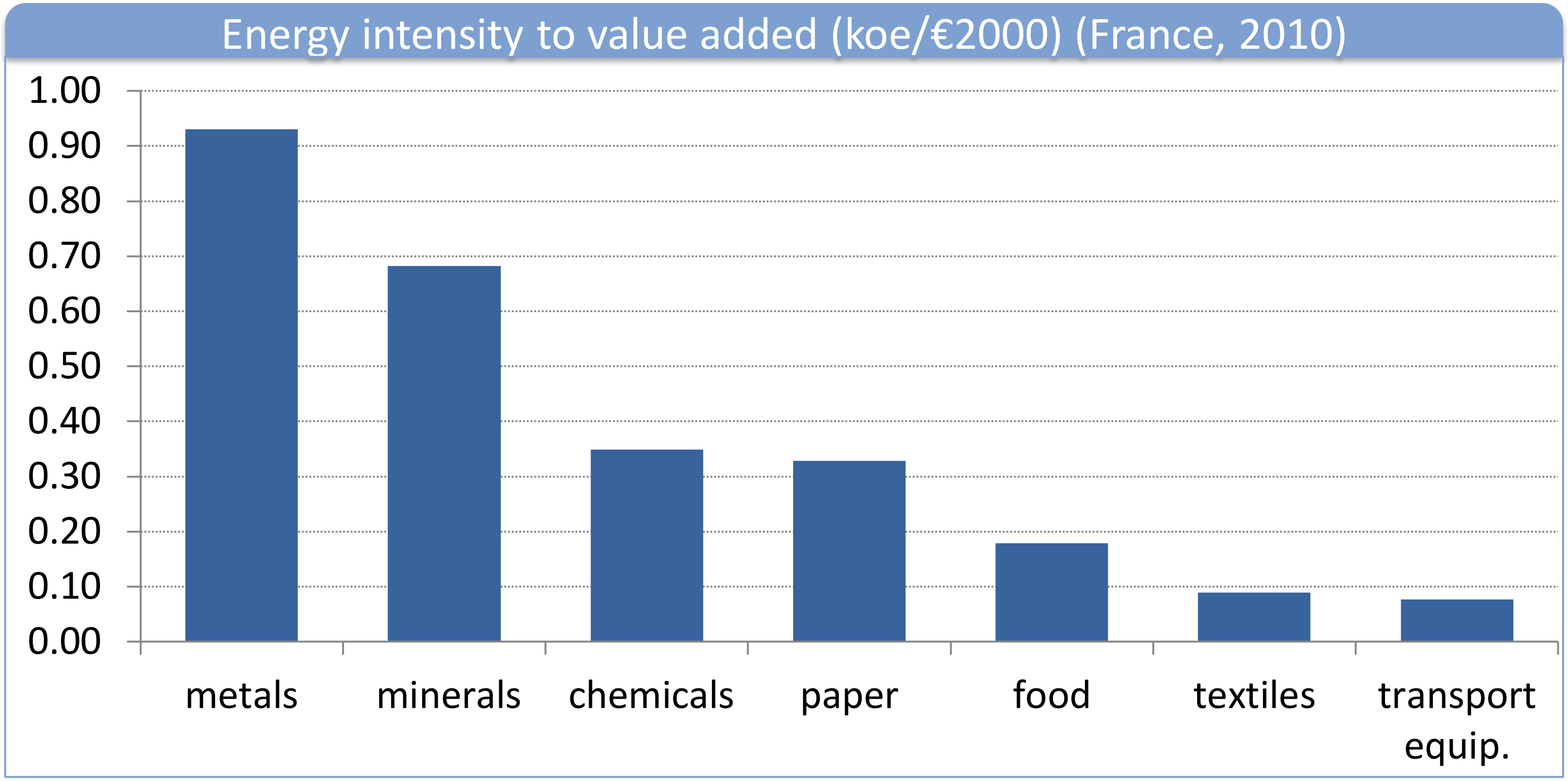
Various types of energy efficiency indicators in ODYSSEE

- 8 different types of energy efficiency indicators (+CO2)

Type
1. Energy intensities (e.g. toe /€ or $ 2005)
2. Specific energy consumption (toe/ton, kWh/appliance)
3. Adjusted specific energy consumption for benchmarking
4. Energy efficiency index (ODEX)
5. Energy savings (ktoe, GWh)
6. Decomposition of energy consumption variation (ktoe, GWh)
7. Adjusted energy intensities (in purchasing power parities, at reference climate and economic structure) (toe /€ or $ 2005 ppp)
8. Indicators of diffusion of efficient technologies and practices) (indicators of market transformation) (%)

Increasing complexity

ODYSSEE indicators: example of energy intensities



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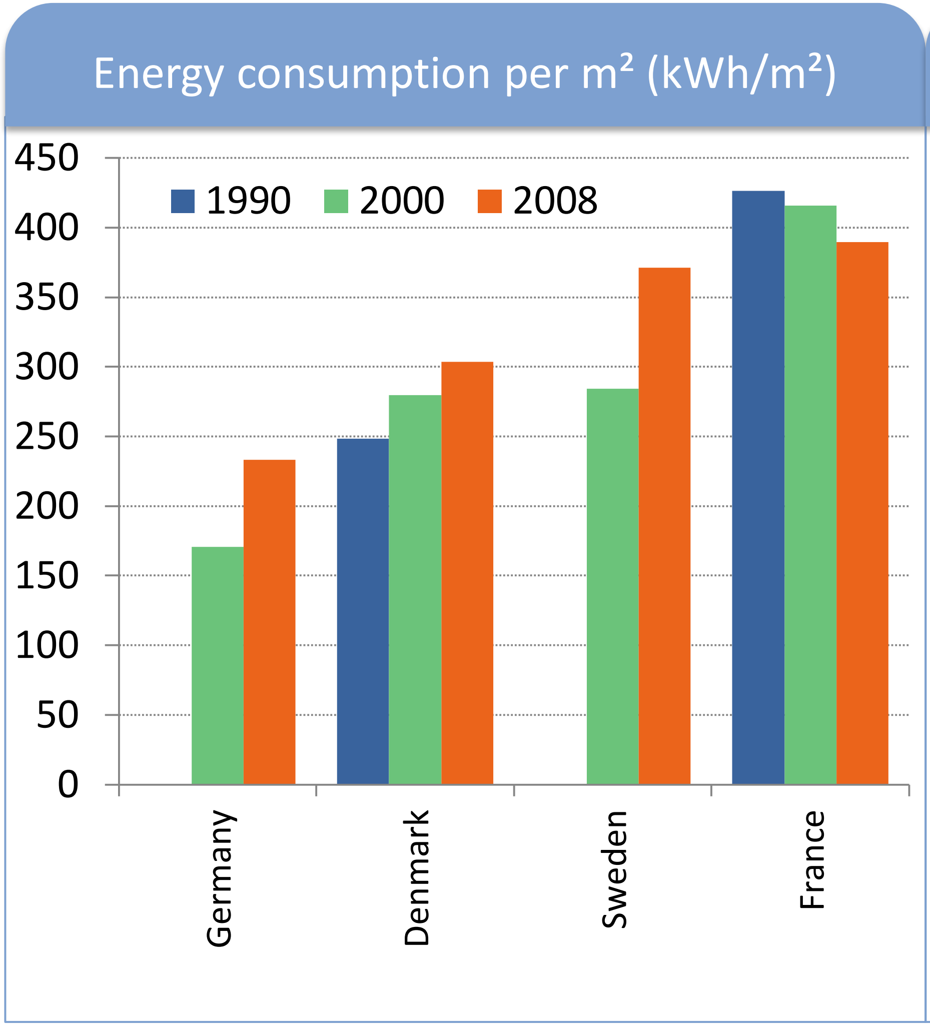
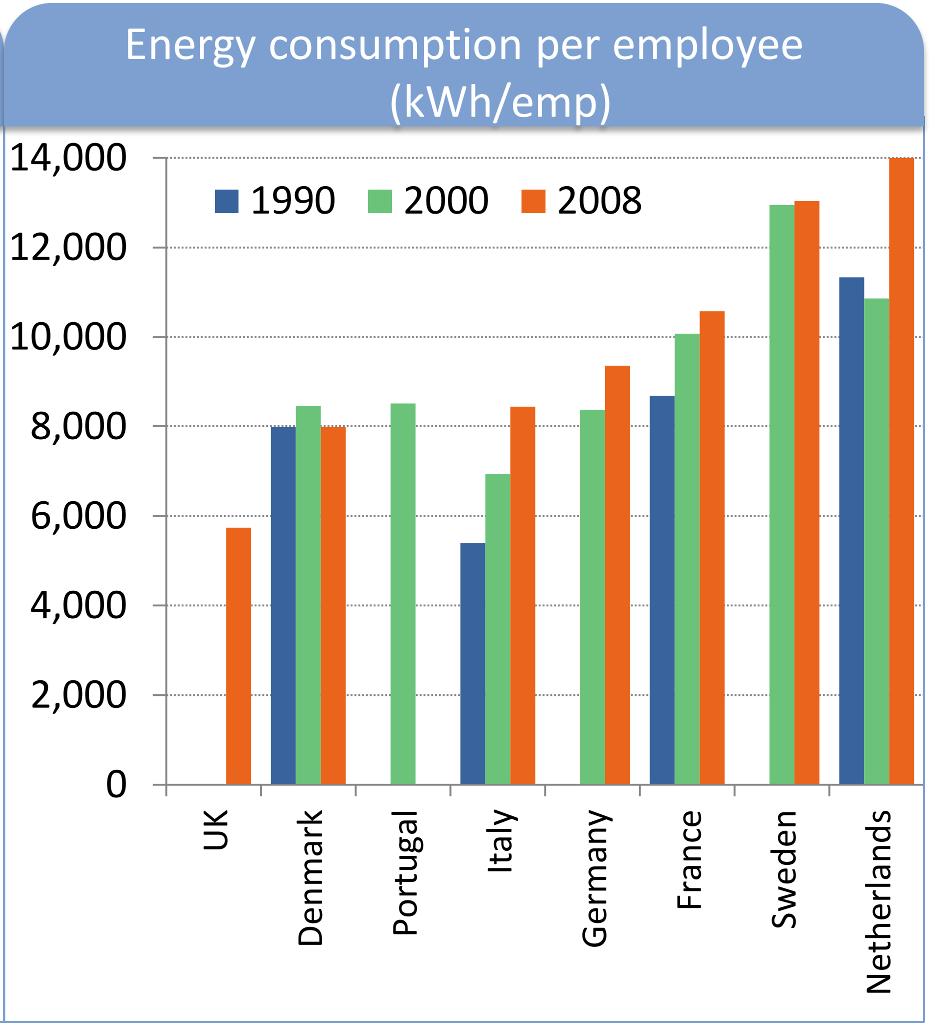
ODYSSEE indicators: example of specific energy consumption: case of hotels /restaurants





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What can we learn from indicators?

- Simple indicators will describe trends in energy use,... and energy efficiency, if detailed enough;

- Indicators are more powerful when combined; for instance:
  - Comparing trend in energy use per household and per m2 will show the impact of change in dwelling size;
  - Comparing trend in energy use per household in final and useful energy will show the impact of fuel substitutions;
  - Comparing the industrial intensity with an intensity at constant structure will show the effect of structural changes;

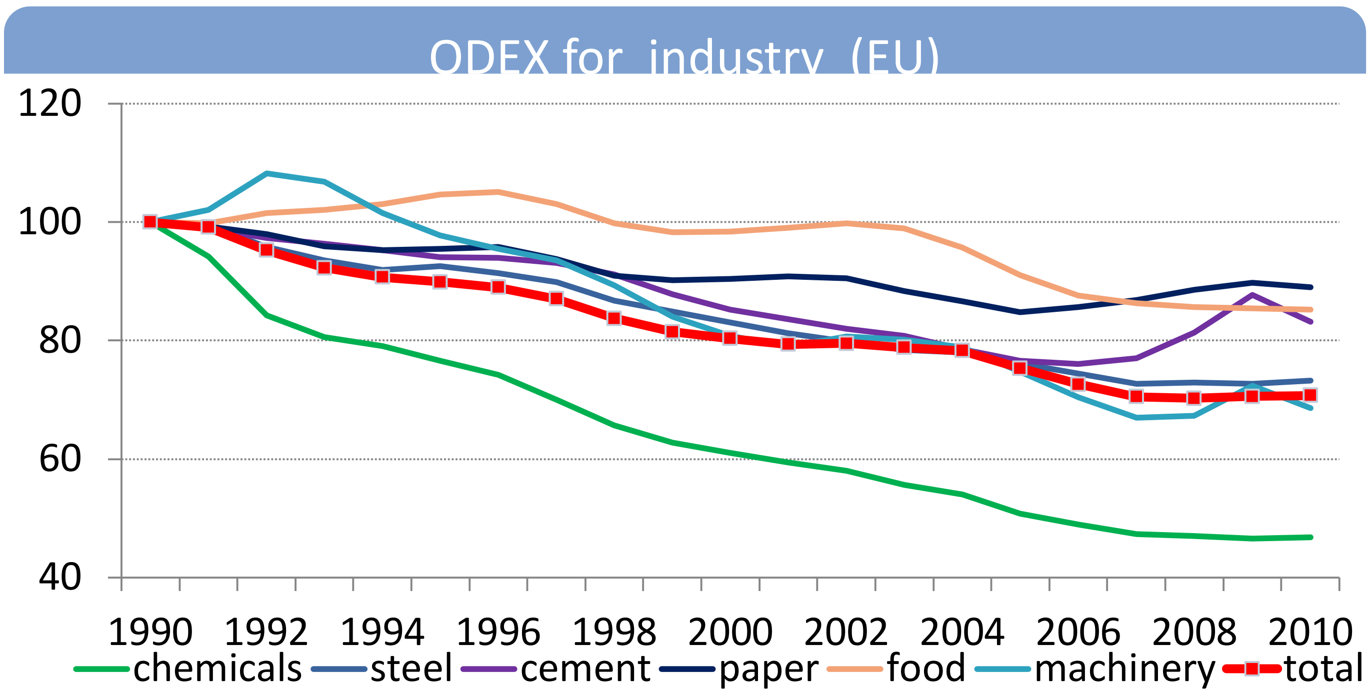
- Indicators help understanding the energy consumption trends in an end-use, sub-sector or sector: they can show what is due to energy efficiency, to economic factors, to life styles, to fuel substitutions ....

- Indicators enable to benchmark countries in terms of trends and level of performance → need adjusted indicators to have meaningful comparisons

Complex ODYSSEE indicators: ODEX in industry

ODEX in industry is calculated from unit consumption trends by branch

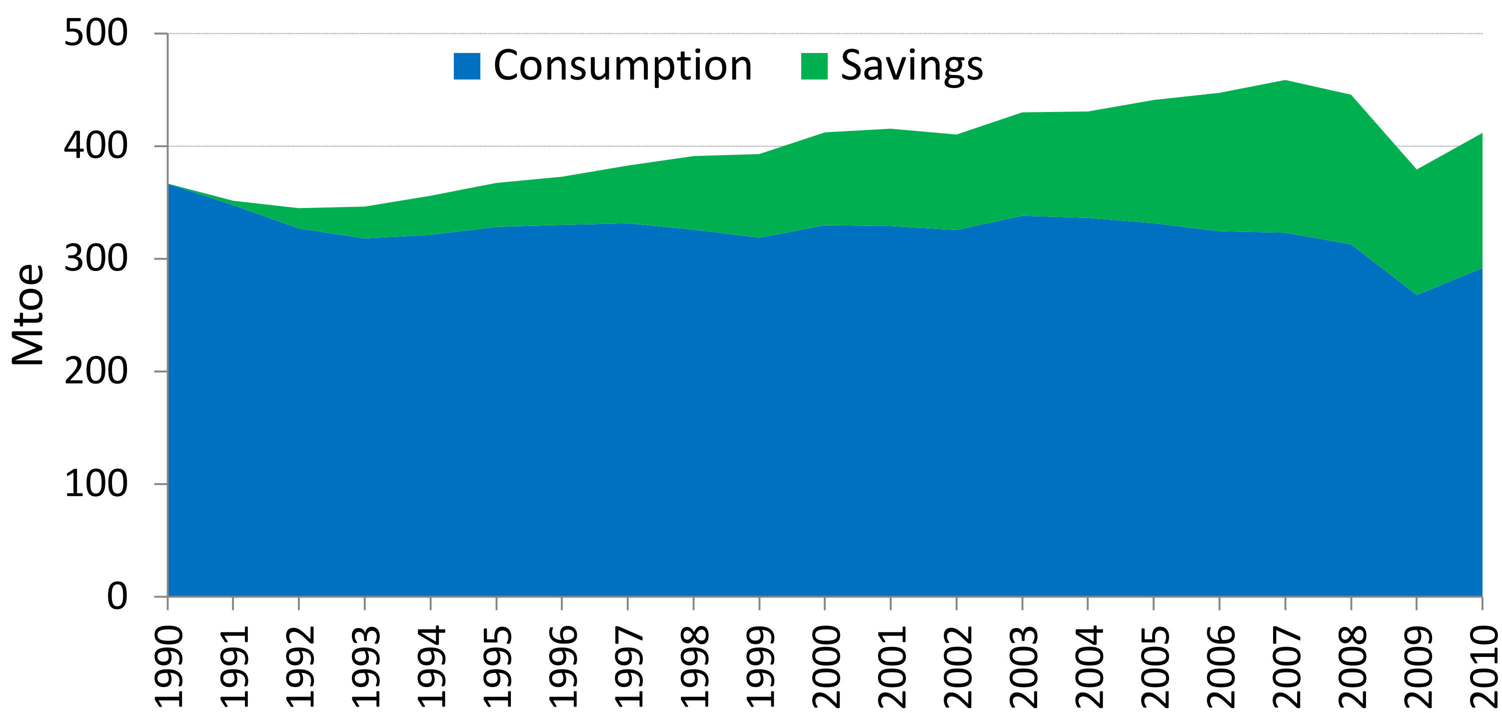
- By combining unit consumption indices by branch in one index on the basis of the current weight of each branch in the industry consumption;
- Unit consumption by branch are expressed in different units, selected so as to be as close as possible to energy efficiency evaluation :
  - toe/t for energy intensive product (steel, cement, paper)
  - toe/industrial production index for other branches



ODEX= 70 in 2007 → energy efficiency improved by 30% between 1990 and and 2007 (2%/year). No progress since 2008 with even a reverse trend in 2009.

- In 2010, energy savings in industry reached 120 Mtoe compared to 1990: without energy efficiency improvement , energy consumption would have been higher by 120 Mtoe

Energy consumption and savings in industry (EU)



How energy efficiency indicators can be used to support policy making ?

- Indicators can first of all be used to monitor the results achieved in terms of energy savings or according to the way the targets are stated:
    - To check that the country is on track compared to its targets ("distance to target")
    - To conform to reporting requirements of the parliament or other institutions (e.g. EU Commission for EU member countries)
- To understand why the targets are not met so as to identify corrective policy measures: which sectors, end-uses, drivers are responsible for deviation (e.g. lifestyle, structural changes...)

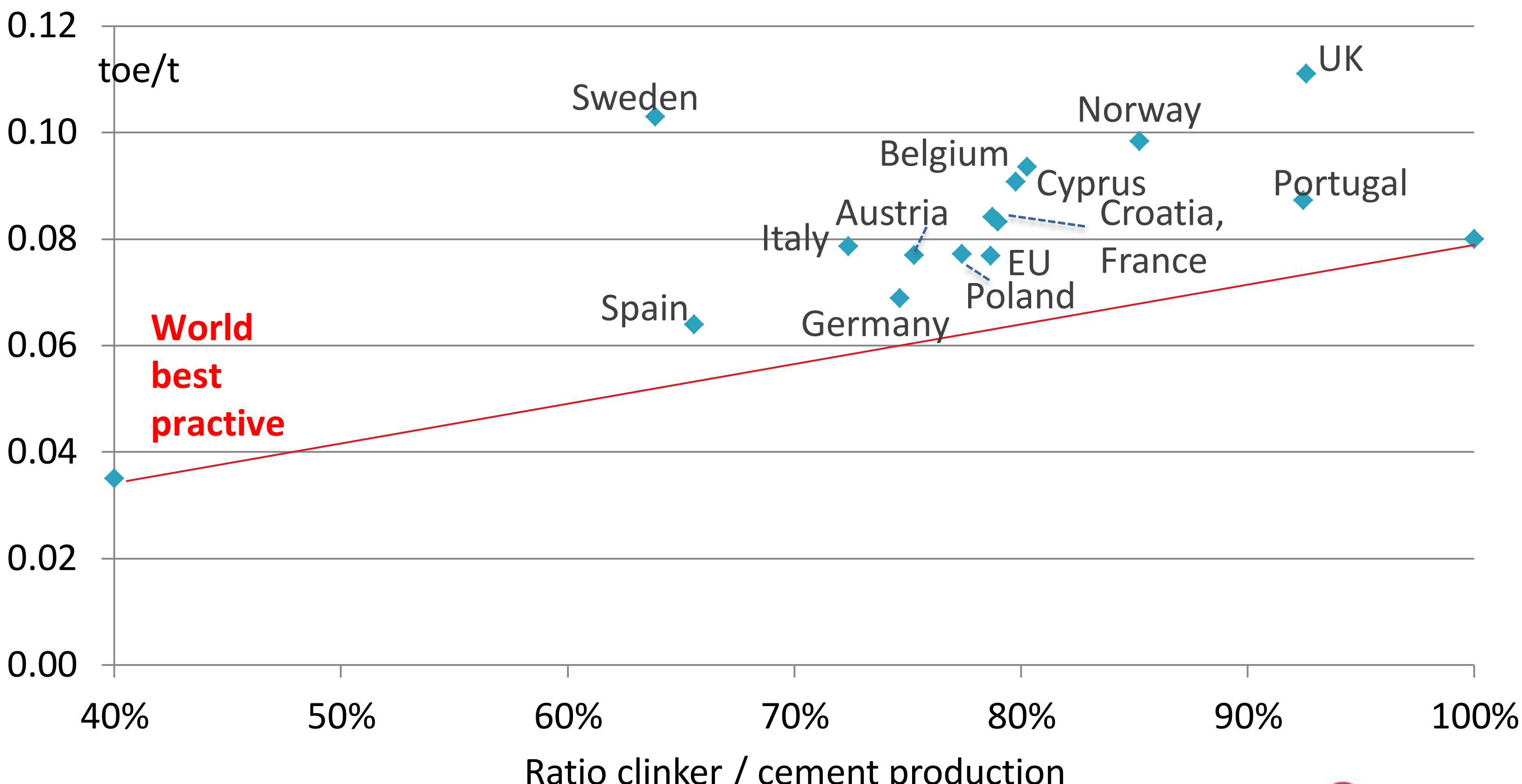
How energy efficiency indicators can be used to support policy making ? (cont'd)

- To benchmark the countries progress and performance with respect to specific countries (e.g. France with Germany for appliances; France with The Netherlands for heating) or group of countries (e.g. Denmark with main EU countries for heating), etc...

- To justify the public budget spent on energy efficiency programmes and to give arguments to policy makers to maintain or even increase the public budget on energy efficiency → need of innovative indicators that are meaningful for Economic of Finances Ministries (e.g. foreign currencies saved for importing counties, subsides saved from public budget for countries with price subsidies

Complex ODYSSEE indicators: benchmarking of specific energy consumption: case of cement

The energy performance of cement production is linked to the share of clinker produced in the country in relation to the cement production: the higher this ratio, the higher the specific energy consumption. Distance to the red line (best practice) indicates the potential of energy saving



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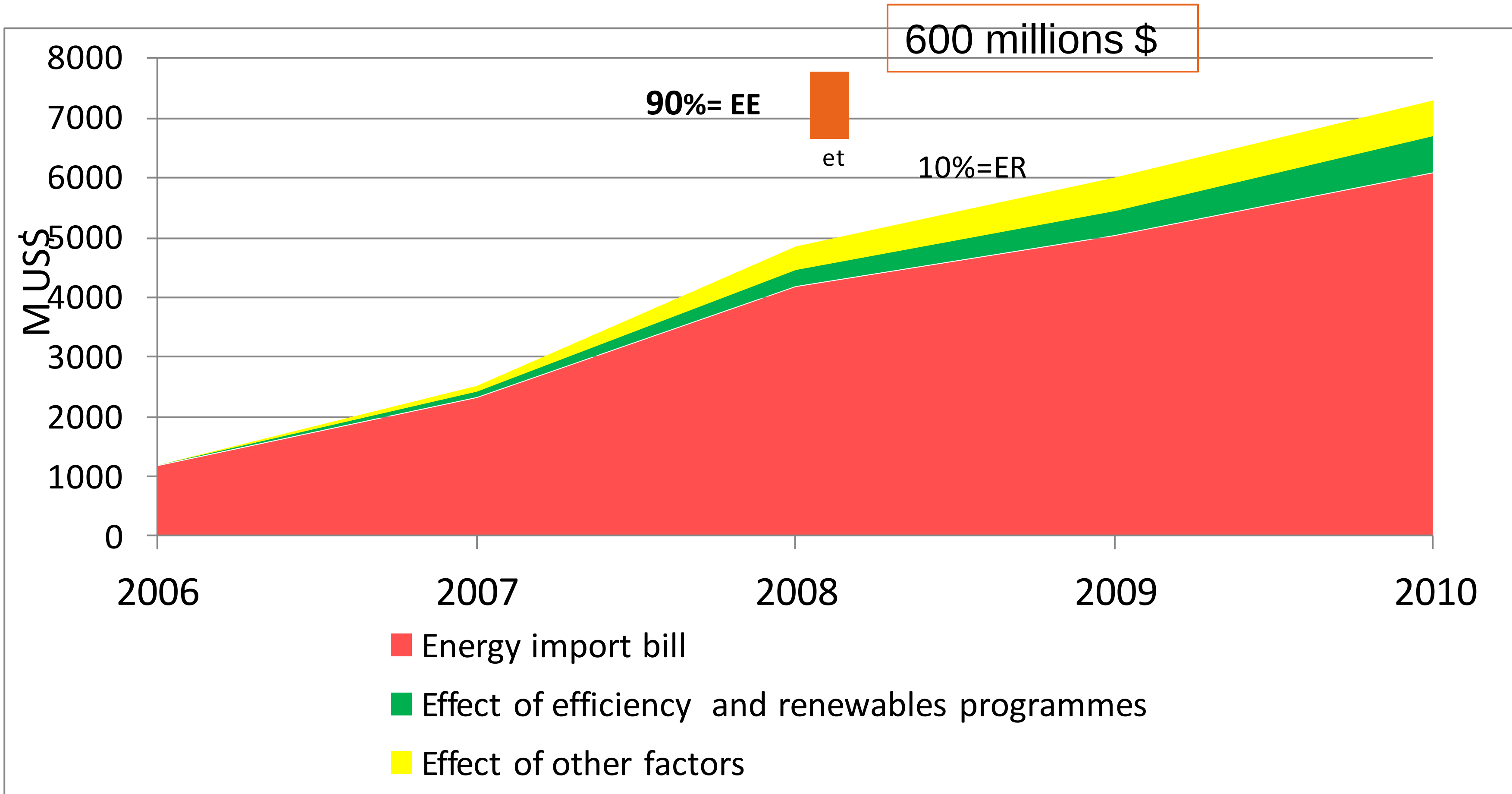
Justification of the public budget spent

Impact of energy efficiency (EE) and renewables (ER) on import bill in Tunisia



Source ANME, 2012

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Conclusion: indicators and policies: the European experience (1)

- Policy makers need data and indicators to monitor the impact of their actions, to prepare new policy measures and to assess long– term energy savings potentials

- Data needed are not just merely the usual energy statistics from the energy balance but more detailed data by end-use

- Strategies have to be defined to collect such data ... in a permanent way:
  - by combining detailed surveys every 2 to 3 years with modelling or lighter surveys in between the survey years
  - by imposing reporting requirements to utilities, equipment manufacturers , utilities→ exchange of international experience is very useful in that matter

- Although such indicators can be used to assess the impact of policies, it is seldom that they can measure the impact of a single measure→ they measure the impact of packages of measures acting on a given end-use (e.g. new cars, lighting, solar heaters...)

Conclusion: indicators and policies

- Greater use of indicators by policy makers increases the quality and quantity of data and indicators ;

- Indicators need to be permanently adapted to meet policy requirements (e.g. in EU countries the increasing use of biomass and power production of households);

- Indicators should be easy to understand by policy makers...
  - This does not mean that they should be too simple, but that
  - Communication is important

- Indicators should be well updated to be useful for policy makers
  - This is somehow contradictory with the use of detailed indicators, that require detailed data produced with some delays, but means that
  - Updating procedures should be developed to provide preliminary detailed indicators (e.g. on energy savings) by mid year t for year t-1 → under development for ODYSSEE.

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Thank you

bruno.lapillonne@enerdata.net
http://www.enerdata.fr

http://www.odyssee-indicators.org

http://www.wec-indicators.enerdata.eu

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6. **Annex: example of targets and indicators**

Example of official targets in the field of energy efficiency : Energy transition in Germany (Energiewende)

	2011	2020	2050		
Greenhouse gas emissions					
Greenhouse gas emissions (compared with 1990)	-26.4 %	-40 %	2030 -55 %	2040 -70 %	2050 -80 % to -95 %
Efficiency					
Primary energy consumption (compared with 2008)	-6.0 %	-20 %	-50 %		
Energy productivity (final energy consumption)	2.0 % per annum (2008–2011)	2.1 % per annum (2008–2050)			
Gross electricity consumption (compared with 2008)	-2.1 %	-10 %	-25 %		
Share of electricity generation from combined heat and power plants	15.4 % (2010)	25 %	-		
Buildings					
Heat requirement	no data	-20 %	-		
Primary energy requirement	no data	-	around -80 %		
Rate of modernisation	approx. 1 % per annum	Doubling of levels to 2 % per annum			
Transport					
Final energy consumption (compared with 2005)	approx. -0.5 %	-10 %	-40 %		
Number of electric vehicles	approx. 6,600	1 million	2030 6 million	-	
Renewable energies					
Share in gross electricity consumption	20.3 %	at least 35 %	2030 at least 50 %	2040 at least 65 %	2050 at least 80 %
Share in gross final energy consumption	12.1 %	18 %	2030 30 %	2040 45 %	2050 60 %

W. Eichhammer, Fraunhofer ISI, IEA, 2013

French official targets in the field of energy efficiency, as included in Energy Laws

- Raise the annual energy intensity reduction of the GDP to -2%/year by 2015 and –2.5%/year by 2030
- Obligation of energy savings for suppliers of electricity, gas, heating oil, and district heat to be made in consumer premises. imposed on (54 TWh* for 2006-2008 and 345 TWh* over 2010-2013) (with possibilities of buying energy savings certificates from other actors) ("White certificates");
- Energy uses of new buildings below 15 kWh/m2/year in 2020 (heating, water heating and ventilation)
- Thermal retroffiting of:
    - 400, 000 dwellings per year until 2020 with an objective of 38% total savings in in 2020 for all dwellings built before 2008;
    - 120 Mm2 of public buildings by 2020 with an objective of 40% savings
- 139.5 TWh total energy savings in 2016 with final consumers according to National Energy Efficiency Action Plan as required by EU ESD Directive

**lifetime discounted energy savings"*

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Indicators to monitor the Energiewende in Germany

Energy Supply
1. Primary energy by energy carriers*
2. Final energy by energy carriers
3. Final energy by sectors
4. Gross final energy
5. Gross electricity generation by energy carrier
6. Electricity consumption by sectors *

Energy Efficiency
7. Energy efficiency in the overall economy*
8. Energy efficiency in Industry
9. Energy efficiency in Services

Renewable Energies
10. RES share in Gross Final Energy Consumption*
11. RES share in Gross Electricity Consumption *
12. Feed-in tariffs and differential costs
13. Charge on electricity prices and privileged amount of electricity
14. Merit-Order-Effect

Power Plants
15. Existing power plants by federal regions
16. CHP*
17. Power plant planing
18. Electricity storage
19. Market shares

Grids
20. Existing grid and grid extensions by region
21. Grid investments
22. Grid stability
23. Grid quality
24. Smart Grids and Smart Meters
25. Grid interconnection

Buildings
26. Primary energy demand*
27. Final energy demand heat*
28. Building rehabilitation rate*
29. (Specific) Final energy consumption buildings
30. Surfaces of buildings
31. (Energetic) Investments in the building sector

Transport
32. Final energy consumption transport*
33. Stock electric vehicles*
34. Specific fuel consumption new cars
35. Demand for mobility

GHG emissions
36. CO2 and GHG emissions*
37. GHG emissions by source group
38. GHG emissions by sector and usage
39. Avoided emissionen by renewable energies

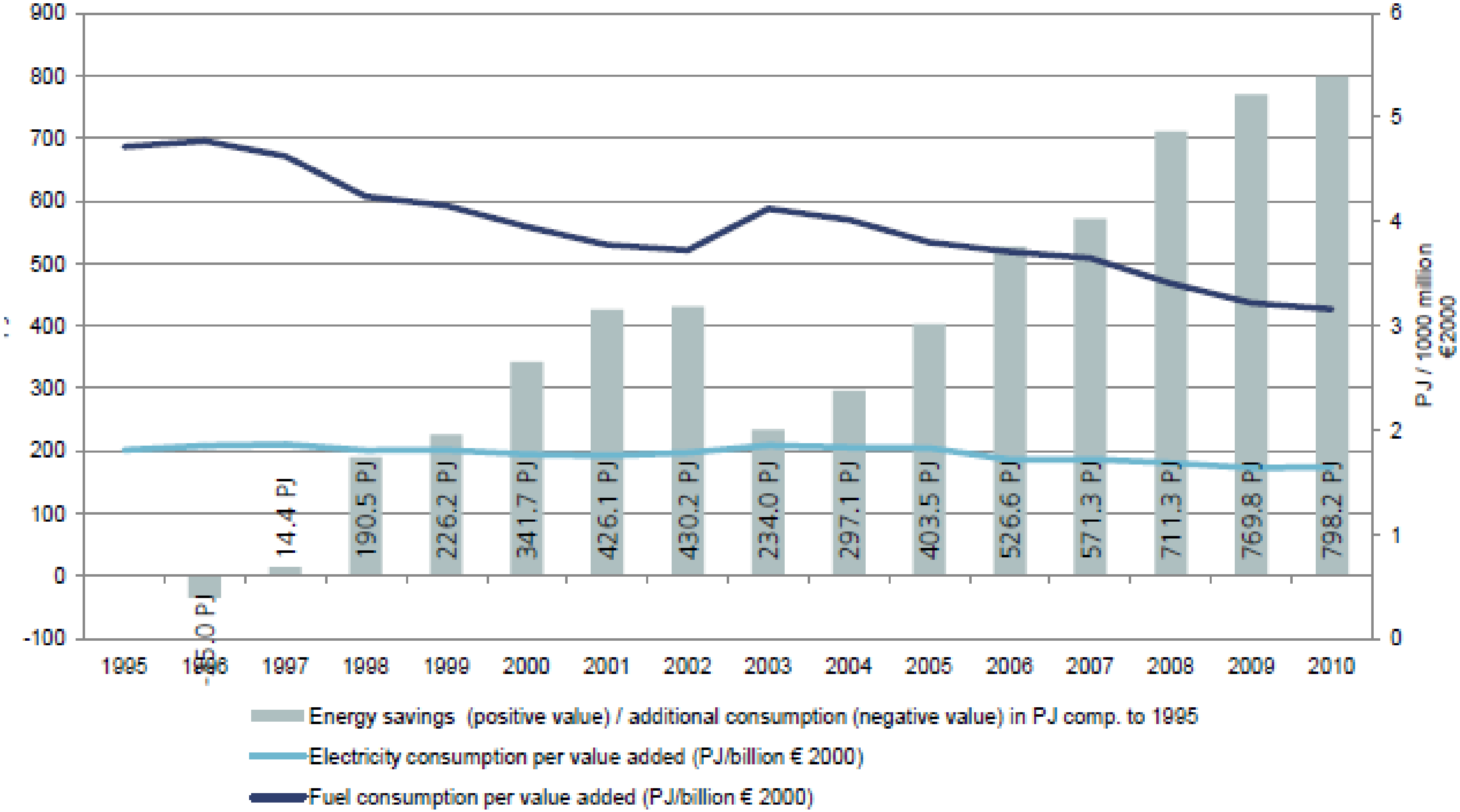
Energy prices and costs
40. Price development of energetic raw materials and emission certificates
41. Gas prices by user group
42. Mineral oil prices
43. Electricity prices by user group
44. Exemption rules for industries
45. Energy costs by target groups and revenue
46. International energy price comparison

Macro-economic impacts
47. Cost-benefits
48. Investments
49. Employment

Indicators with a * are target indicators

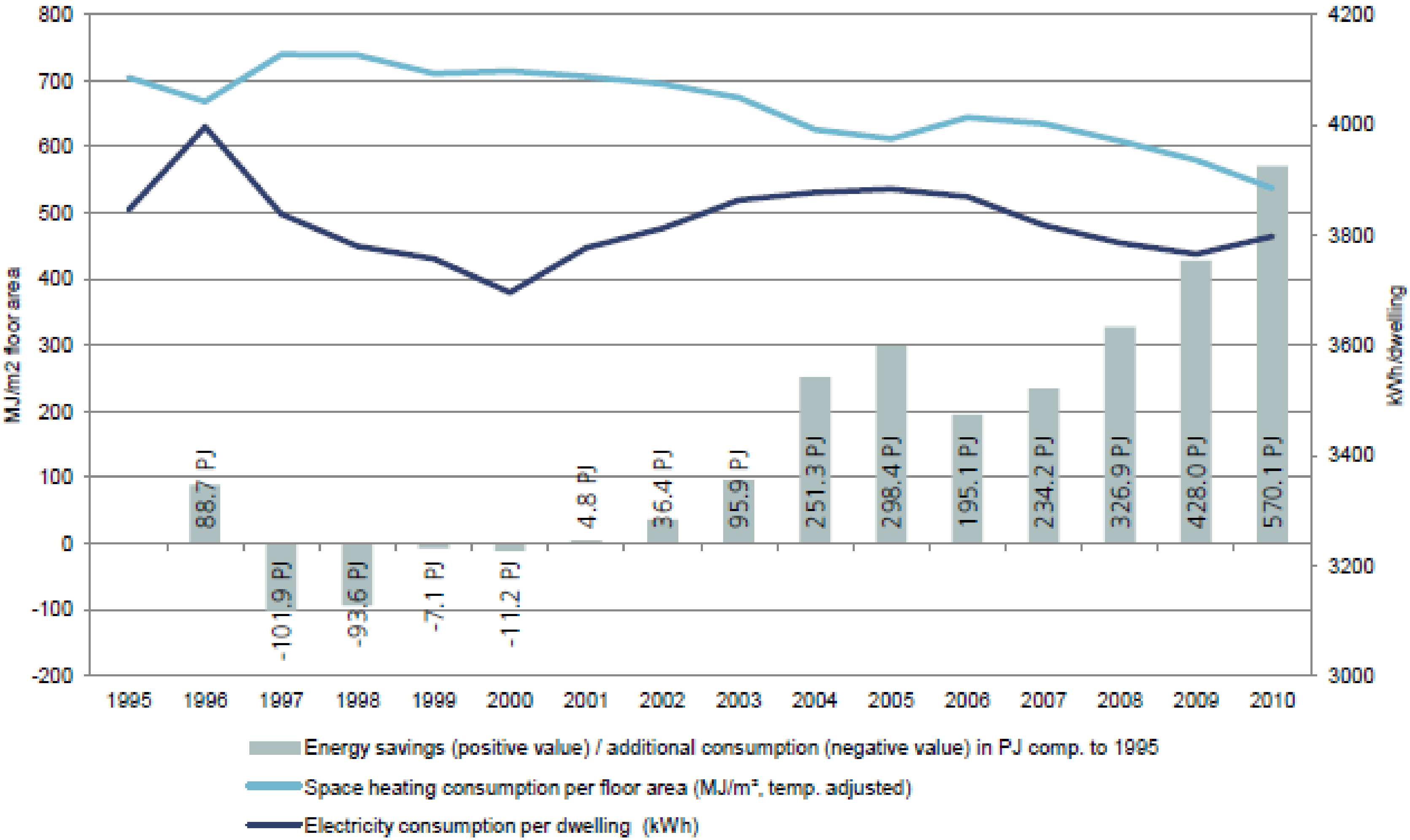
W. Eichhammer, Fraunhofer ISI, IEA, 2013

Indicators to monitor the Energiewende in Germany: energy efficiency indicators and energy savings in industry



W. Eichhammer, Fraunhofer ISI, IEA, 2013

Indicators to monitor the Energiewende in Germany: energy efficiency indicators and energy savings for households



W. Eichhammer, Fraunhofer ISI, IEA, 2013

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