



Indicators for Energy Efficiency Policies

1st Policy Dialogue on Energy Efficiency in Latin America and the Caribbean: *Towards Sustainable Institutionalities*

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- ▶ 1. Energy efficiency policies: a top priority in the EU and at world level
- 2. Why energy efficiency indicators?
- 3. Example of indicators from ODYSSEE in Europe
- 4. Conclusions

High priority on energy efficiency in the EU

- Increasing implications of European public authorities at EU level (EU Commission /parliament) and national levels to promote energy efficiency
- As a way to address the main challenges facing the EU:
 - Risk of tensions on supply and thus on the cost and security of supply
 - Climatic risk linked to the increase in Greenhouse Gas emissions

From soft commitments to more constraining and quantitative targets

- Previously very general and qualitative targets set in the framework of the EU energy policy or national policies
- Now **quantitative targets** are set in the EU:
 - That are more constraining and ambitious
 - That are increasingly integrated within energy law and Directives
 - That are defined both at the level of the total consumption but also by sector or end-use (“sectoral targets”)
 - That generally require yearly monitoring, with standardised procedures, and **reporting obligations**
- More and more countries at world level with quantities targets

Example of official targets in the field of energy efficiency : EU Directives

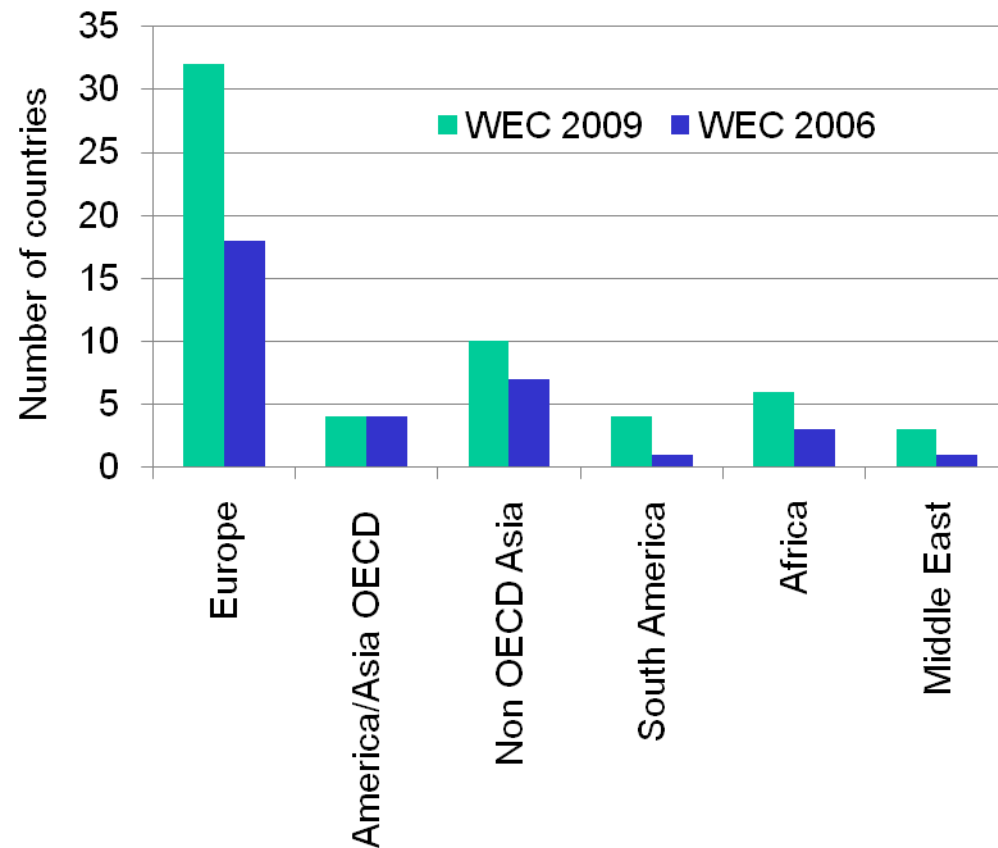
- **9% energy savings** in 2016 compared to 2008 for each EU member country (“Energy Service Directive” (ESD) adopted in May 2006), with **reporting obligation** imposed to each EU member on actions undertaken and energy savings achieved, with harmonised calculation model using combination of top-down and bottom-up methods
- **20%** energy efficiency progress by 2020
- **18%** share of cogeneration by 2010
- **130g CO₂/km** for new cars by 2012 (new Directive)
- **Ban** of incandescent lamps in 2012

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 retrofitting 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 for all public buildings
- 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*

At world level also, increasing number of countries with quantitative targets on energy efficiency

Energy efficiency programmes with quantitative targets



➤ About 60 countries in 2009 compared to 35 in 2006, with quantitative targets in their national energy efficiency programme according to WEC-ADEME surveys;

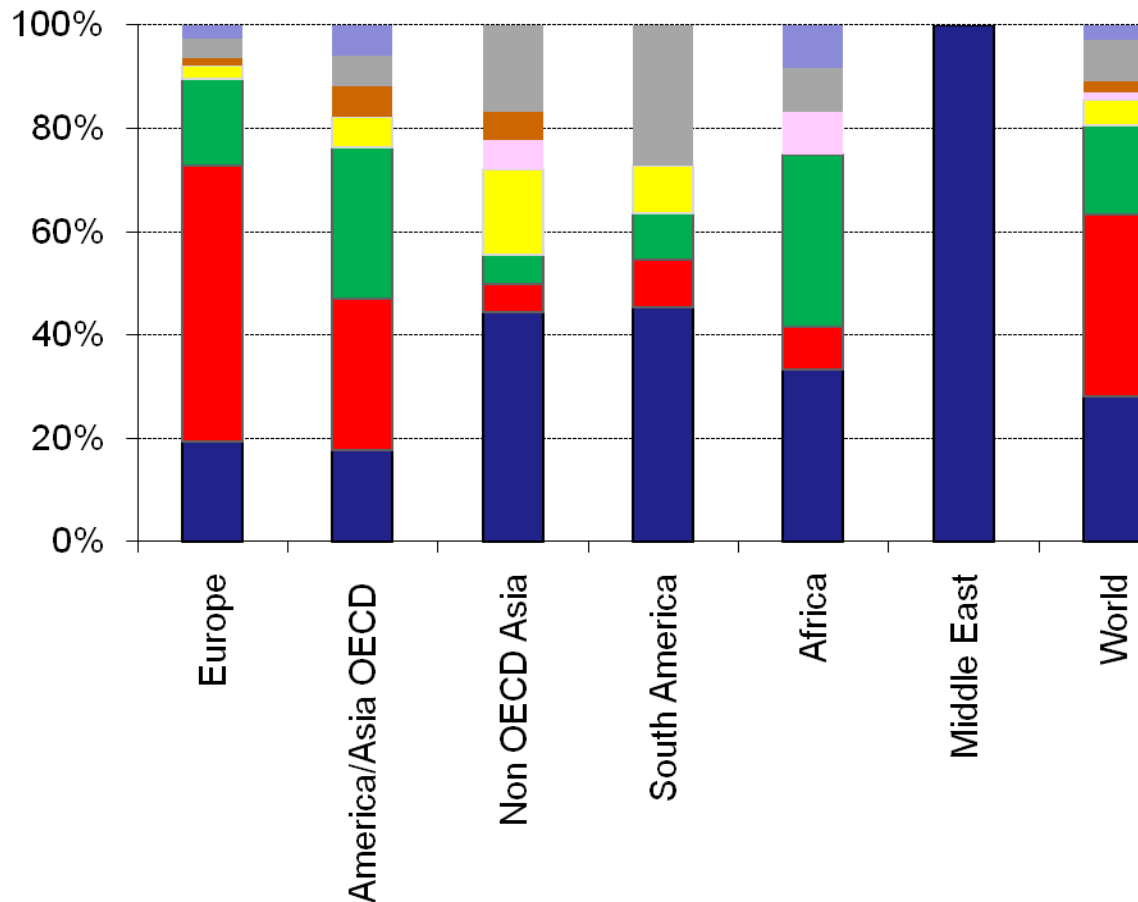
➤ Progression in all regions, and especially in Europe;

➤ This reflects more ambitious policies

Source: WEC/ADEME surveys

About 2/3 of targets on final or primary energy consumption and 1/3 of sectoral targets.

Main quantitative targets of energy efficiency programmes



➤ At world level:

- 1/3 of programmes have a target on the final consumption
- less than 1/3 on the primary consumption
- 17% for households
- 8% for services.

➤ Different focus in these targets according to regions:

- final consumers.
- priority to the primary consumption in other regions

➤ Slightly over 1/3 of the countries with multiple targets (of which 2/3 are in Europe)



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Energy efficiency indicators : a necessary tool to assess the progress achieved ?

- Monitoring on a yearly basis the results achieved in terms of **energy savings** becomes now a necessity for many governments and institutions,
 - To check that the country is on track compared to its targets (“distance to target”)
 - To justify the public budget spent
 - To conform to reporting requirements of the parliament or other institutions (e.g. EU Commission for EU member countries)

Why energy efficiency indicators (cont'd)?

- These evaluations are generally based on statistical indicators of energy use, as well as data on market penetration of energy efficient technologies, often referred to as “energy efficiency indicators” ;
- This type of evaluation is usually referred to as “top-down” measurement of energy savings as opposed to bottom-up evaluation in which the evaluation is more based on detailed data collected at a micro level (ex-post, from surveys or ex ante from modelling/estimates)

Multiple use of energy efficiency indicators

- Beyond a monitoring of the energy savings and progress achieved these indicators can be also used :
 - ✓ To **understand** why the targets are not met so as to identify corrective measures
 - ✓ To **compare/benchmark** the countries progress and performance with respect to energy efficiency performances and assess potential for improvement
 - ✓ Finally to assess the **long term potential** for energy efficiency improvement so as to see what new measures could be implemented → in that case technico economic models such as MEDEE or MURE can be used (case of ESD potential study for the EU Commission) (<http://www.eepotential.eu>)

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Example of ODYSSEE energy efficiency indicators:
 ~180 indicators split in 9 different types, of which 5 quite specific to ODYSSEE

Type	Level
1. Energy intensities	by sector & sub sector
2. Adjusted intensities	final and industry
3. Specific energy consumption	by sub sector & end-use
4. Benchmarked specific energy consumption	steel, cement, paper, heating
5. Energy efficiency indices (ODEX)	final and by sector
6. Energy savings	final, by sector and sub sectors
7. Indicators of diffusion	by sector
8. CO ₂ intensities	by sector & sub sector
9. Specific CO ₂ emissions	by sub sector & end-use

Originality of ODYSSEE data base on indicators: a wide range of Odyssee indicators

In ODYSSEE : a wide range of indicators and number is increasing: why?

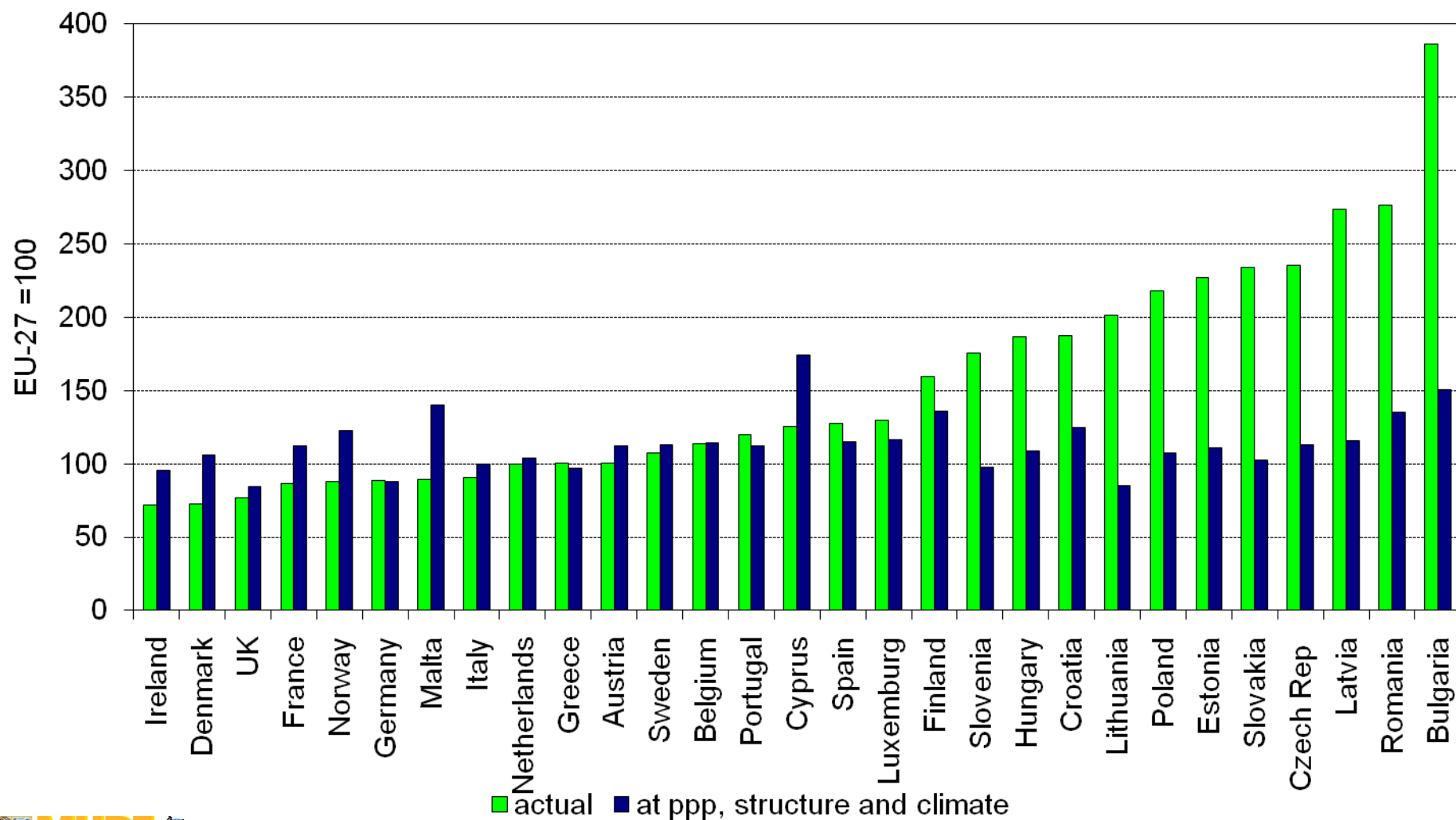
- Energy efficiency has different meaning and frontiers (economic versus technical efficiency).
- Policy measures aims at different target (e.g. cars, mobility behavior):
 - ➔ depending on the definition used and the target, different indicators may be considered; (e.g. for cars toe/passenger-km, toe/car; l/100 km, l/kg);
- Interpretation is enriched by comparing several indicators to show for instance the impact on energy consumption of factors not linked to energy efficiency (e.g. lifestyles, behaviors , structural changes in industry, modal shift);
- Alternative indicators are often necessary to cope with possible data gaps (alternative indicators);

Adjusted energy intensities (to GDP or value added)

Objective	Compare overall energy productivity performance among countries
Principle of calculation	Calculation of fictive energy intensities in toe/€ with several adjustments at a reference situation (EU-27 average)
Interpretation	Comparison more relevant than with actual energy intensities → necessary for comparison Cannot correct for all structural differences Somehow a proxy, in the absence of a better indicator, of overall energy efficiency performance (from an economic viewpoint)
Examples	Final energy intensity at EU economic and industry structure Energy intensity of industry (or manufacturing) at EU structure

Adjusted energy intensities: examples

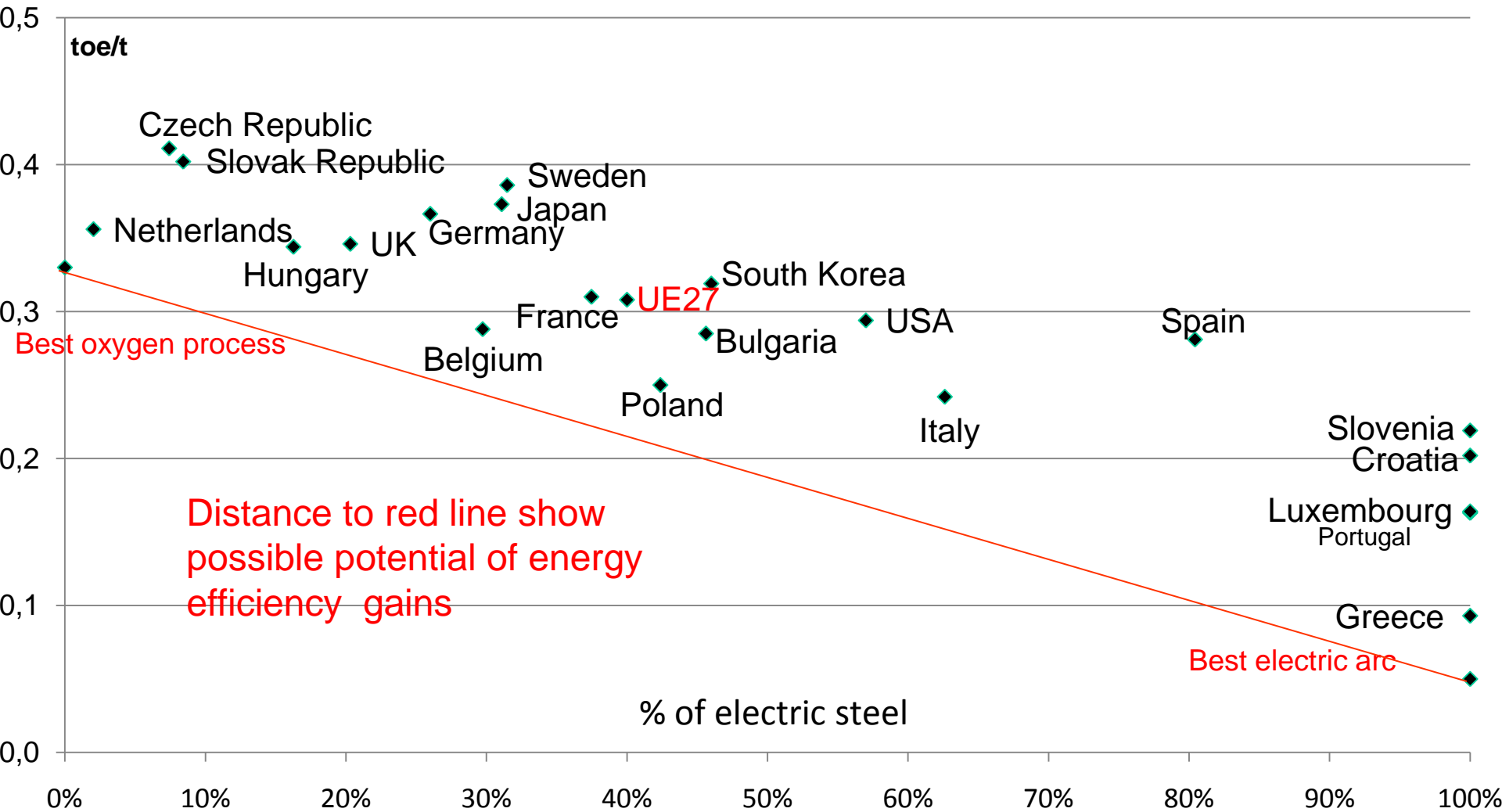
Final energy intensities adjusted for differences in prices (ppp), climate and industry & economic structures narrow difference between countries



Benchmarked specific energy consumption

Objective	Compare sectoral energy efficiency performance among countries and with benchmark values (e.g. the 3 best EU countries, the best world practice) Evaluate energy savings potential
Principle of calculation	Calculation of specific consumption with the maximum adjustment permitted from data available (e.g. process mix, rate of appliance ownership, climate) and use of graphics to add non quantifiable adjustments
Interpretation	
Examples	Consumption per ton of steel as a function of process mix (share of electric steel) Consumption for heating in useful (or final energy) per degree day as a function of central heating penetration

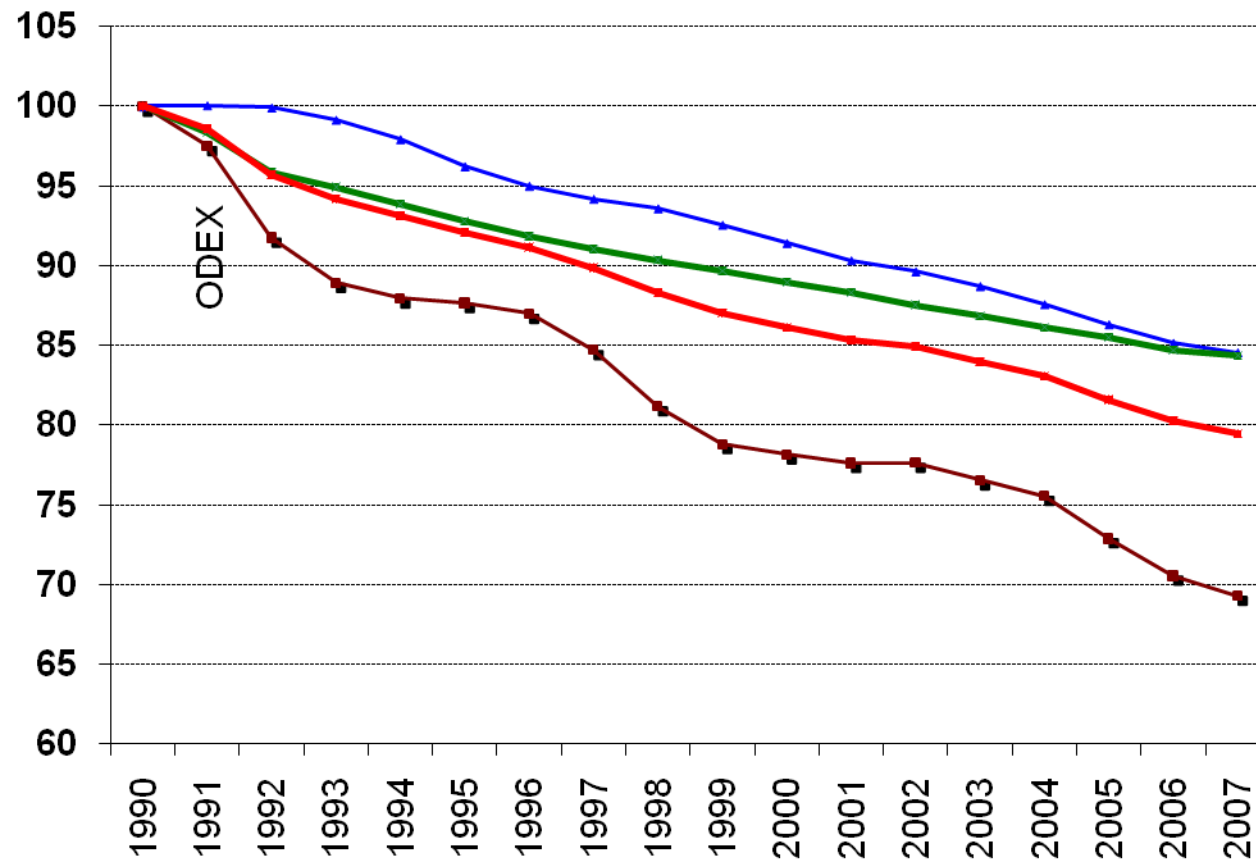
Benchmarking of the specific consumption: case of crude steel



Energy efficiency index (ODEX)

Objective	Measure energy efficiency progress at the level of the main end-use sectors (industry, transport, households) and at the level of all final consumers
Principle of calculation	ODEX by sector combines unit consumption indices by sub-sector into one index for the sector by weighting each sub-sector index by its share in the energy consumption
Interpretation	ODEX=79 in 2007 with 100 in 1990 → 21% energy efficiency improvements between 1990 and 2007 Much better indicator than energy intensities as cleaned from structural changes or other factors that have nothing to do with energy efficiency (e.g. increase in comfort or in equipment ownership, structural changes in industry)

Example of energy efficiency index (ODEX): final consumers (EU-27)



ODEX= 79 in 2007
→ 21% energy efficiency improvement between 1990 and 2007

— Industry — Transport — Households (technical) — Total

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

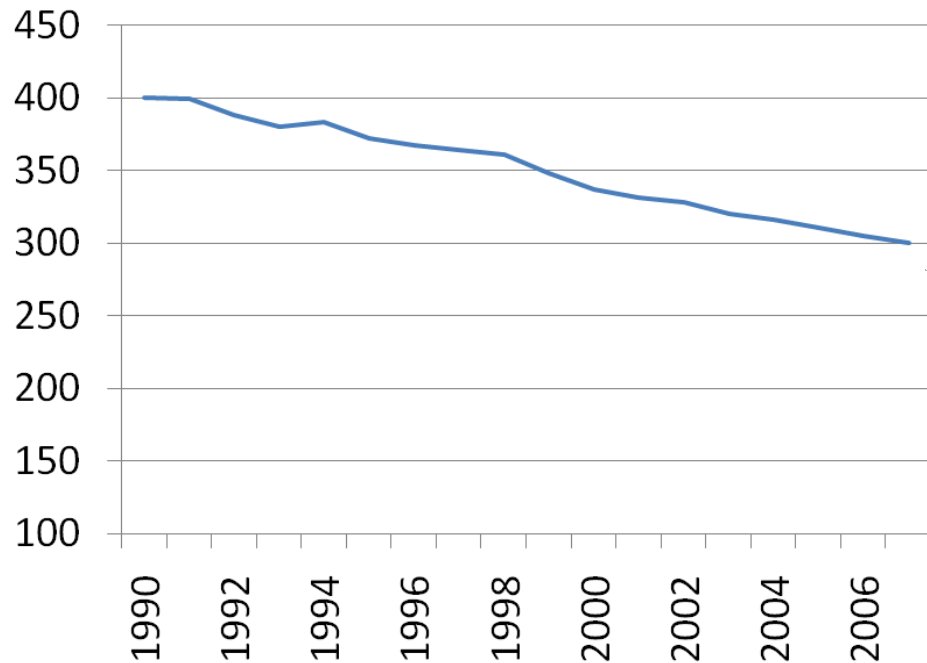
Energy savings by sub-sector or end-use

Objective	Measure the amount of energy saved through energy efficiency progress by end-use or sub -sector
Principle of calculation	Derived from the multiplication of the variation of an energy efficiency indicator (I) by an indicator of activity (A) over a reference period: $ES = \Delta I_{(t,0)} * A_t$ For instance, the energy savings of a given appliance (e.g. refrigerators) are derived from the variation in the average specific energy consumption per appliance (in kWh/year) multiplied by the stock of refrigerators;
Interpretation	The indicator assesses total energy savings whatever their drivers (market price, autonomous or policy measures for instance)

Energy savings: example of the refrigerator stock

- A reduction of the average specific consumption of the refrigerator 'stock' from 400 to 300 kWh in a country with 2 million of refrigerators will result in total electricity savings equal to 100 GWh.
- Methodology officially proposed by the European Commission for the monitoring of the 9% savings required by the Energy Service Directive (ESD) with top-down indicators

kWh/year



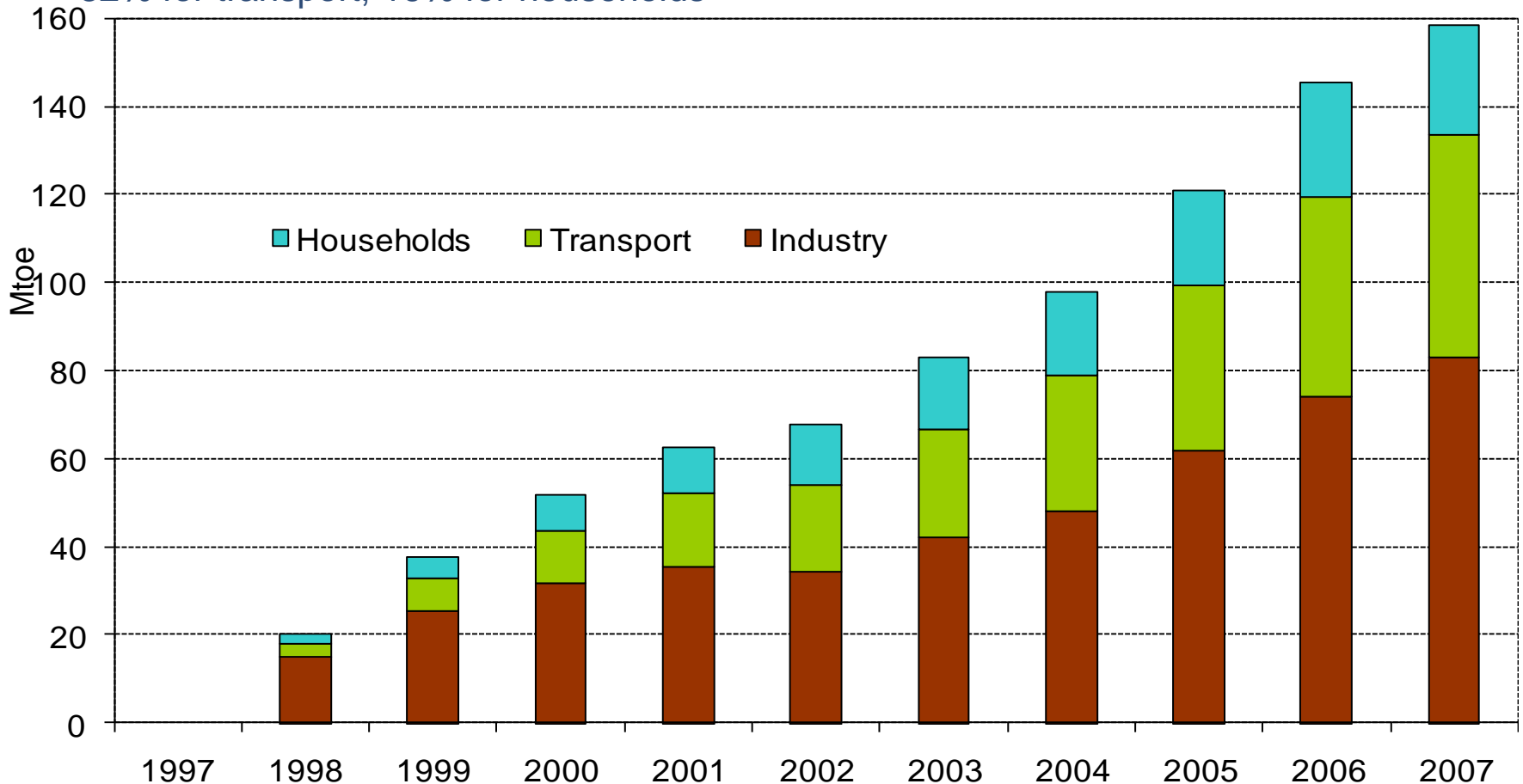
• Energy savings in 2007 (compared to 1990) = 100 GWh $((400-300) \times 1)$

assuming a stock of 1 M refrigerators in 2007

• Rate of energy savings: 25%
(=100/400)

Energy savings for final consumers(EU-27)

About 158 Mtoe energy savings in 2007 compared to 1997: without energy savings the final energy consumption would have been in 2007 158 Mtoe higher. Calculated by summing savings by end-use or sub-sector. More than half of savings in industry 52%; 32% for transport, 16% for households

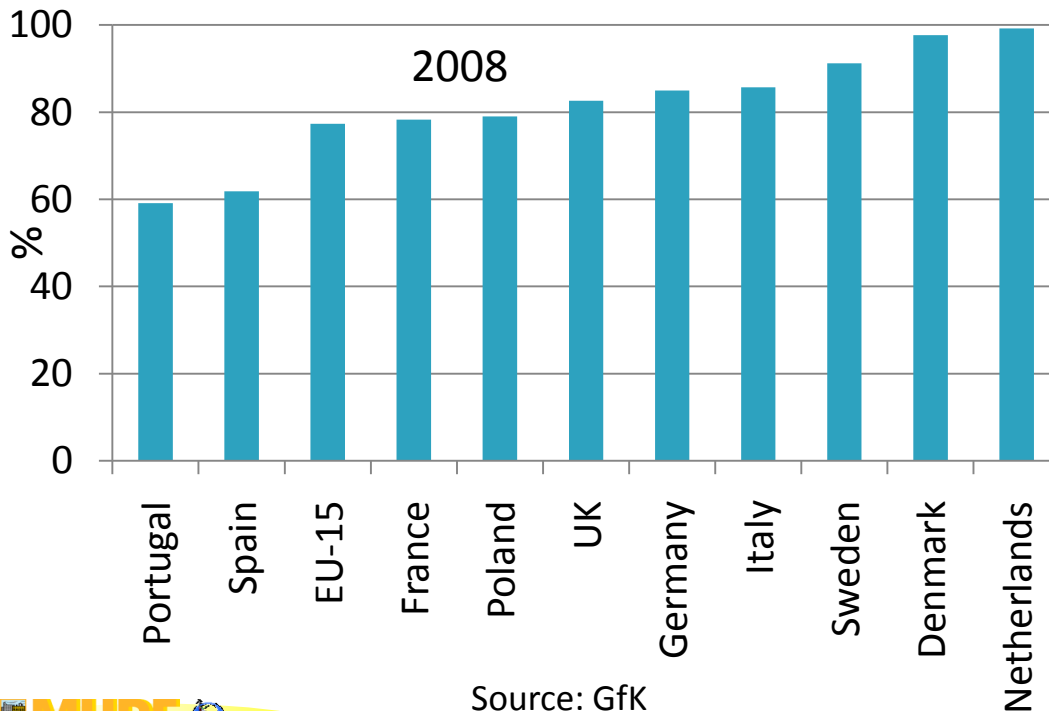


Indicators of diffusion

Objective	<p>Complement the existing energy efficiency indicators with indicators that are easier to monitor and are more rapidly updated than energy efficiency indicators that depend on the availability of data on end-use consumption.</p> <p>Capture the penetration of energy efficiency technologies and practices and of end-use renewables</p> <p>Can be used to calculate the energy savings linked to the penetration of these efficiency technologies and practices using standardized deemed savings by technology or equipment</p>
Principle of calculation	<p>Ratio between the share of the stock (or sales) of efficient technologies fro a given end-use and the total stock (or sales)</p>
Interpretation	<p>Measure the status and impact of the penetration of energy efficiency technologies and practices</p>
Examples	<p>Number or % of solar water heaters</p> <p>% of label A in new sales of electrical appliance, ...)</p> <p>% of passenger transport by public modes, % of transport of goods by rail and water</p>

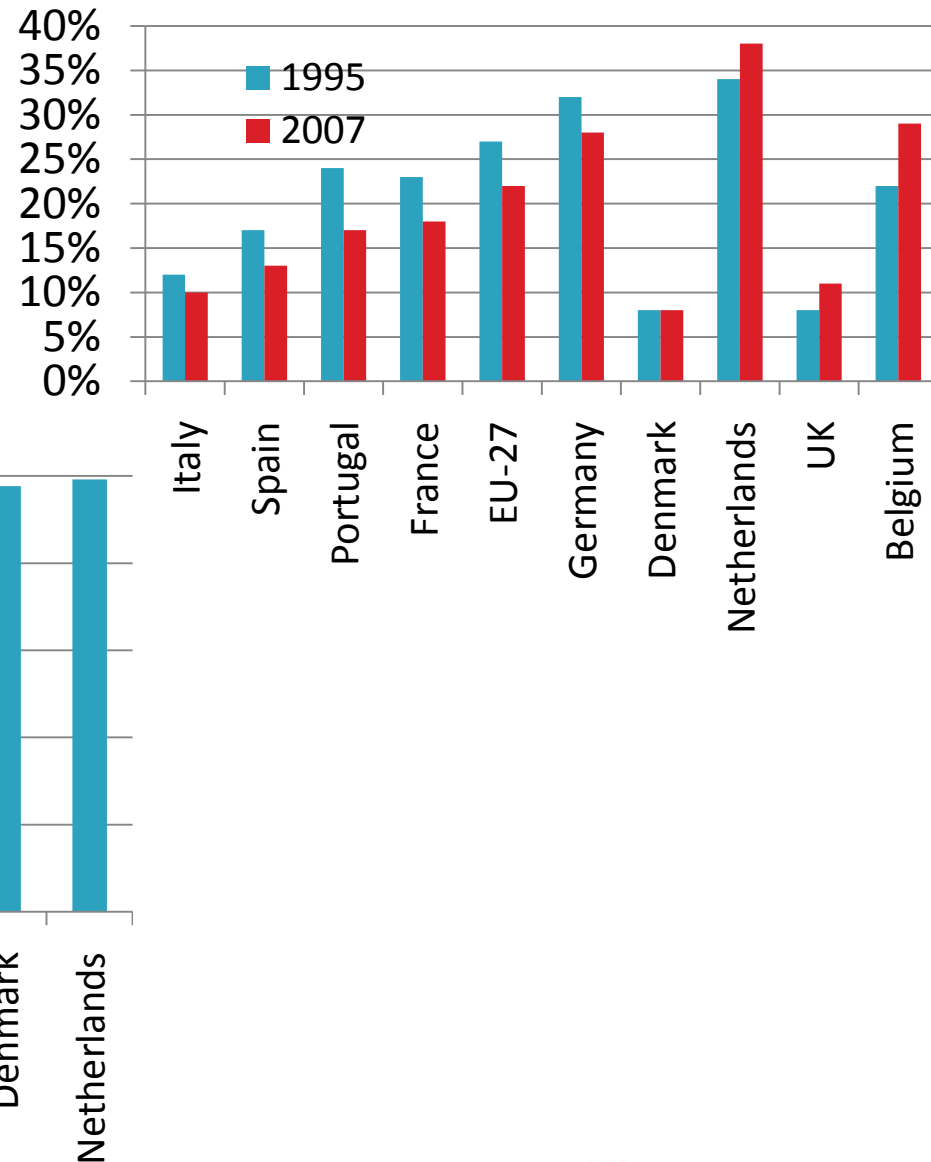
Examples of indicators of diffusion

Case of washing machines: share of efficiency label case of A & A+



Source: GfK

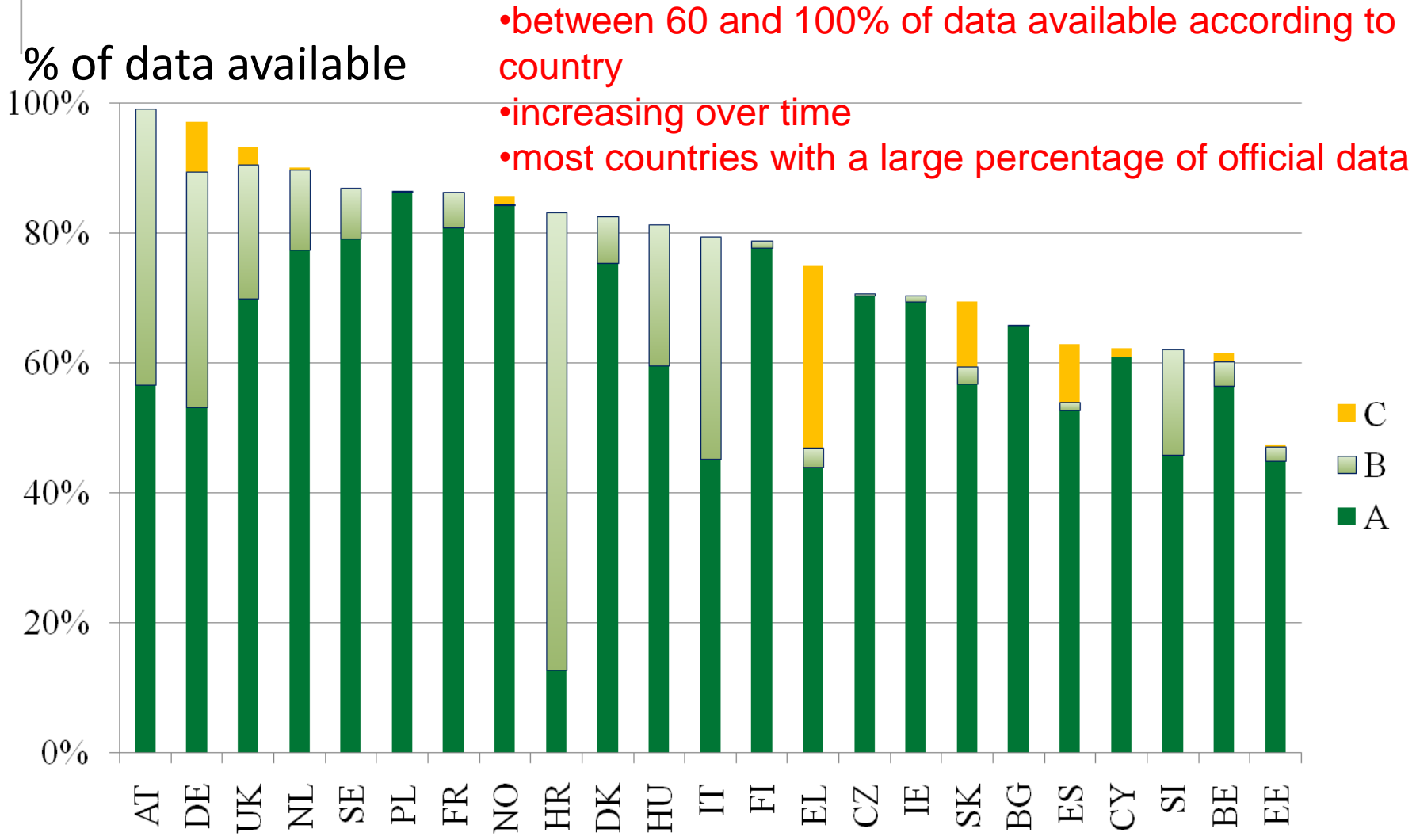
Case of transport: share of rail and water in freight transport



Qualification of ODYSSEE data and indicators

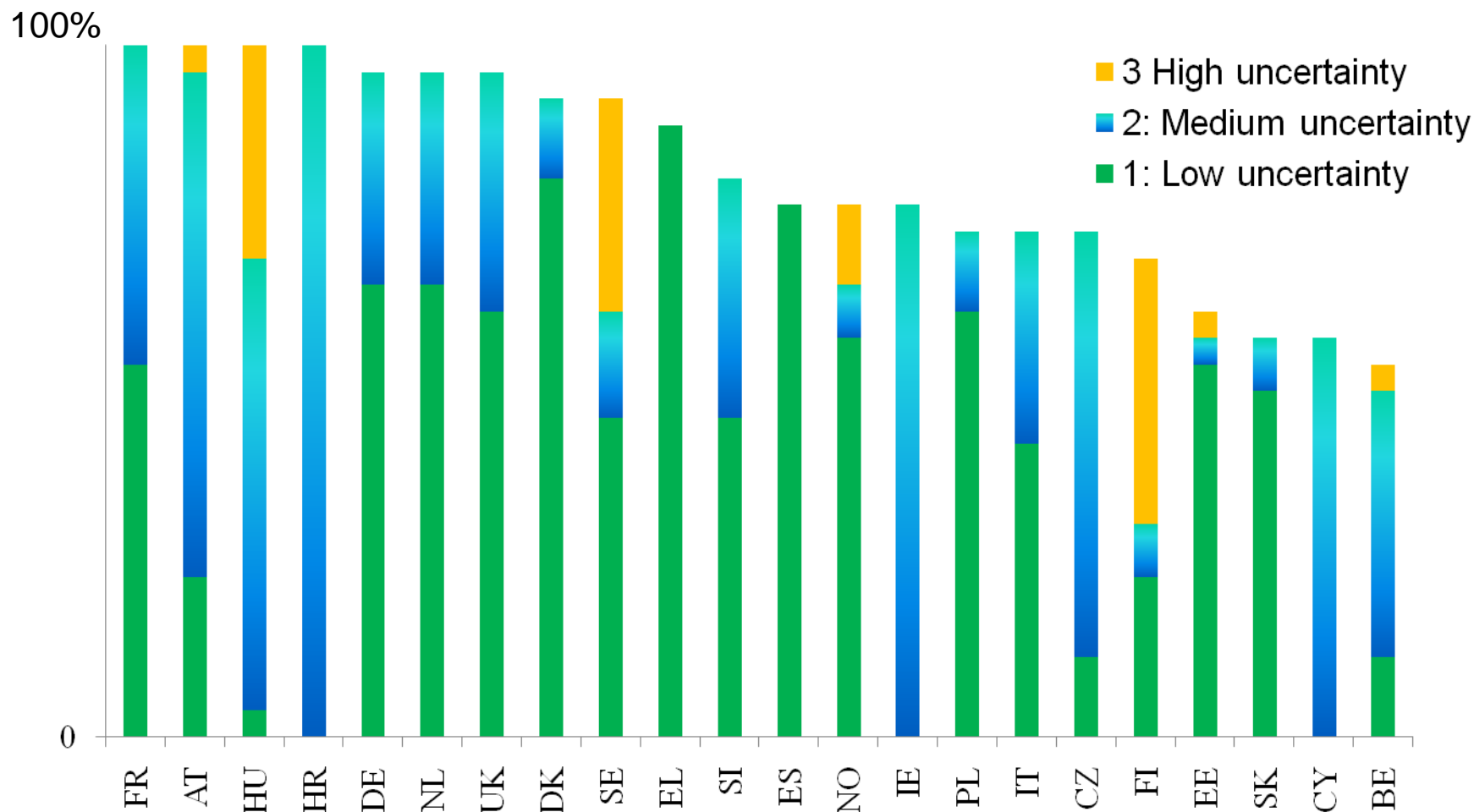
- National teams have been asked to qualify the **sources** of all Odyssee data, and the **uncertainty** of the data used to calculate ODEX (i.e. key data)
- Qualification of sources:
 - **A: Official sources statistics**: national statistical office, Eurostat/AIE, Ministries statistics ; model estimations used as official statistics ; all data “stamped” by Ministries
 - **B: Surveys/ modelling estimates** : consulting, research centres, universities, industrial associations
 - **C: Estimations made by national teams** (for the project)
- Data uncertainty:
 - **1 Good**: low uncertainty
 - **2 Medium**: medium uncertainty
 - **3 Poor**: large uncertainty

Quality of data sources for all ODYSSEE data



A: Official statistics B: Surveys/ modelling C: Estimations

Uncertainty of key data*



* data used to calculate energy savings and energy efficiency gains by sector

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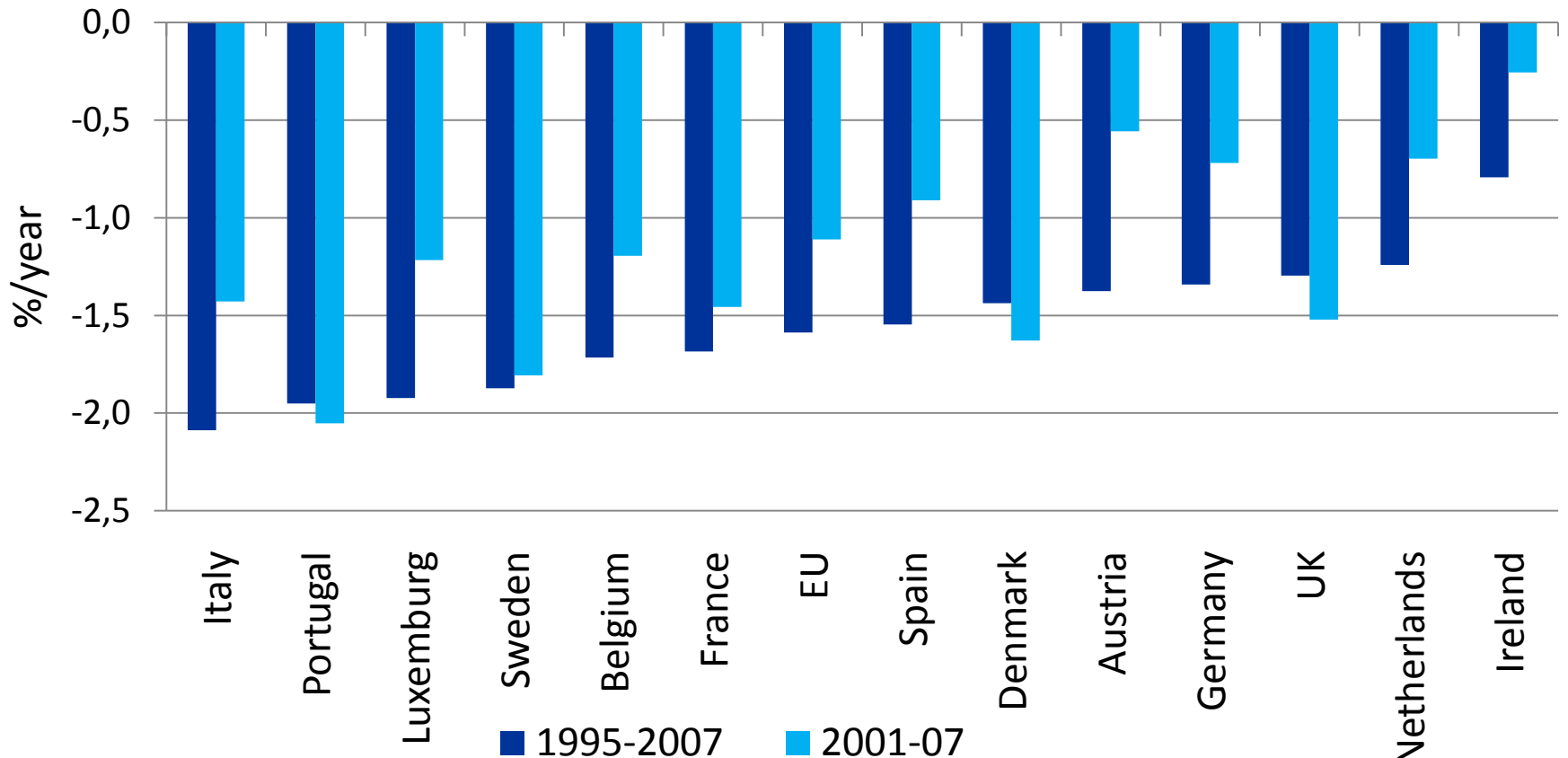
Conclusion: indicators and policies: the European experience (1)

- 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 : case of new cars

Trends in the specific consumption of new cars is clearly the result of several policy measures, at EU level (agreement with car manufacturers association in 1995, mandatory car labelling), but also at national level (fiscal measures, subsidies) → it is impossible to dissociate their relative effect

Trends in the specific consumption of new cars by country





■ Thank you

■ bruno.lapillonne@enerdata.net

■ <http://www.enerdata.fr>

■ <http://www.odyssee-indicators.org>

■ <http://www.eepotential.eu>

■ <http://www.wec-indicators.enerdata.eu>

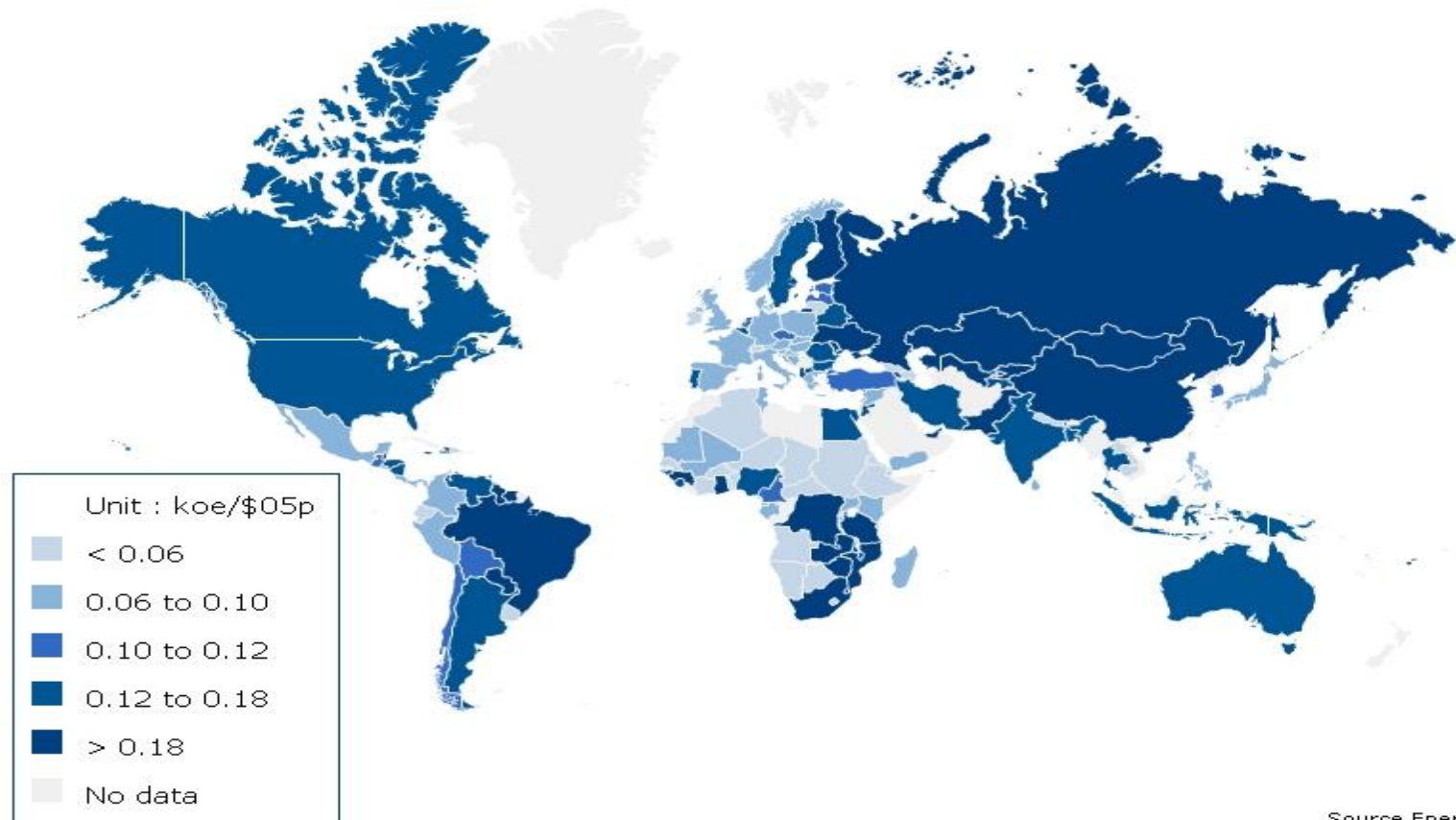
■ <http://www.wec-policies.enerdata.eu>

WEC energy efficiency/CO2 indicators: dissemination

■ Interactive query and mapping by indicator at

http://www.worldenergy.org/work_programme/technical_programme/technical_committees/energy_efficiency_policies_and_indicators/default.asp or <http://wec-indicators.enerdata.eu/>

Energy intensity of industry (to value added)



Source Enerdata

WEC indicators: interactive query and mapping by indicator

For each indicator : value for 2008 and trend (1990-2008); possibility of zoom by region

