

Energy efficiency trends in EU industry

Odyssee-Mure webinar series on Energy Efficiency organised by Leonardo ENERGY

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Enerdata*

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ODYSSEE-MURE

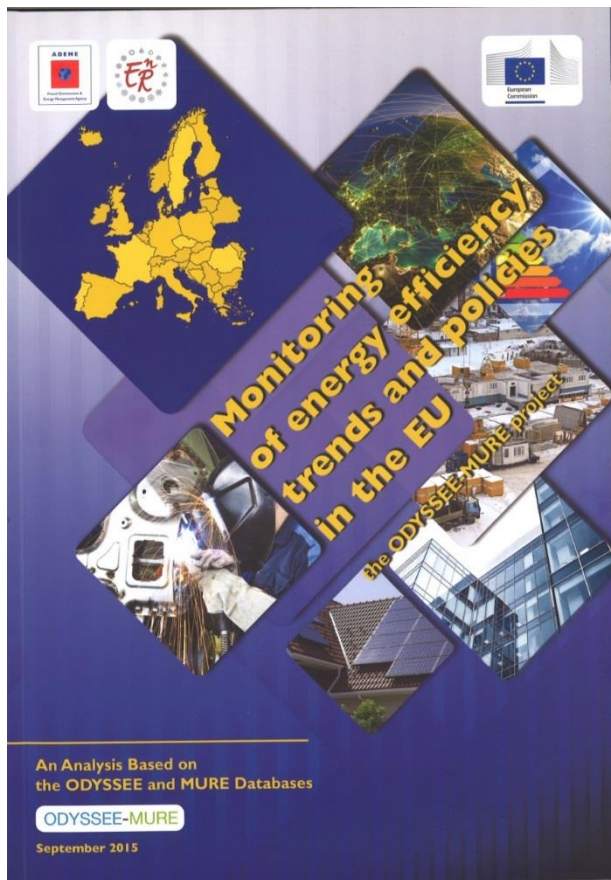
- The webinar is based on data and indicators prepared in the framework of the ODYSSEE MURE project; a summary is available in a policy brief at <http://www.odyssee-mure.eu/publications/policy-brief/>;
- The ODYSSEE MURE project is supported by the H2020 programme of the European Commission and coordinated by ADEME, the French Energy and Environment Agency;
- The project covers 31 countries (all EU Member States, Norway, Serbia and Switzerland);
- Its main objectives are to :
 - ✓ Evaluate and compare energy efficiency progress by sector, and relate the progress to the observed trend in energy consumption;
 - ✓ Evaluate energy efficiency policy measures.
- The project relies on two data bases:
 - ✓ **ODYSSEE** on energy efficiency indicators, managed by Enerdata;
 - ✓ **MURE** on existing policy measures, managed by Fraunhofer-ISI and ISINNOVA.

www.odyssee-mure.eu

ODYSSEE-MURE

The ODYSSEE data tools

<http://www.indicators.odyssee-mure.eu/>



The screenshot shows the homepage of the ODYSSEE data tools. The header includes the "Odyssee" logo and a globe icon. Below the header, there is a text box explaining that the ODYSSEE indicators are accessible through different data tools: the full data base, the key indicators facility, and five specific data facilities (market diffusion, decomposition, benchmarking, energy saving, and energy efficiency indicator scoreboard). The text also notes that access to the data base is restricted, while other tools are in public access.

ODYSSEE DATABASE **KEY INDICATORS**

MARKET DIFFUSION **DECOMPOSITION** **BENCHMARKING** **ENERGY SAVING** **ENERGY EFFICIENCY INDICATOR SCOREBOARD**

Co-funded by the Intelligent Energy Europe Programme of the European Union

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<http://www.odyssee-mure.eu/publications/br/energy-efficiency-trends-policies-in-europe.html>

About Enerdata: a global energy intelligence company

- Independent research company since 1991, specialised on
 - ✓ Global energy market and GHG
 - ✓ Energy efficiency & demand
- Leveraging global databases & forecasting models
- Headquartered in Grenoble (France) with an office in Singapore

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2. Energy efficiency trends
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ODYSSEE DATABASE



KEY INDICATORS



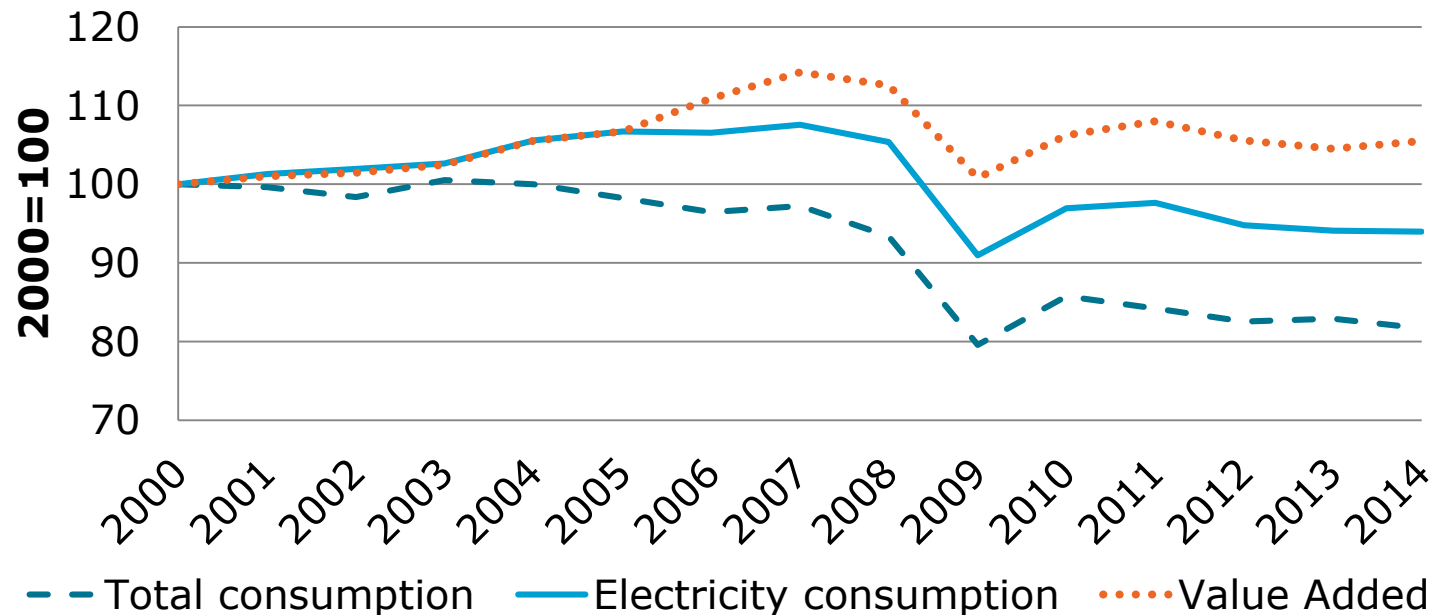


Trends in energy consumption, industrial activity and GHG

Decrease of industrial consumption since 2004

- From 2004 to 2007 and in 2014 energy consumption decreased despite industrial growth; between 2007 and 2013, the reduction was much faster than industrial activity;
- Electricity consumption follows the same declining trend as total consumption since 2007, while it was increasing regularly before.
- In 2014 industry consumed 18% less than in 2000.

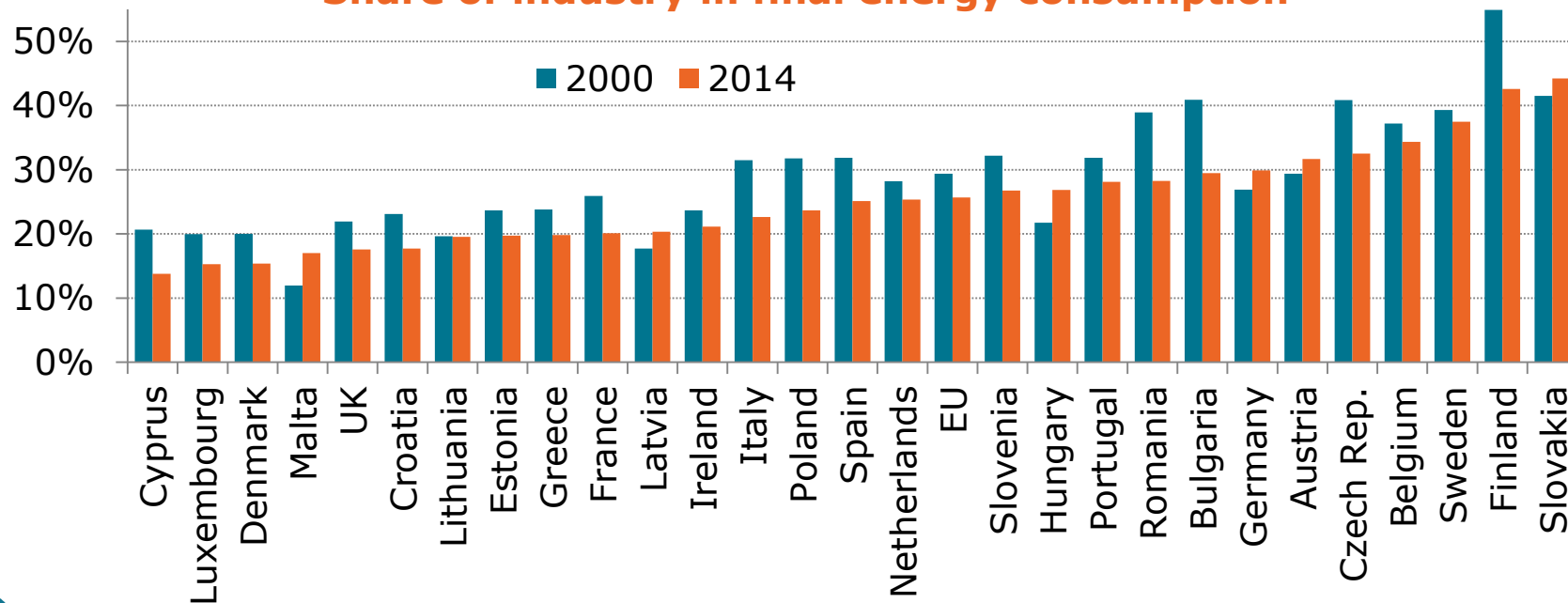
Energy consumption and activity in industry (EU)



Industry absorbs a declining share of final consumption

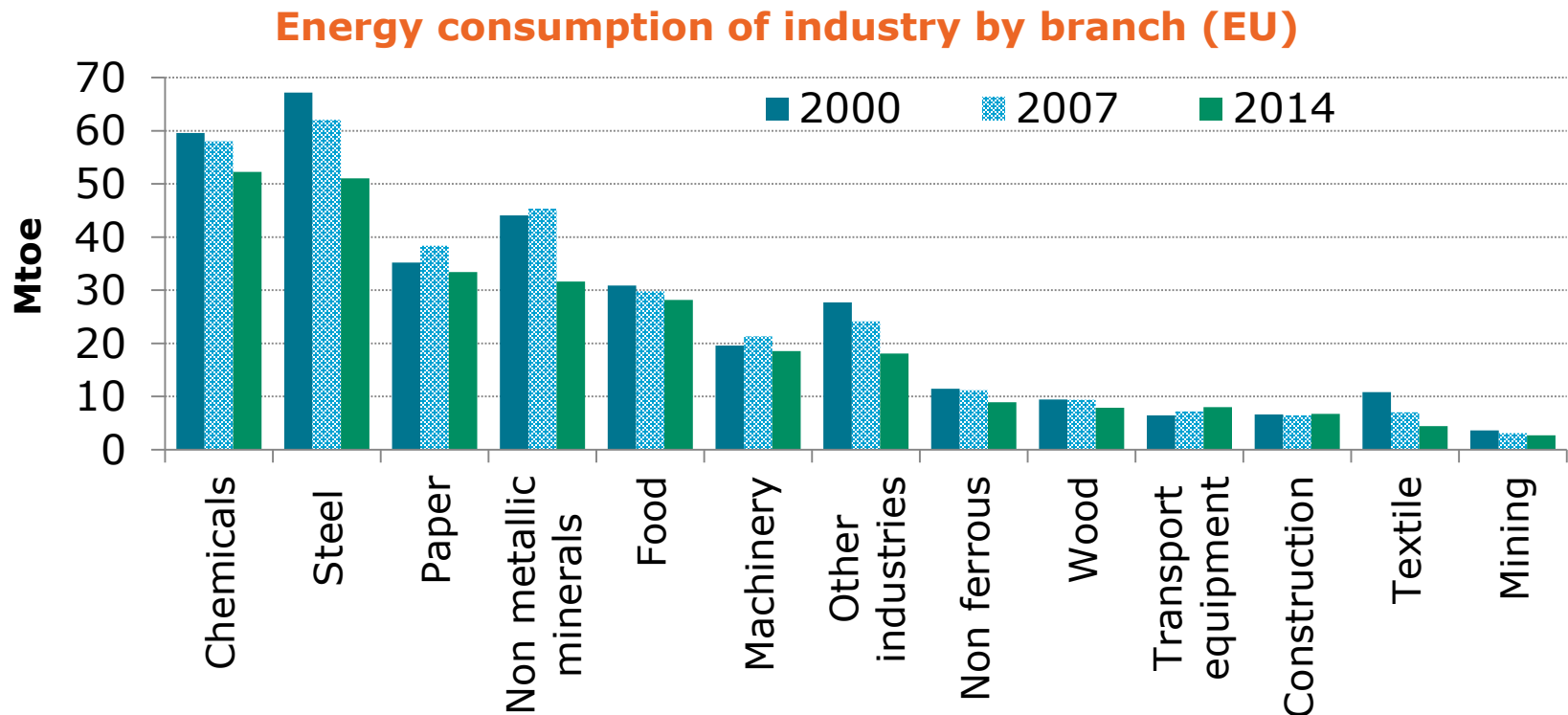
- In most EU countries, the share of industry in the final energy consumption is declining (by 3.5 points at EU level since 2000 from 29% to 26%).
- Significant decline in Bulgaria, Romania and Finland (> 10 points).
- In 6 countries, the share of industry is increasing: by 2-3 points in Latvia, Germany, Austria and Slovakia, and even 5 points in Malta and Hungary.
- Large discrepancies among countries, as to the importance of industry: ~ 40% in Finland, 15-20% in Denmark, Greece or UK.

Share of industry in final energy consumption



The decrease of energy consumption concerns most industrial branches... however with different magnitudes

- Strong reduction for **non metallic** minerals and **steel** (-28% and -24%).
- **Chemicals** and **steel** are the largest energy consumers (19% each in 2014) followed by paper and non metallic minerals (12% each).
- Around **2/3** of consumption remain concentrated in **5 energy intensive** branches (chemicals, steel, non metallic, paper and non ferrous)

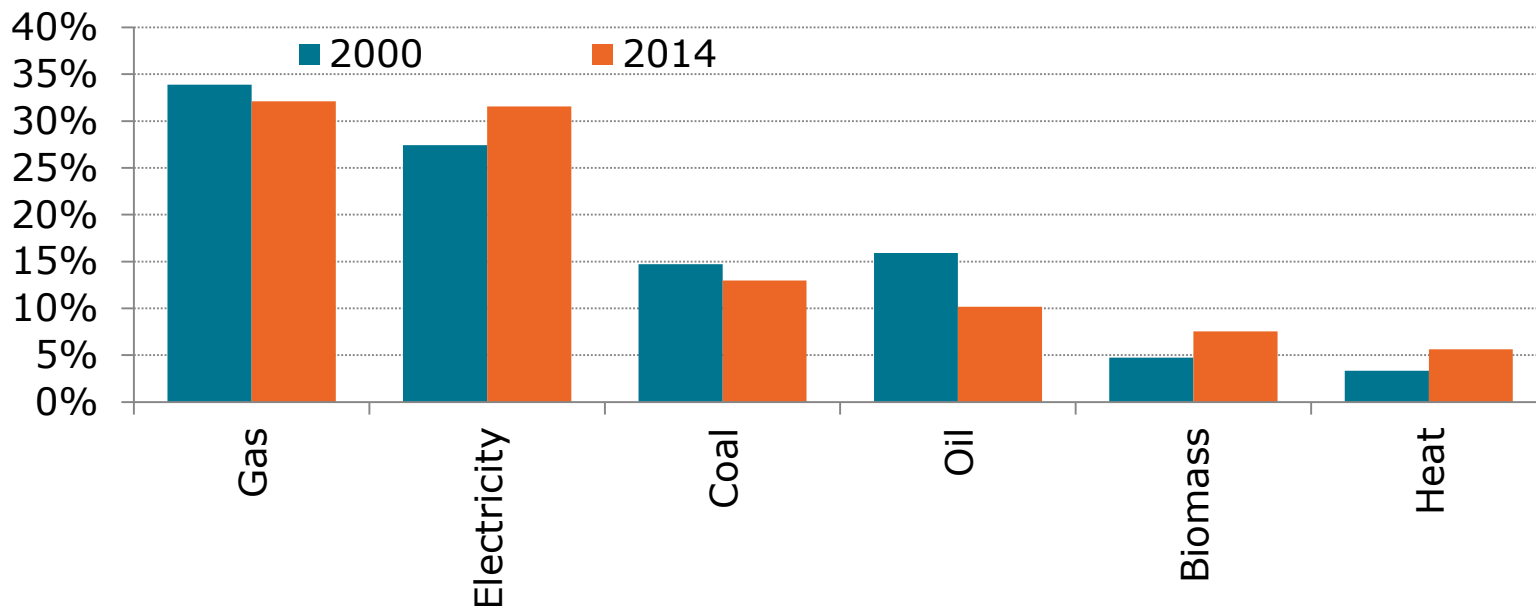


Increasing share of electricity, biomass and heat in the energy mix of industry (+9 points since 2000)



- Electricity (+4 pts), biomass (+3) and heat (+2).
- Electricity now close to natural gas (around 32%), with a market share around 35% in 3 large EU countries (France, Italy and UK).
- Penetration of electricity partly linked to electrification: ~ 10% of the electricity used in 2014 linked to replacement of fuels by electricity since 2000.
- High share of biomass in Latvia (53%), Sweden (40%) and Finland (34%) because of the importance of wood and pulp & paper industry.

Trends in the fuel mix in industry

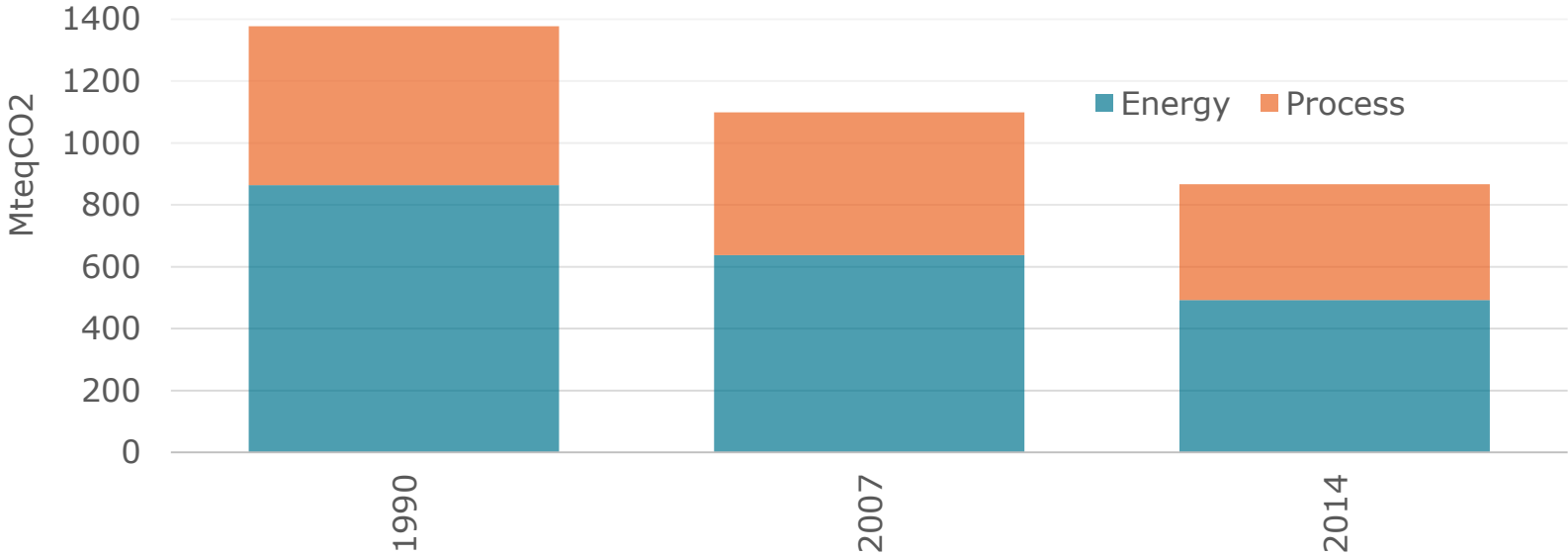




Strong decrease of CO2 emissions in industry: -37% since 1990 or -1.9%/year

- Stronger decrease for emissions linked to energy combustion (-43%), than for emissions from industrial process (-27%). As a result emissions from process represent an increasing share of total emissions (43% in 2014 against 37% in 1990);
- In 2014, industry accounts for 22% of total EU GHG emissions.

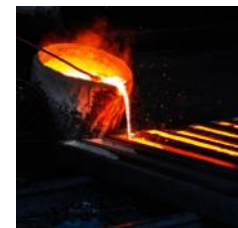
CO2 emissions in industry





Energy efficiency trends

Energy efficiency trends in industry



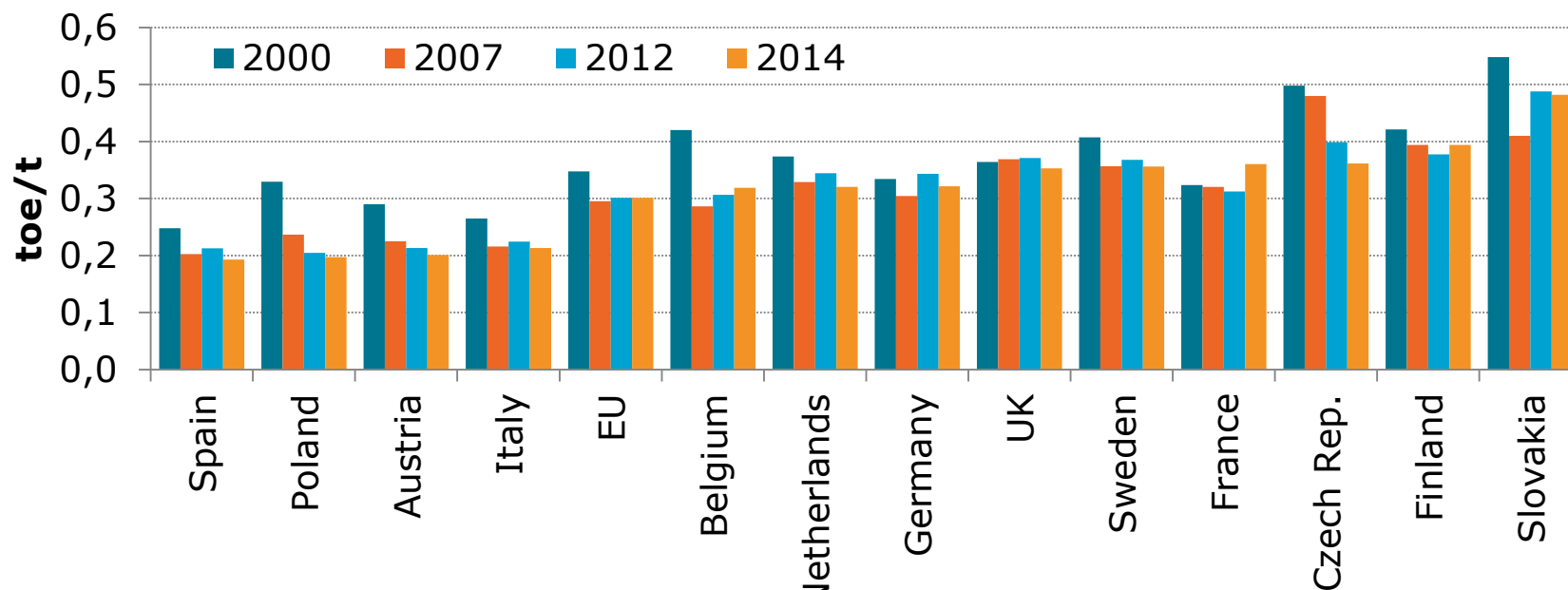
- Energy efficiency progress is measured in industry from the reduction in the indicator of specific consumption per ton.
- The reduction was generally significant until 2007 in most branches, implying energy efficiency improvements.
- Since 2007, there is a reverse trend, with an increase of specific consumption in many branches and countries. This is a direct impact of the recession leading to lower utilisation rate of equipment, and thus to a lower operational efficiency; but the technical efficiency did not change (the equipment are the same); we can speak of an “apparent” deterioration of efficiency.

Energy efficiency trends in steel industry



- Energy efficiency progress improved significantly in the steel industry until 2007 in most countries (2.3%/yr at EU level);
- Apparent deterioration of efficiency since 2007 in half of countries (and EU) as a result of the deep recession in this sector.
- Since 2013 or 2014, slight improvement in most countries due to the growth recovery.
- Different performances partly explained by different process mix.

Trends in the specific consumption per ton of steel in EU countries



Only countries with production > 4 Mt are shown

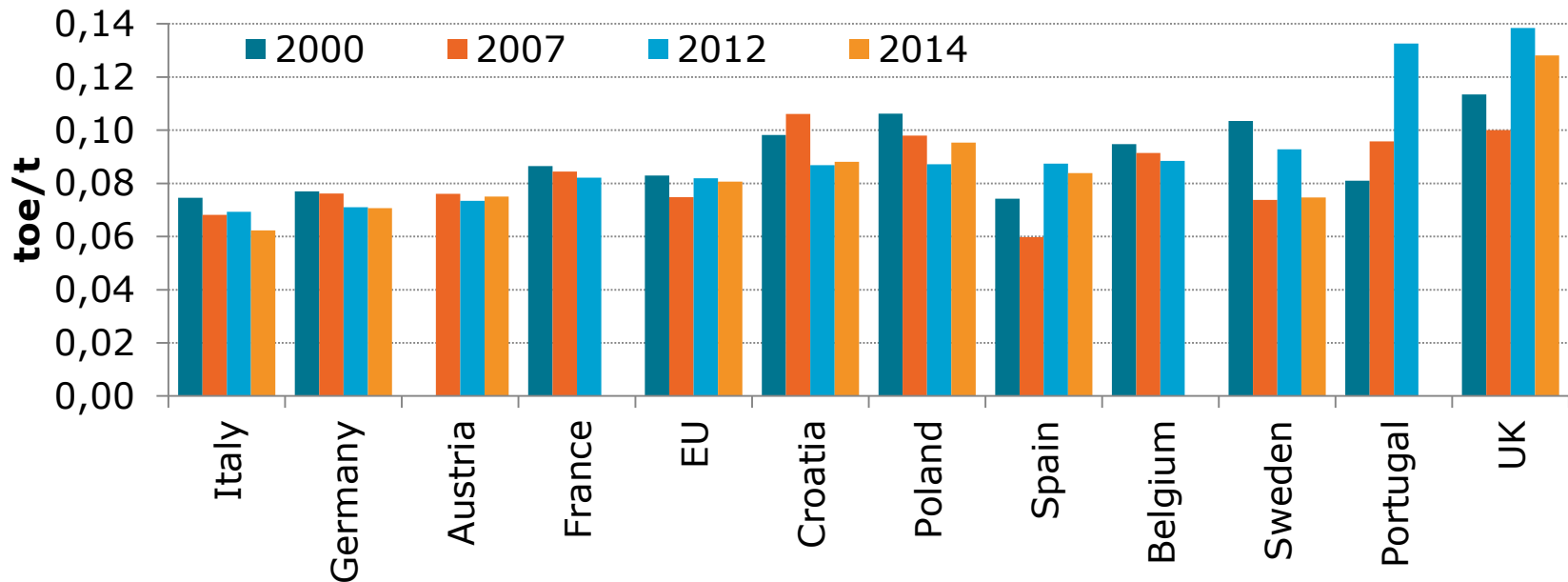
Source: ODYSSEE

Disparate trends in specific consumption of cement

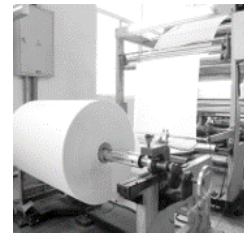


- In 5 countries and at EU level, the specific consumption per ton of cement was higher in 2012 than in 2007, especially in Spain, UK and Portugal.
- In 7 countries, the specific consumption decreased.
- Since 2012, slight decrease of the specific consumption for Italy, Spain and UK due to the growth recovery (-0,8%/yr at EU level).
- Differences among countries are explained by differences in the ratio clinker to cement production and in the efficiency of clinker production.

Trends in the specific consumption per ton of cement

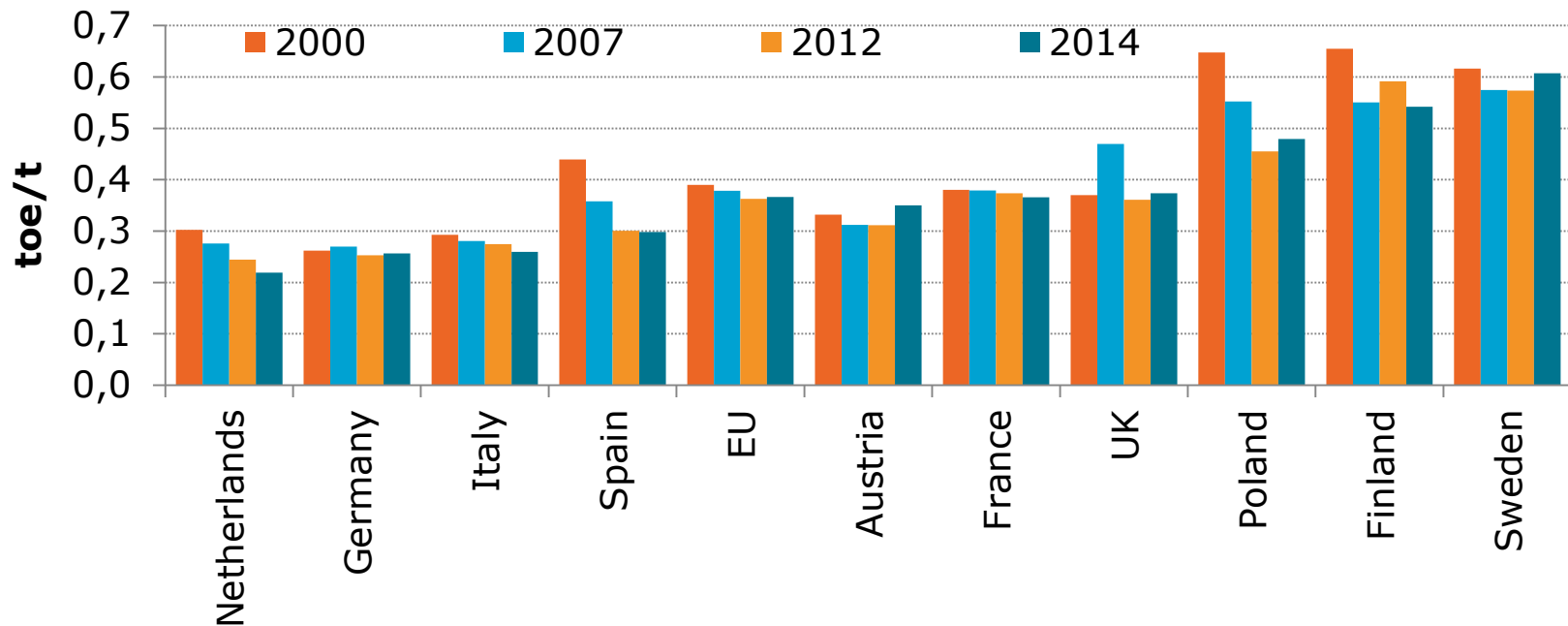


Energy efficiency trends in pulp & paper industry



- Regular decrease of the specific consumption per ton of paper in most countries from 2000 to 2014 (-0.5%/year at EU level).
- Largest reduction in Netherlands, Poland, Spain (> 2%/yr since 2000).
- Trends influenced by energy efficiency but also by the share of pulp produced in the country.
- Differences among countries depend on the level of pulp production.

Trends in the specific consumption per ton of paper in EU countries



How to measure energy efficiency progress at sector level?

- From the various indicators of specific energy consumption by branch, ODYSSEE proposes **an aggregate indicator** for the sector, called **ODEX** (“ODYSSEE energy efficiency index”), that summarises the trend in energy efficiency progress.
- ODEX is calculated by weighting the **indices** of specific consumption of each branch with their share in the industrial energy consumption.
- As indices are used, specific consumption by branch can be expressed **in different physical units** so as to be as close as possible to energy efficiency evaluation (e.g. toe/ton for steel, cement and paper and toe/IPI* for the other branches).

IPI: Industrial Production Index calculated from variation in physical production

ODEX calculation: from gross to final value?

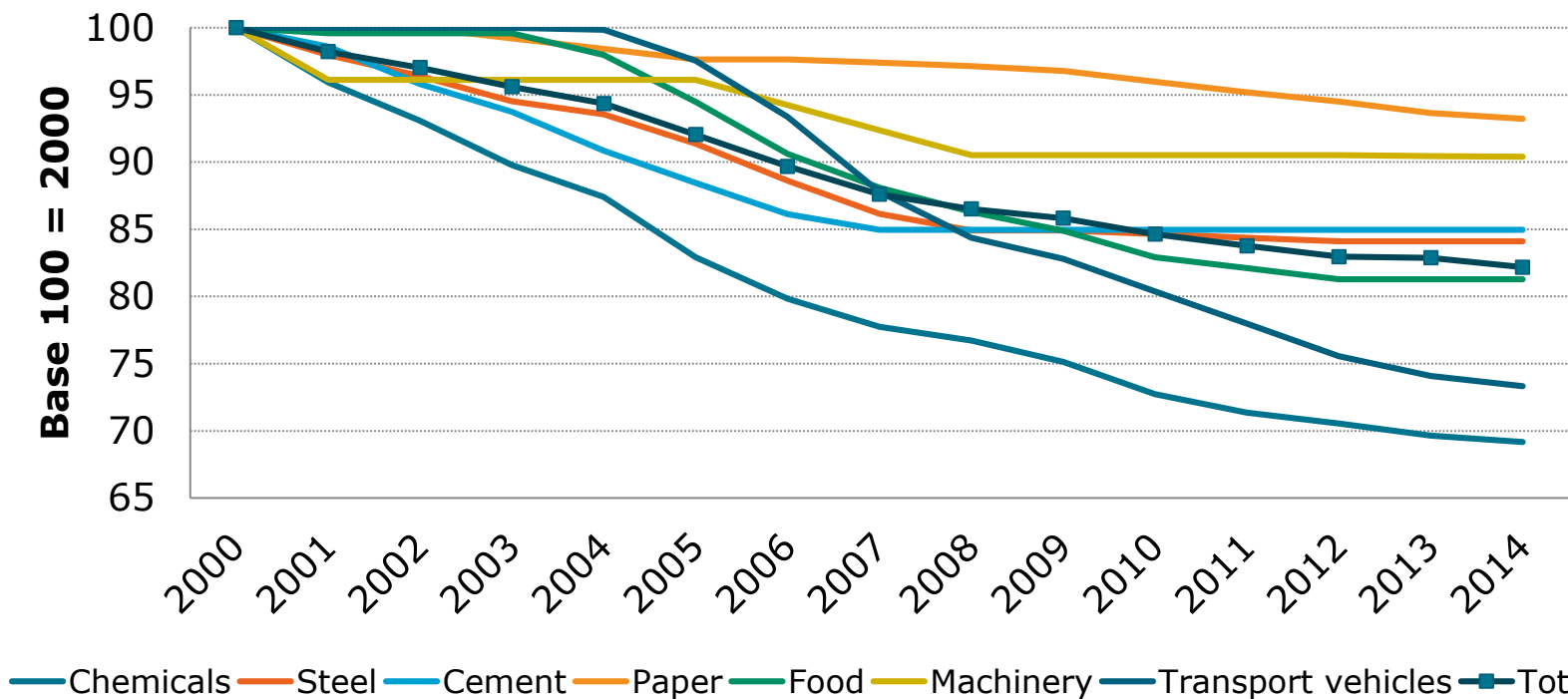


- The gross value of the ODEX is not used directly to assess energy efficiency trends. Two adaptations are done to derive the final value:
 - ODEX is expressed for each year as a 3 years moving average to smoothen the trends.
 - Only technical efficiency is taken into account, i.e. net of negative efficiency trends due to inefficient operation of industrial facilities with low capacity utilization as was the case since 2007 in most countries → an increase in the indicator is not associated to a decrease in efficiency, but as **no** energy efficiency progress.

Slower energy efficiency progress since 2007

- Energy efficiency in EU industry improved by 1.4%/year since 2000.
- Twice less progress since 2007 (0.9%/yr since 2007 compared to 1.9%/yr before) because of a slower progress in some branches and even no more energy efficiency improvement for others because of the recession (e.g. cement, machinery, steel).

Trends in energy efficiency in EU industry (based on ODEX)



Specific consumption per ton for steel, cement and paper; consumption per IPI for other branches. Technical ODEX; branches with low consumption share not shown.

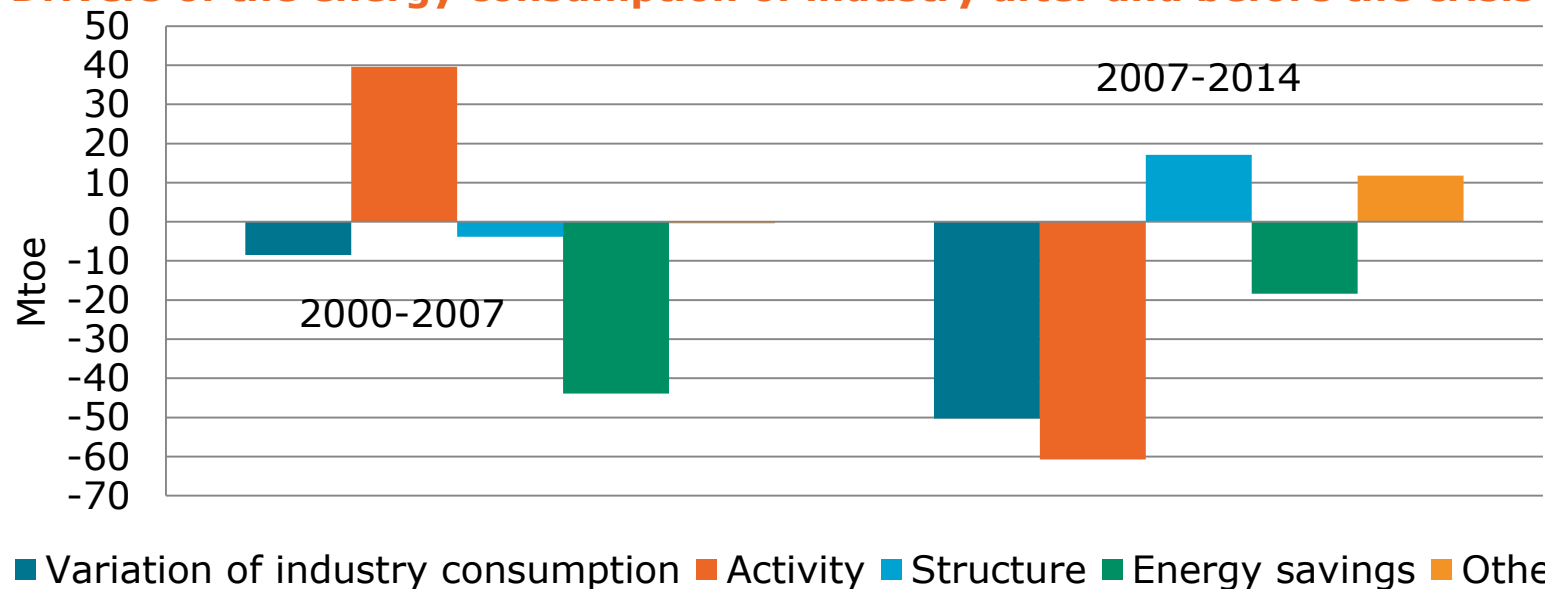


Drivers of energy consumption variation

Recession is the main factor behind the energy consumption reduction since 2007

- Between 2000 and 2007, consumption was almost stable as energy savings balanced the impact of industrial growth activity (-44 and +39 Mtoe).
- Since 2007, most of the consumption reduction is explained by the industrial recession and, to a lower extent, energy savings; structural changes and other effects had a reverse impact.

Drivers of the energy consumption of industry after and before the crisis

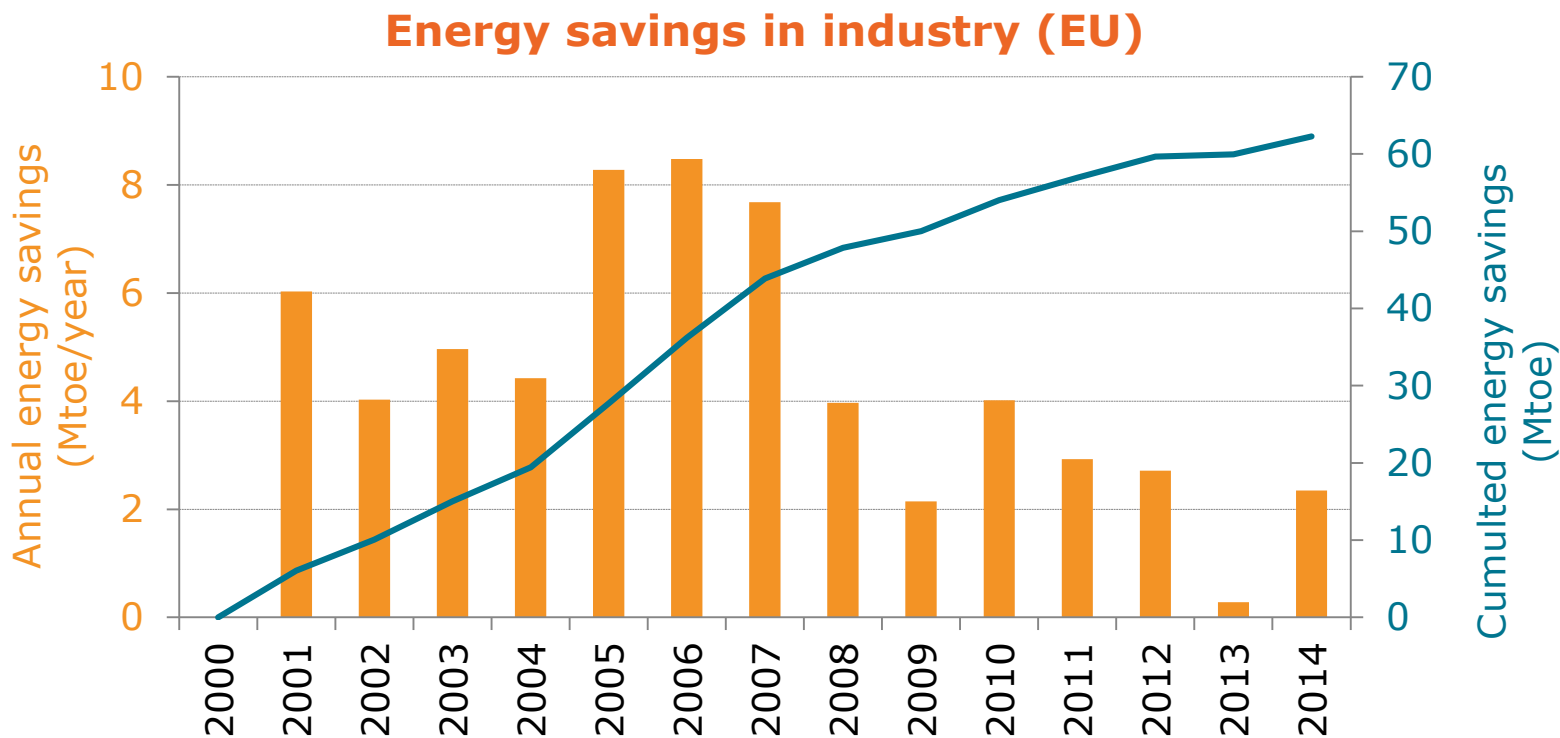


Other effects: mainly "negative" savings due to inefficient operations in industry

Source: Decomposition facility ODYSSEE

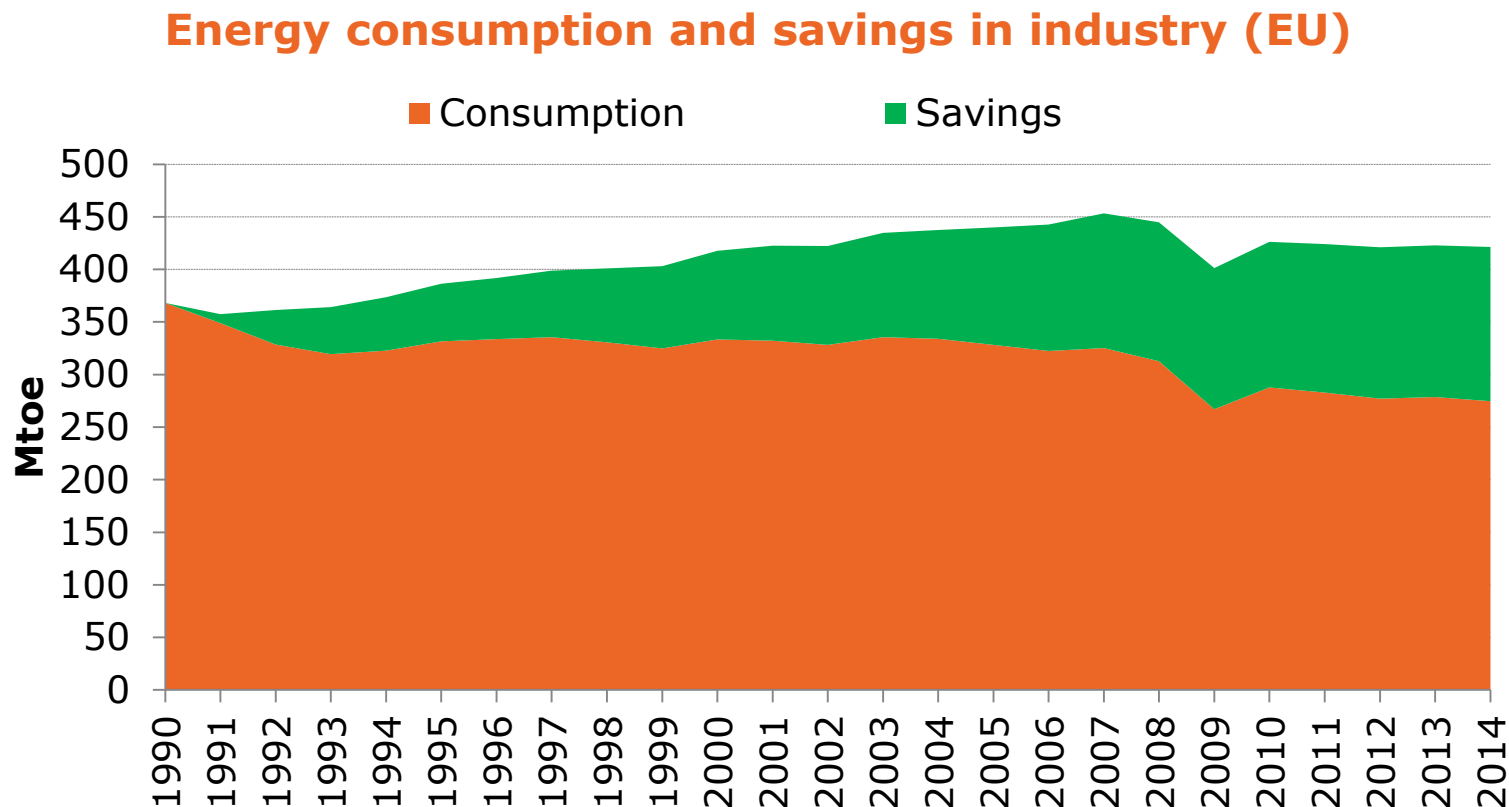
Energy savings more than twice lower since 2007

- Because of the slower pace of energy efficiency improvement since 2007, the annual volume of energy savings in industry has more than halved from an average of 6.3 Mtoe/year to 2.6 Mtoe/year.
- In 2014, energy savings reached almost 62 Mtoe compared to 2000: without energy efficiency improvement, energy consumption would have been higher by 62 Mtoe.



150 Mtoe energy savings in 2014 compared to 1990

- Without energy efficiency improvements since 1990, energy consumption would have been higher by 150 Mtoe, i.e. 53% higher.
- In total cumulated savings since 1990 amount to 2.3 Gtoe

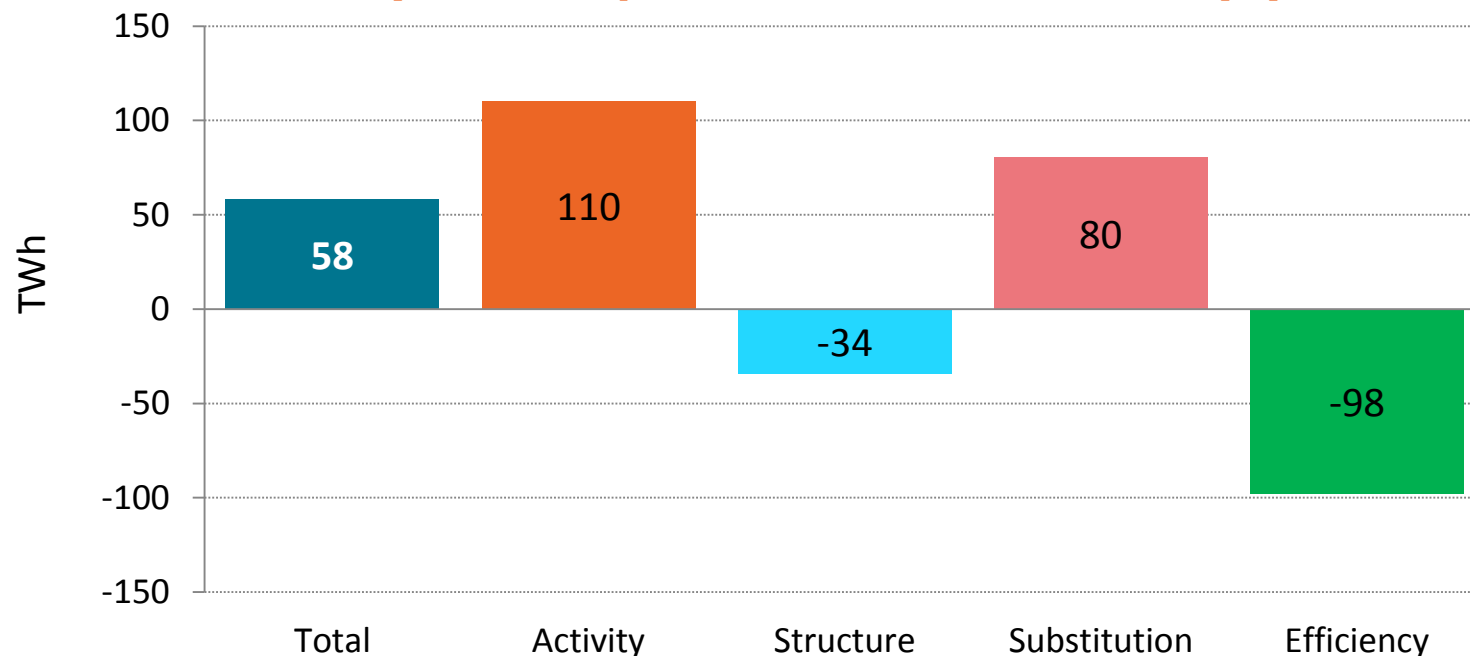


Source: ODYSSEE

The decomposition method can also be used to explain the consumption variation by fuel: case of electricity

- Industrial electricity consumption increased by 58 TWh from 2000 to 2008.
- Two factors contributed to this increase: industrial growth (+ 110 TWh) and substitution of electricity to fossil fuels (+ 80 TWh), mainly in machinery, food and steel.
- Their effect was partly offset by energy efficiency improvements (-98 TWh), mainly in chemicals and steel.

Drivers of electricity consumption variation in industry (EU, 2000-2008)



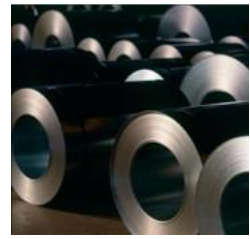


Benchmarking

Benchmarking Indicators in industry

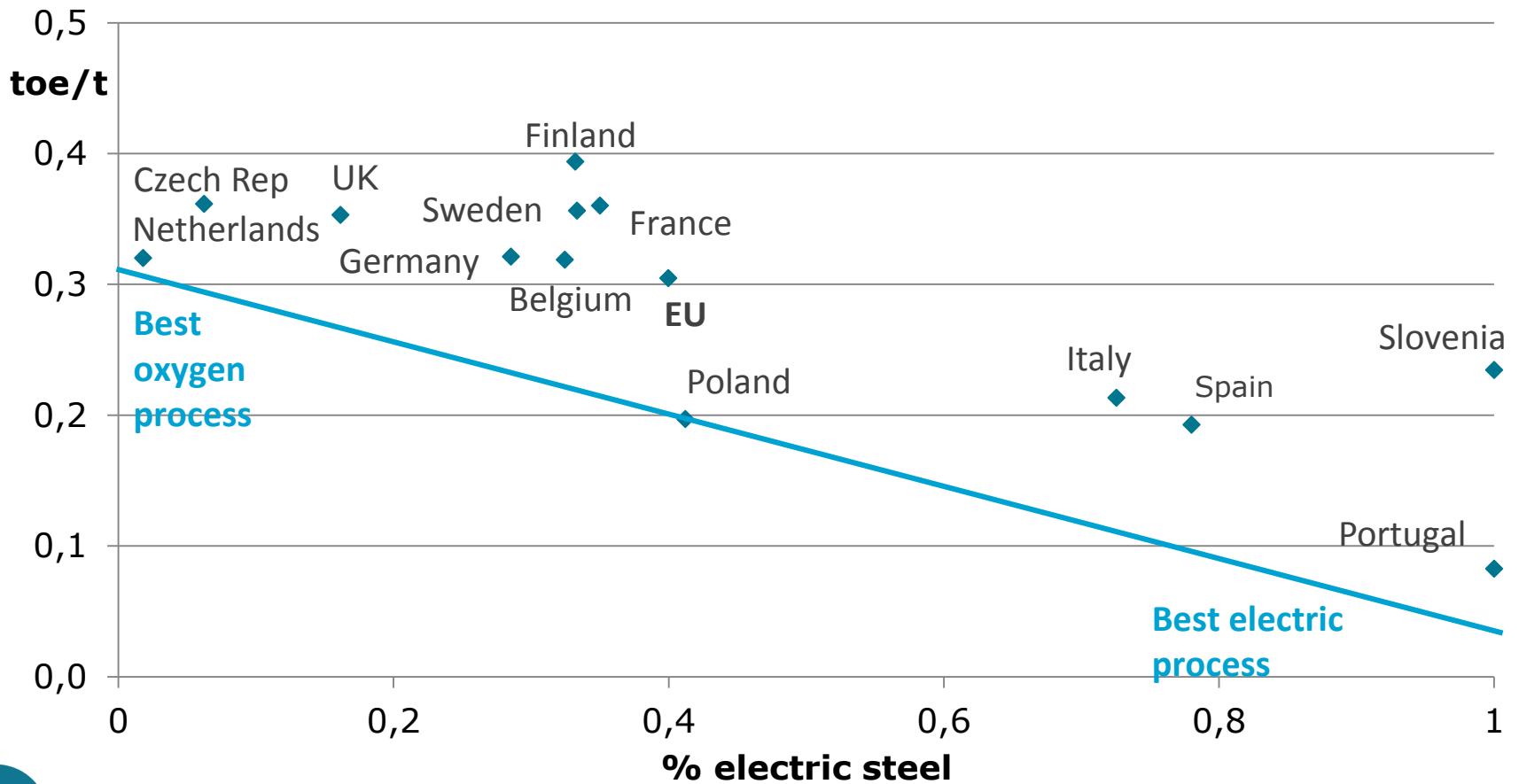
- Benchmarking or energy key performance indicators are mainly calculated for the 3 main intensive branches (steel, paper and cement).
- Benchmarking indicators should take into account as much as possible factors of differences that are not linked to energy efficiency, in particular the industrial product and product mix.

Difference in specific consumption of steel partly explained by differences in process mix



Distance to blue line shows possible potential of energy efficiency gains.

Consumption per tonne of crude steel (2014*)

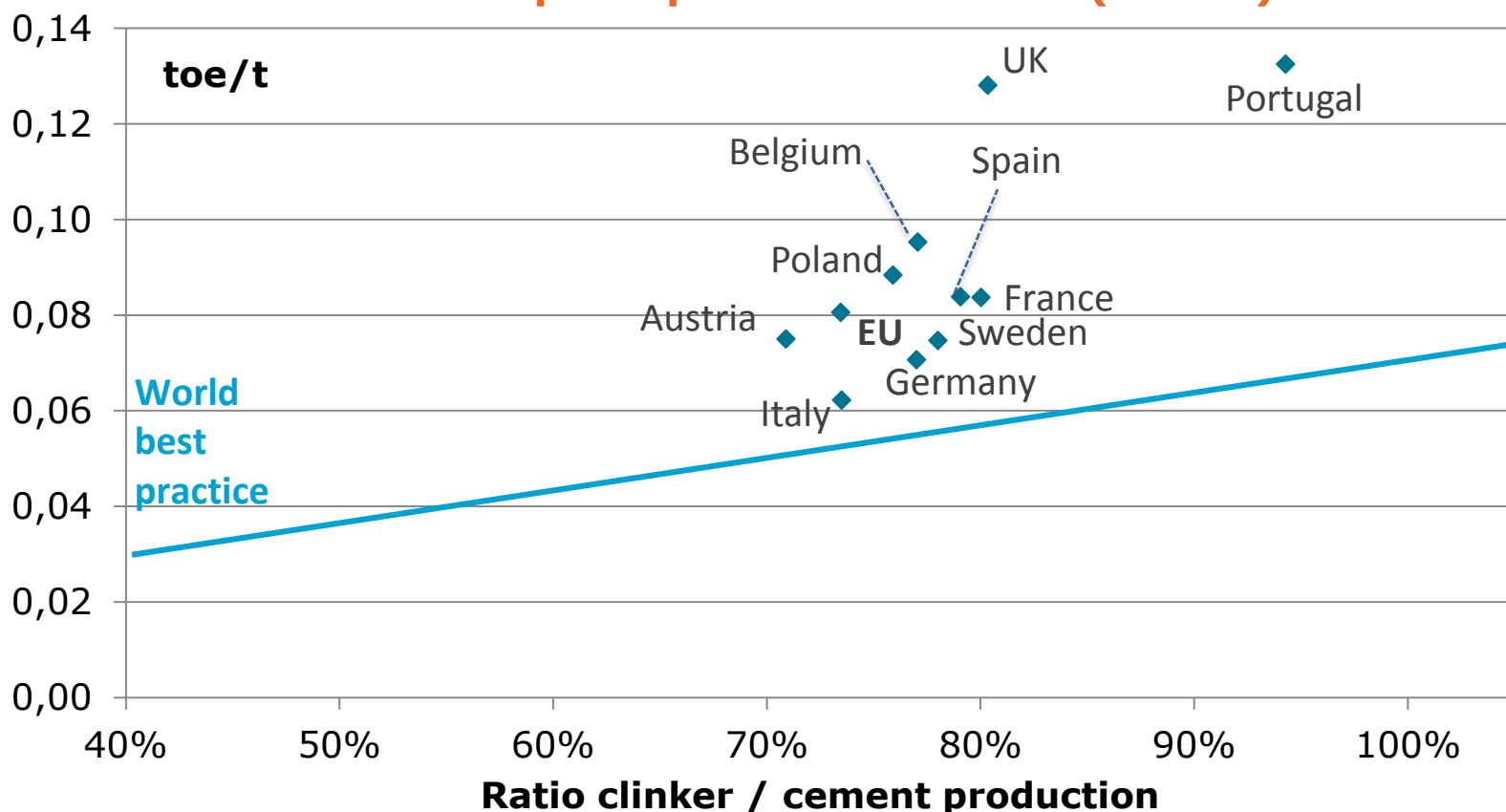


The graph below shows the energy performance of cement production in relation to the share of clinker produced in the country in cement production: the higher this ratio, the higher the specific energy consumption.



For a given value of the ratio, the distance to the blue line (best practice) indicates the potential of energy savings.

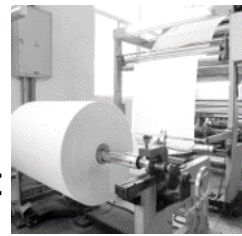
Consumption per ton of cement (2014*)



*2012 data for Portugal and Belgium / 2013 for France

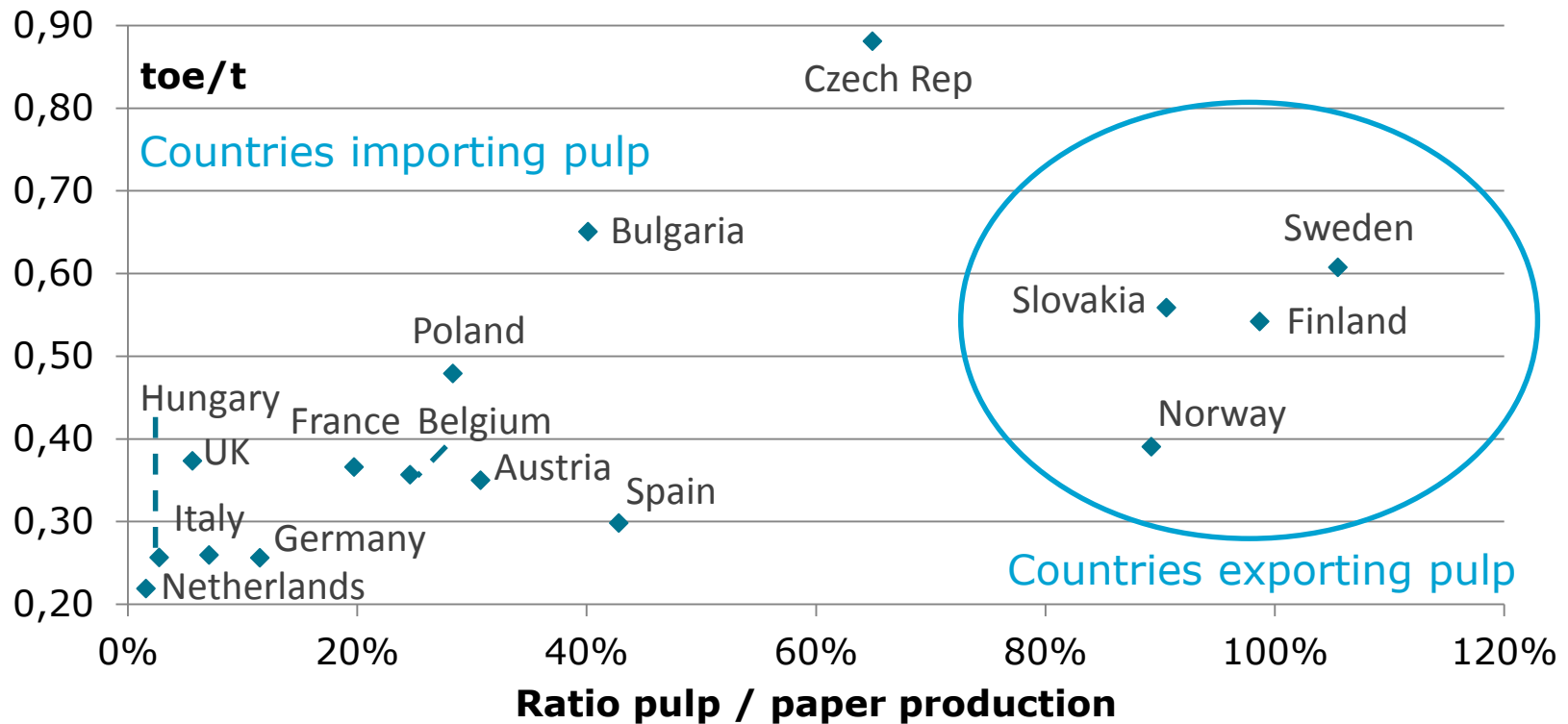
Source: ODYSSEE

The energy performance of the paper industry, which also includes pulp production is linked to the share of pulp produced in the country in relation to paper production: the higher this ratio, the higher the specific consumption.



Comparisons should be made at similar level of this ratio: for countries with a high production of pulp, Norway and Finland have the best performance.

Specific consumption per ton of paper (2014*)

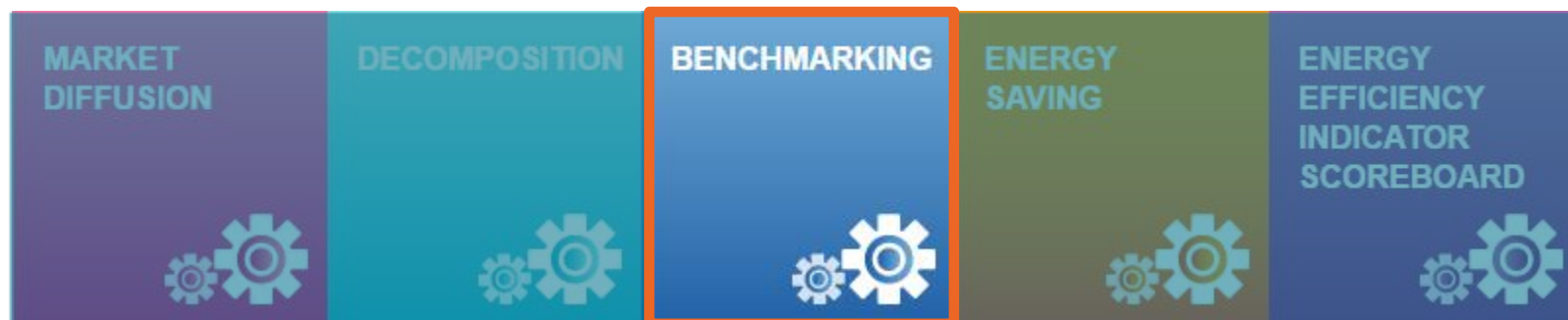


*2013 data for Hungary, Czech Republic, Bulgaria and Belgium

Source: ODYSSEE/ONUDI/FAO

Benchmarking of industry sector

- In ODYSSEE, the benchmarking of industry sector is done by making two adjustments to improve the comparison.
 - Price difference by using purchasing power parities
 - Industry structure by comparing countries with the same reference structure
- A data tool enables to benchmark the countries by doing these adjustments (“benchmarking tool”).



Why using Purchasing Power Parities for cross country comparisons of energy performance ?



- Let us take 2 factories producing cars : one in France and one in Romania, **with the same technical performance**, i.e. the same energy input by car produced (in toe or GJ per car).
- The value added of each car is mainly made from salaries (capital costs and profits also included), whose relative level across countries are mainly influenced by the average difference in the cost of living (**2 times** lower for Romania*)
- ➔ With the same technical performance, **the energy used per unit of value added** (« **energy intensity** ») for the car industry will be **twice** higher in Romania than in France with exchange rates but **the same at ppp**.
- ➔ Energy intensities differences at ppp are closer to differences in technical performance.

* Based on ppp published by Eurostat for 2014

Adjustment methodology in ODYSSEE: industry structure



- Differences in **industry** structure are taken into account by calculating an average industrial intensity with the actual intensity by sub-sector of each country and the same industry structure (i.e. share of each industrial branch in total value added).
- The reference industrial structure is the EU average in the data base and any country in the benchmarking tool.
- The calculation is done in ODYSSEE for:
 - Industry intensity
 - Manufacturing intensity

Benchmarking tool

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Odyssee



The ODYSSEE indicators are accessible under different data tools: the full data base, the key indicators facility, as well as five specific data facilities that focus on specific issues and provide some interpretation: market diffusion, decomposition, benchmarking, energy saving and indicator scoreboard. The access to the data base is restricted, whereas all other data tools are in public access.

ODYSSEE DATABASE



KEY INDICATORS



MARKET
DIFFUSION



DECOMPOSITION



BENCHMARKING



ENERGY
SAVING



ENERGY
EFFICIENCY
INDICATOR
SCOREBOARD



Benchmarking facility compares the energy performance of any country with a selection of other countries.

Co-funded by the Intelligent Energy Europe Programme of the European Union

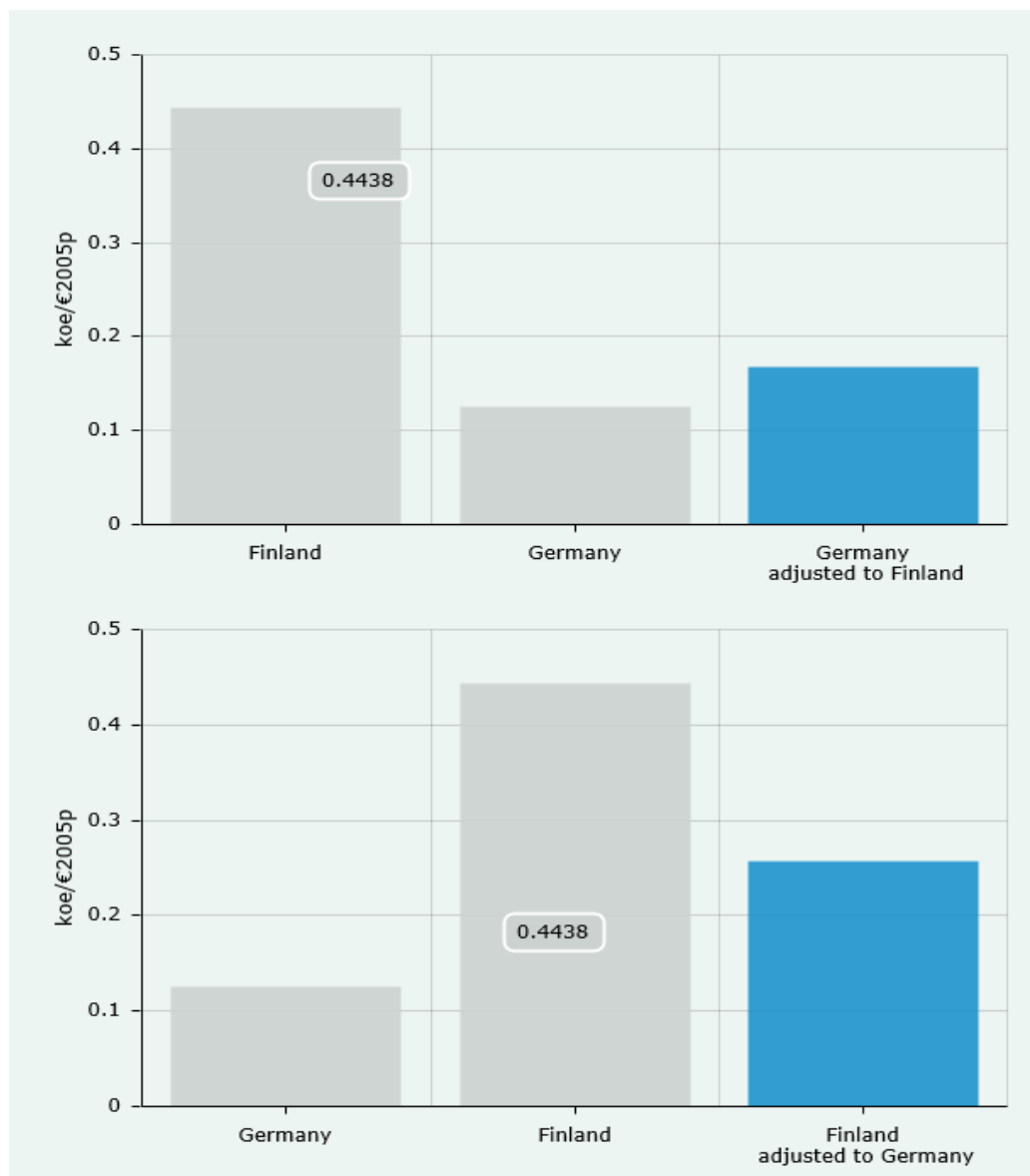


<http://www.indicators.odyssee-mure.eu/>

The benchmarking tool: example

The first graph shows what would be the energy intensity of industry of Germany **adjusted to the same industry structure as Finland**.

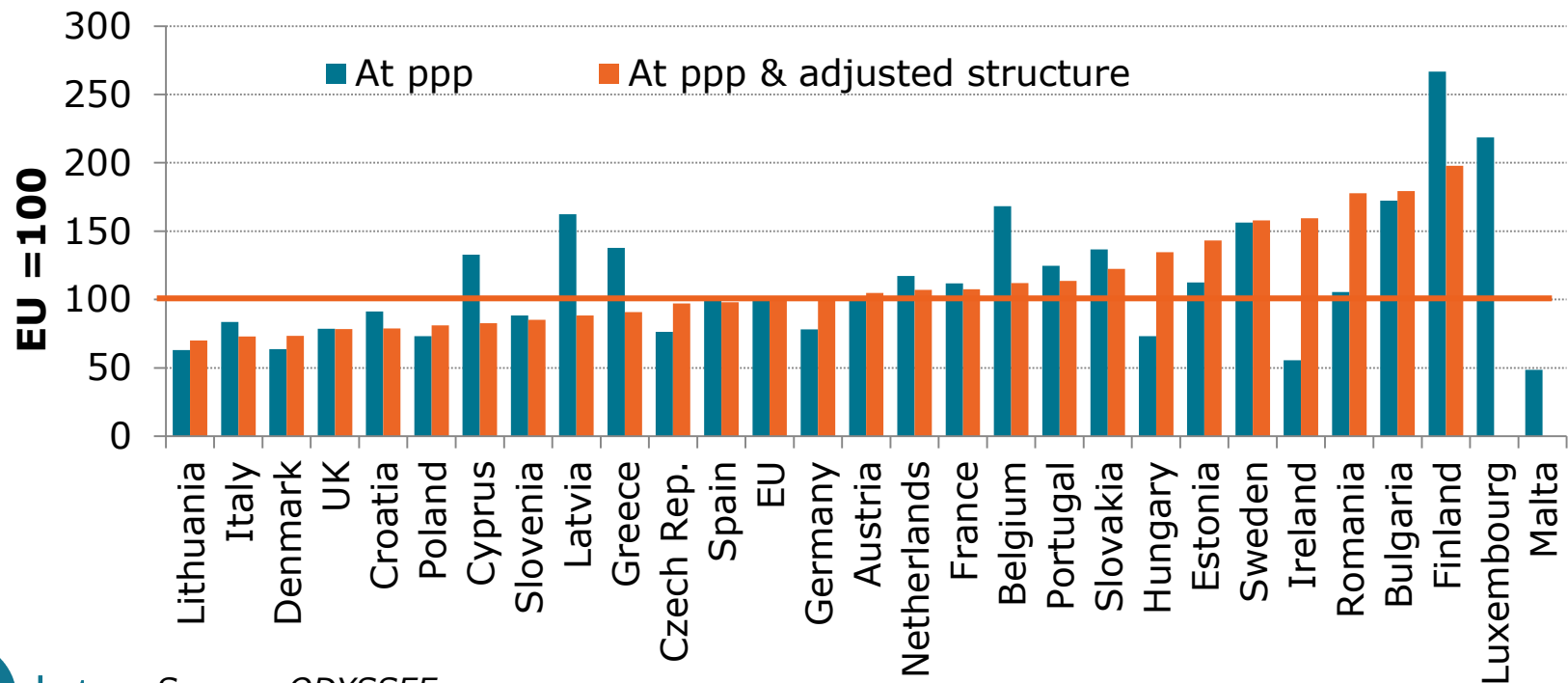
The second graph shows what would be the energy intensity of industry of Finland **adjusted to the same industry structure as Germany**.



Adjustment of all countries to the EU industry structure

- For countries with a share of energy intensive branches lower than the EU average, the adjusted intensity is higher (e.g. France, Germany, Poland, Czech Rep, Romania, Ireland).
- For countries with a higher share of energy intensive branches, the adjustment reduces the intensity (e.g. Finland, a country with a very high share of pulp and paper industry).

Energy intensities of manufacturing adjusted to the same structure in 2013 (EU average)



Source: ODYSSEE

2012 data for Poland and Cyprus / 2011 for Romania

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About Enerdata:

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