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Odyssee



MUREII

Energy Efficiency Trends in Industry in the EU



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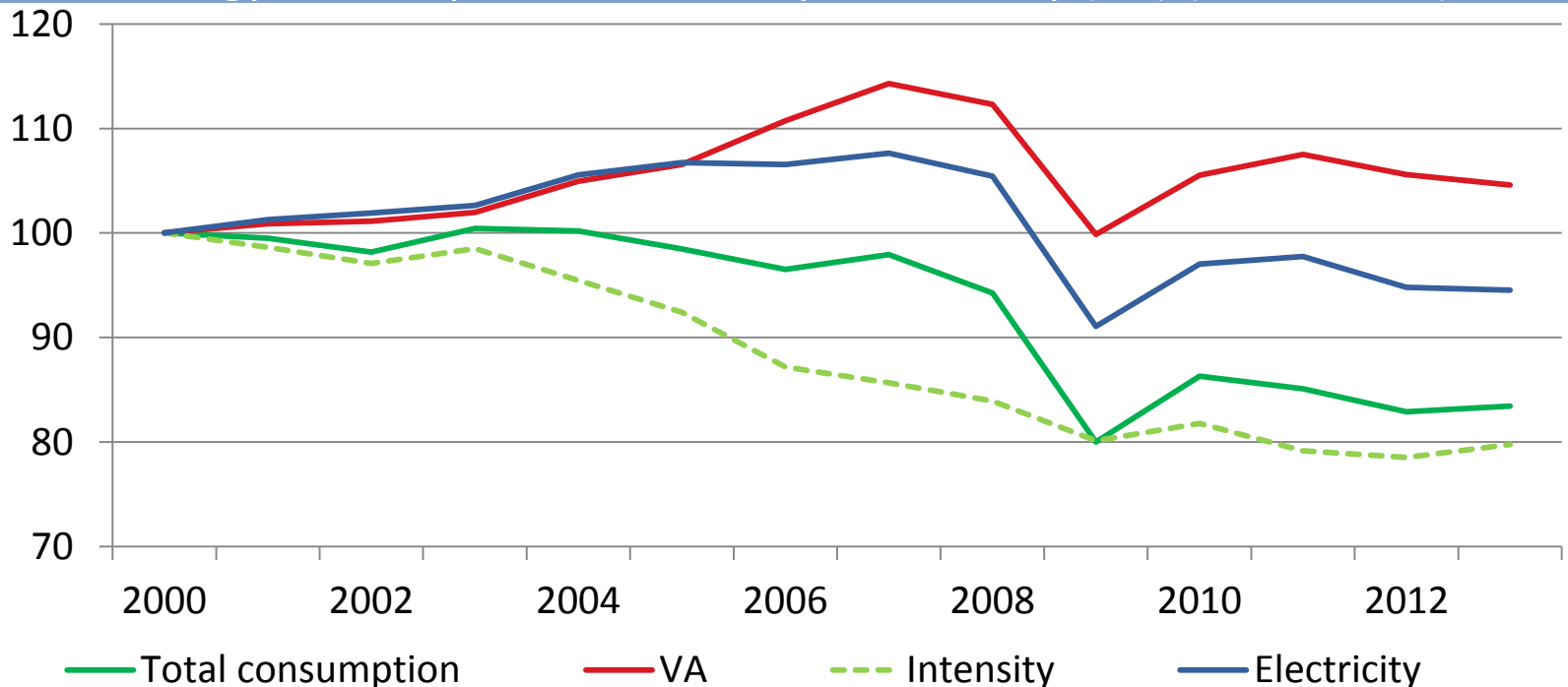
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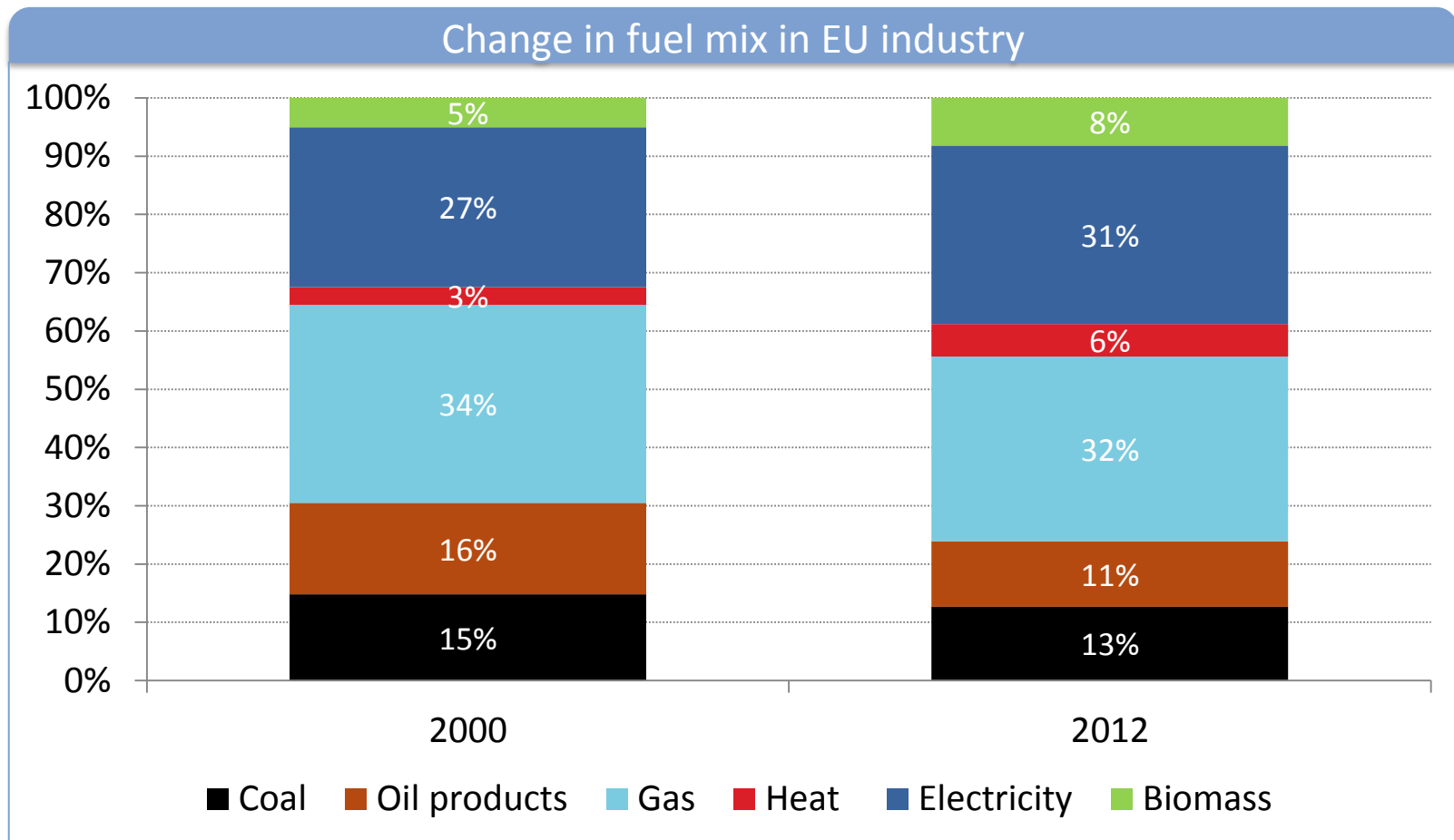
- ▶ **1. Trends in energy consumption**
 - 2. Energy intensity trends
 - 3. Comparison of energy intensities: adjusted intensities
 - 4. Trends and comparison of specific energy consumption
 - 5. Energy efficiency trends
 - 6. CO2 emissions and indicators

- Industrial recession between 2007 and 2009 (-13%) and since 2011 (-3%)
- Decreasing of energy consumption almost twice faster than value added since 2007 (2.6% and 1.5%/year respectively).
- Electricity consumption is more or less following the same trend as total consumption since 2007, while it was increasing regularly before.
- Strong decoupling between energy consumption and production until 2007 (decreasing consumption by 0,3%/yr) and industrial growth almost 2 %/yr.

Energy consumption and activity in industry (EU) (2000 = 100)

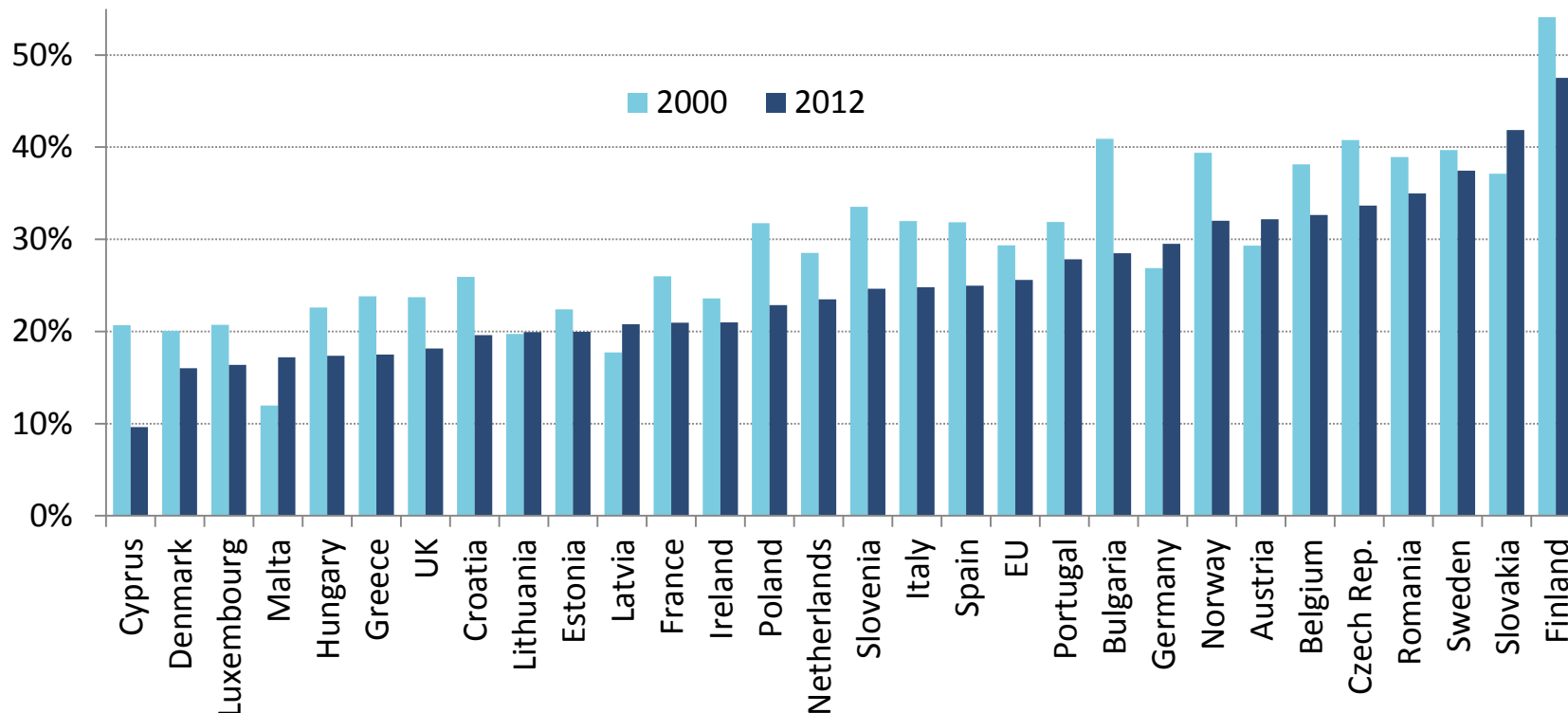


- Increasing share of electricity in industry consumption in the EU (31% in 2012 against 27% in 1990);
- Strong progression for biomass and heat: +3 points each
- The share of fossil fuels is decreasing : -2 points for gas and coal and - 5 points for oil products.



- In most EU countries, the share of industry in the final energy consumption is declining (by 3 points at EU level between 2000 and 2012). Significant decline in Poland, Bulgaria and Cyprus (~10 points). In 5 countries, the share of industry is increasing (Malta, Latvia, Germany, Austria, Slovakia).
- Large discrepancies among countries: around 50% in Finland, 15-20% in Denmark Greece or UK and 26% for the EU average.

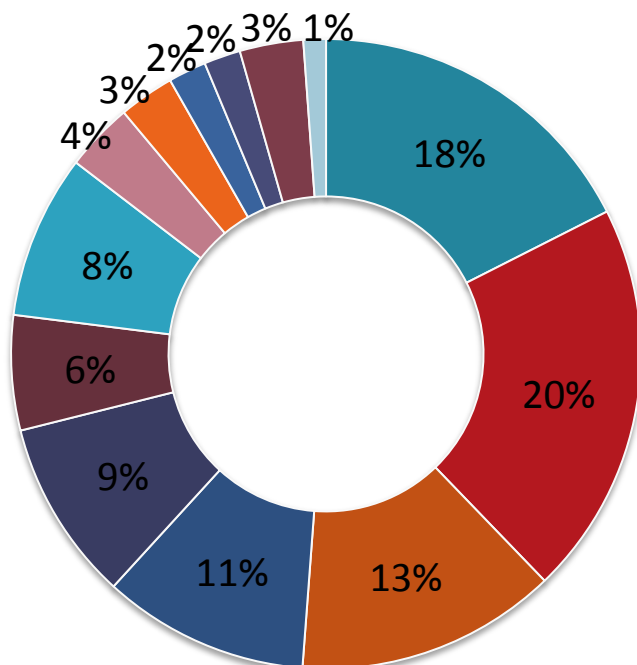
Share of industry in the final energy consumption



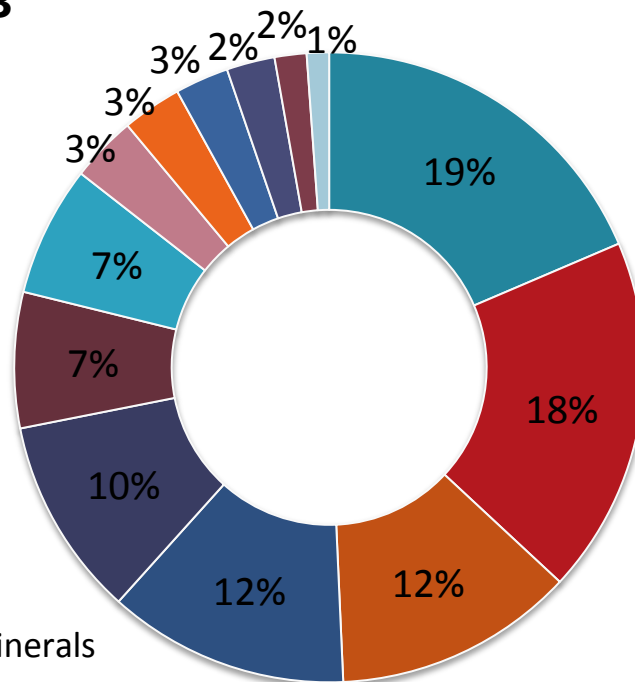
- Chemicals is the largest energy consumer in industry (19% in 2013).
- Steel ranks second with 18%, followed by non metallic minerals and paper (12% each), and food (10%).
- Energy intensive branches (chemicals, steel, non metallic chemicals & non ferrous) represent around 2/3 of total consumption.
- The share of chemicals, paper and food is increasing while the share of steel is declining.

Change in the energy consumption by industrial branch (EU)

2000



2013



Chemicals

Paper

Other manufacturing

Wood

Iron and steel

Food

Non ferrous

Construction

Non metallic minerals

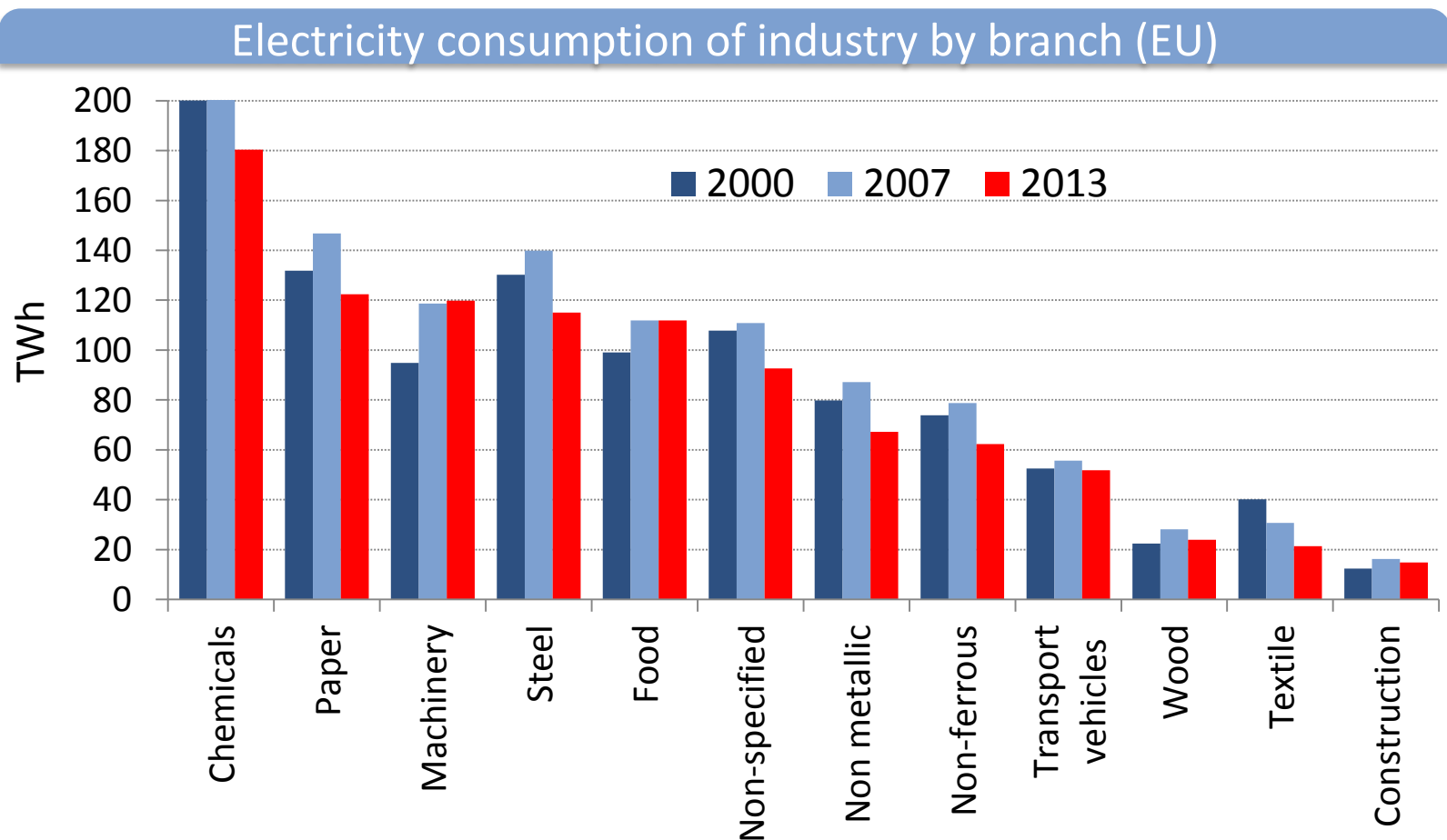
Machinery

Transport vehicles

Textile

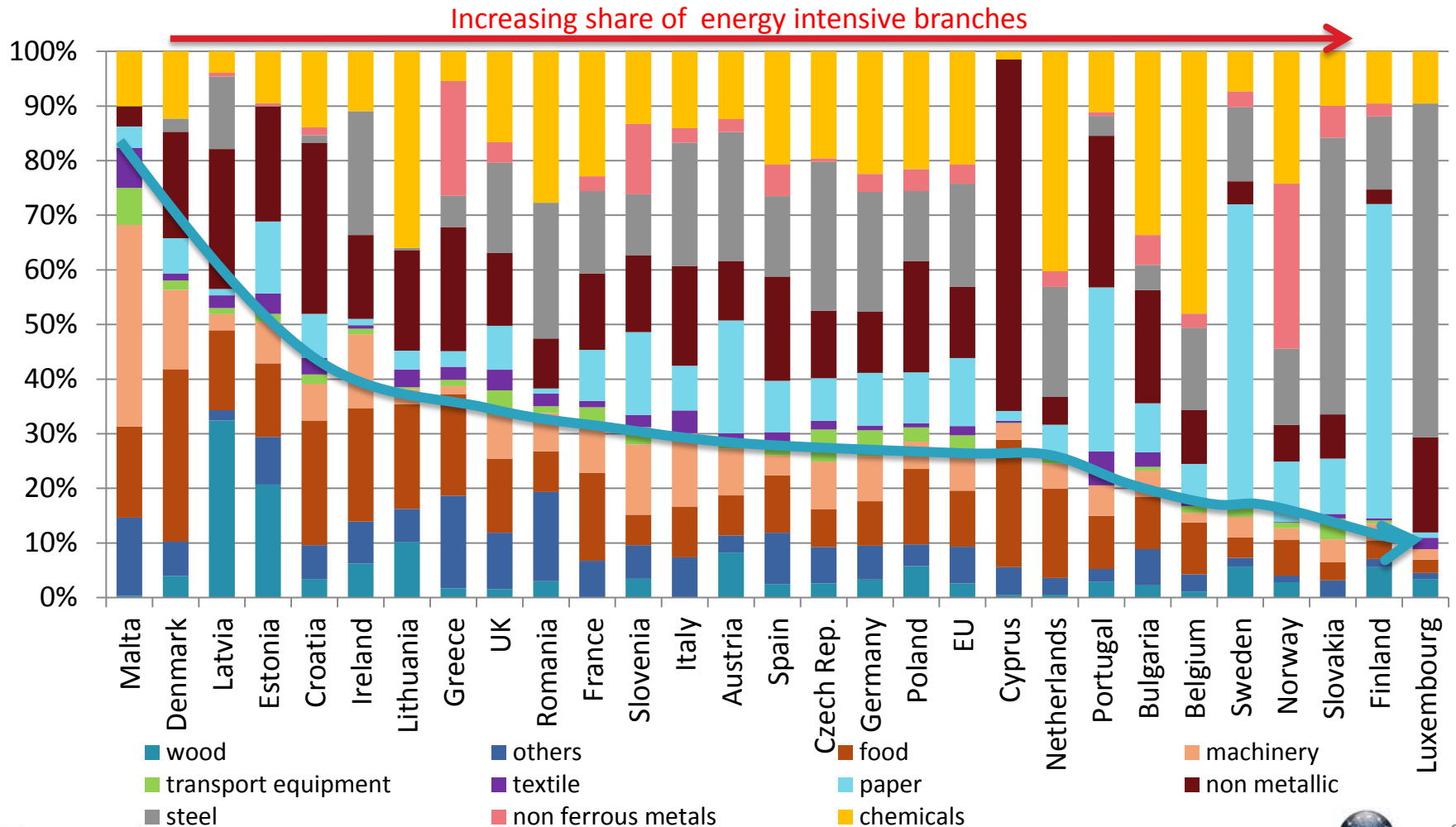
Source: Eurostat

- **Since 2007**, electricity consumption has also **decreased** in all industrial branches.
- **Until 2007**, **increase** for most branches, partly linked to substitution of electricity for fuels (~ 10% of electricity used in 2013 explained by substitution since 2000).
- **Chemical** is the largest electricity intensive branch (**18%**) followed by paper, steel and machinery (12% each)



- Around 85% of consumption in 4 energy intensive branches (chemicals, non ferrous, steel, non metallic and paper in Slovakia, Finland, Luxembourg; around 80% In Belgium, Sweden and Norway; between 60% and 70% in 14 countries, with **67% for the EU average**.
- Decreasing share in Finland (-11 points), Germany, Poland (-3 points); stability at EU level.

Energy consumption by industrial branch (2012)



1. Trends in energy consumption

- ▶ **2. Energy intensity trends**

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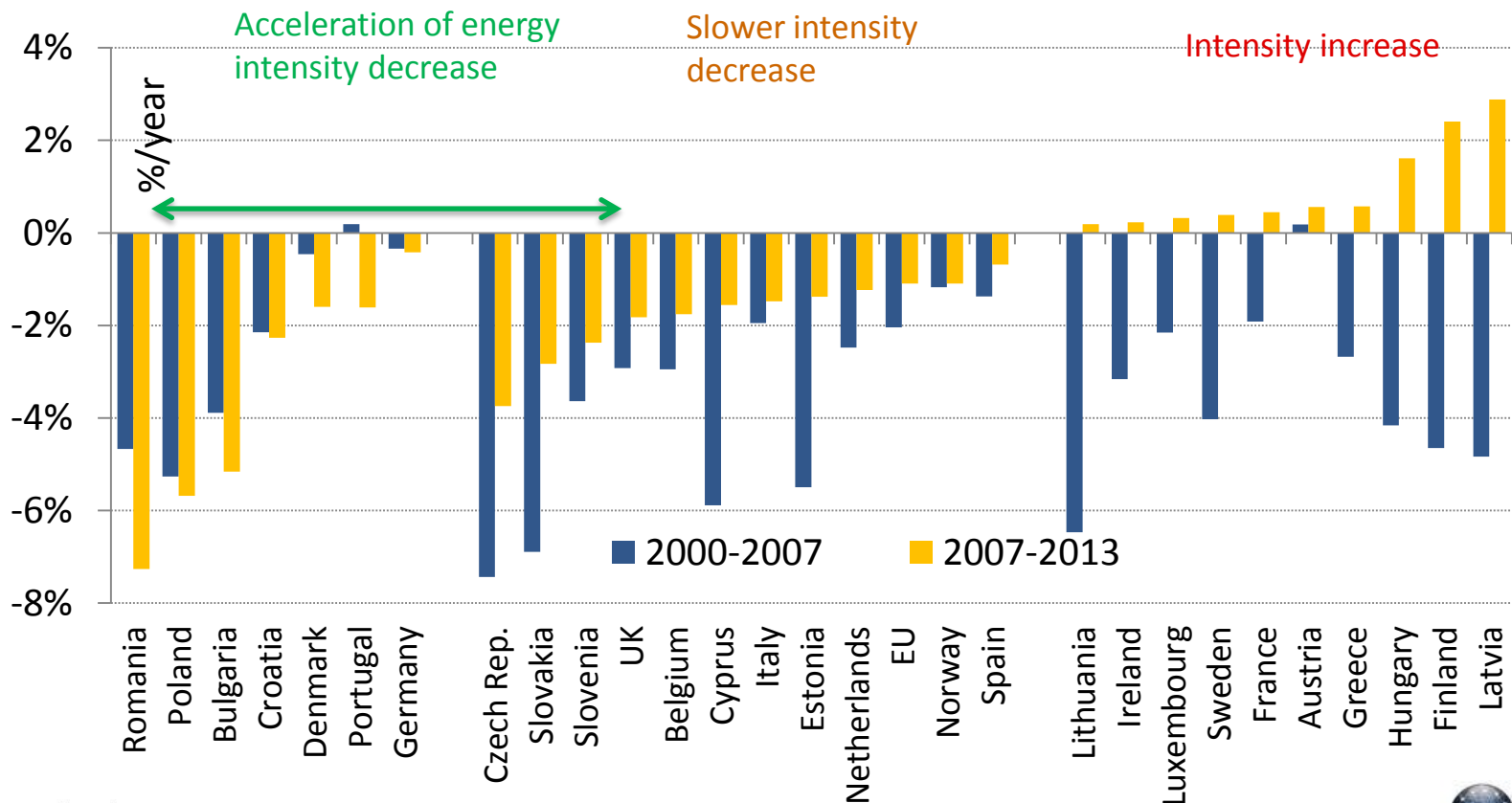
■ Until 2007, energy consumption grew less rapidly than Value Added in all countries → **intensity decrease**.

■ This trend continued after 2007 in **17 countries** with:

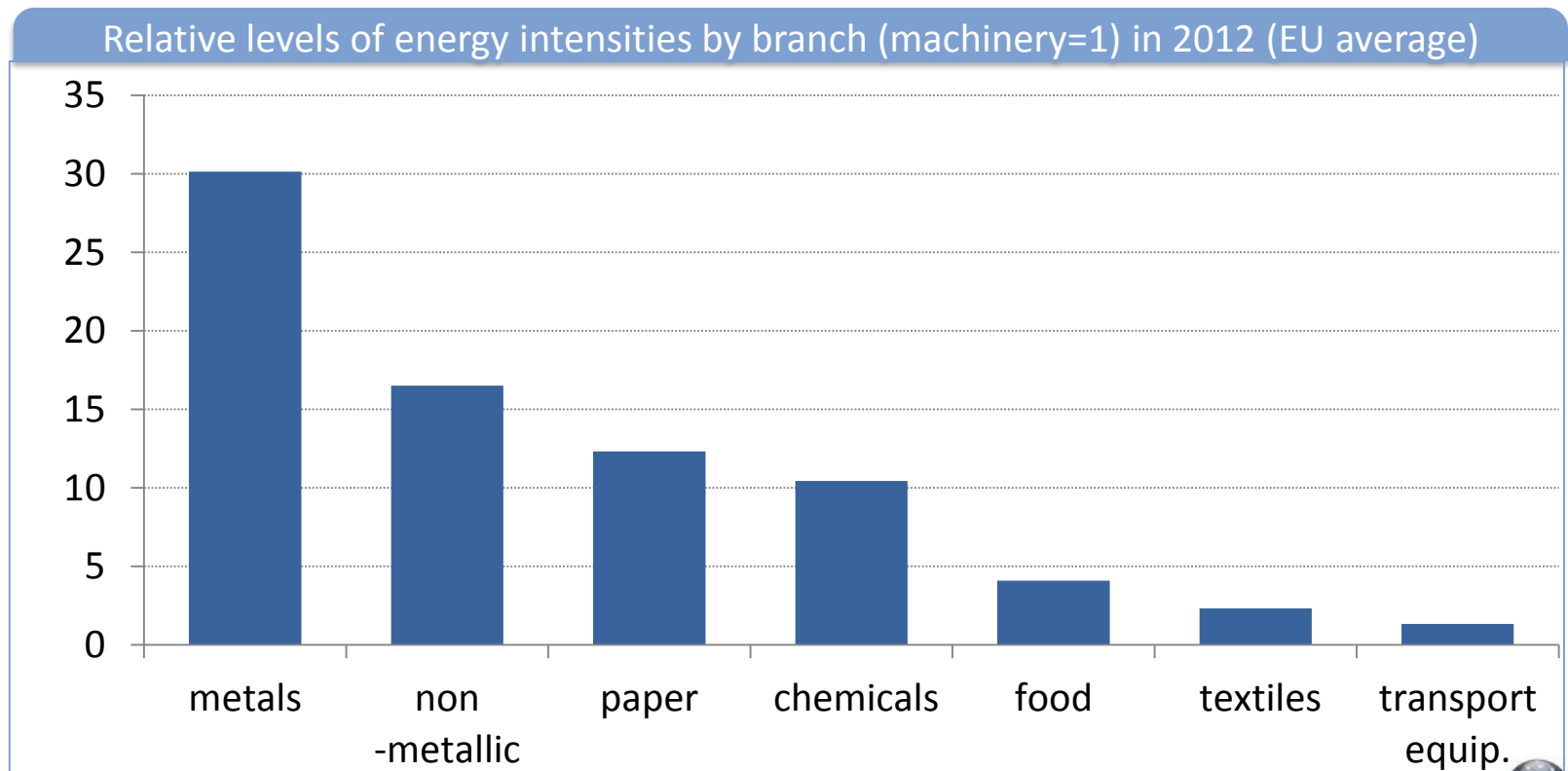
- a faster decrease in 7 countries (generally countries with an industrial growth).
- a slower trend in 11 countries and at EU average (1.1%/yr compared to 2%/yr before).

■ In **11 countries**, the intensity **trend has reversed** since 2007, due to the fact that energy consumption did not follow the reduction in activity.

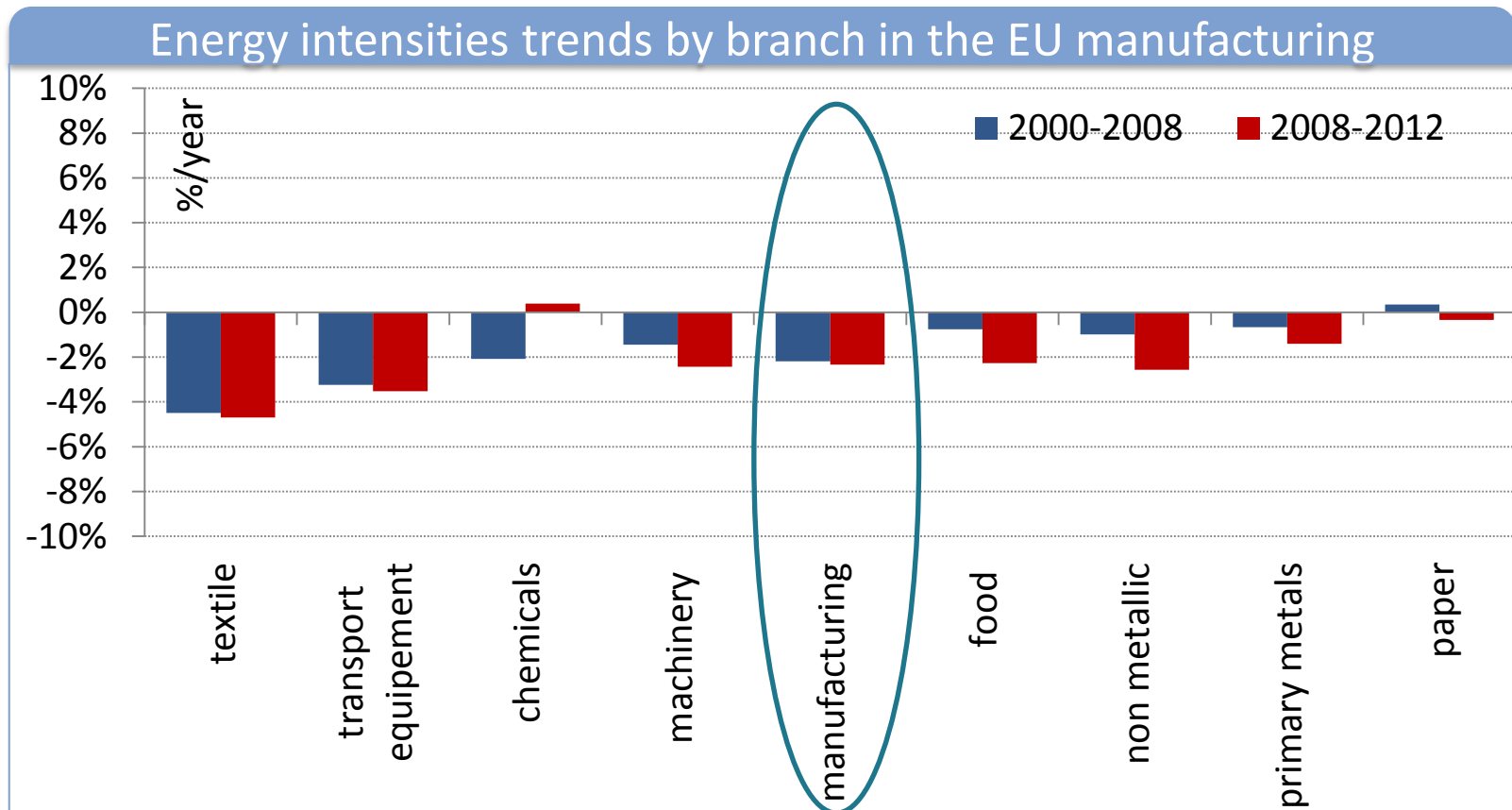
Industrial intensity trends in EU countries



- Primary metals, the most energy intensive branch, require 30 times more energy to produce one unit of value added than machinery, the branch with the lowest intensity.
- Non metallic minerals (17 times more intensive) and paper (12 times)
- A reduction in the share of energy intensive branches in the industrial value added with an increase in the share of equipment and machinery will result, all things being equal, in a reduction of the average energy intensity of manufacturing.

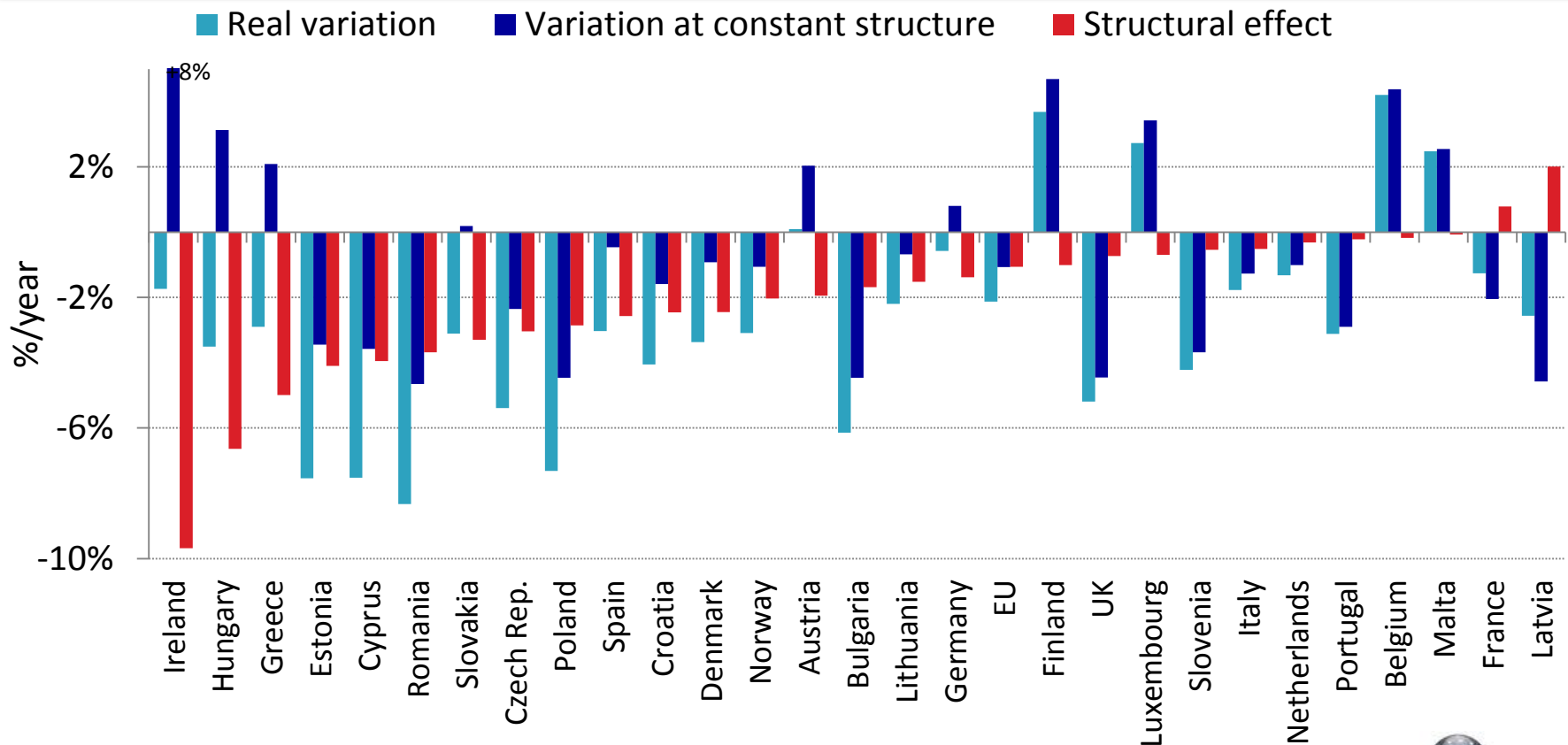


- Acceleration of the energy intensity decrease in manufacturing over the period 2008-2012, especially in food and non metallic;



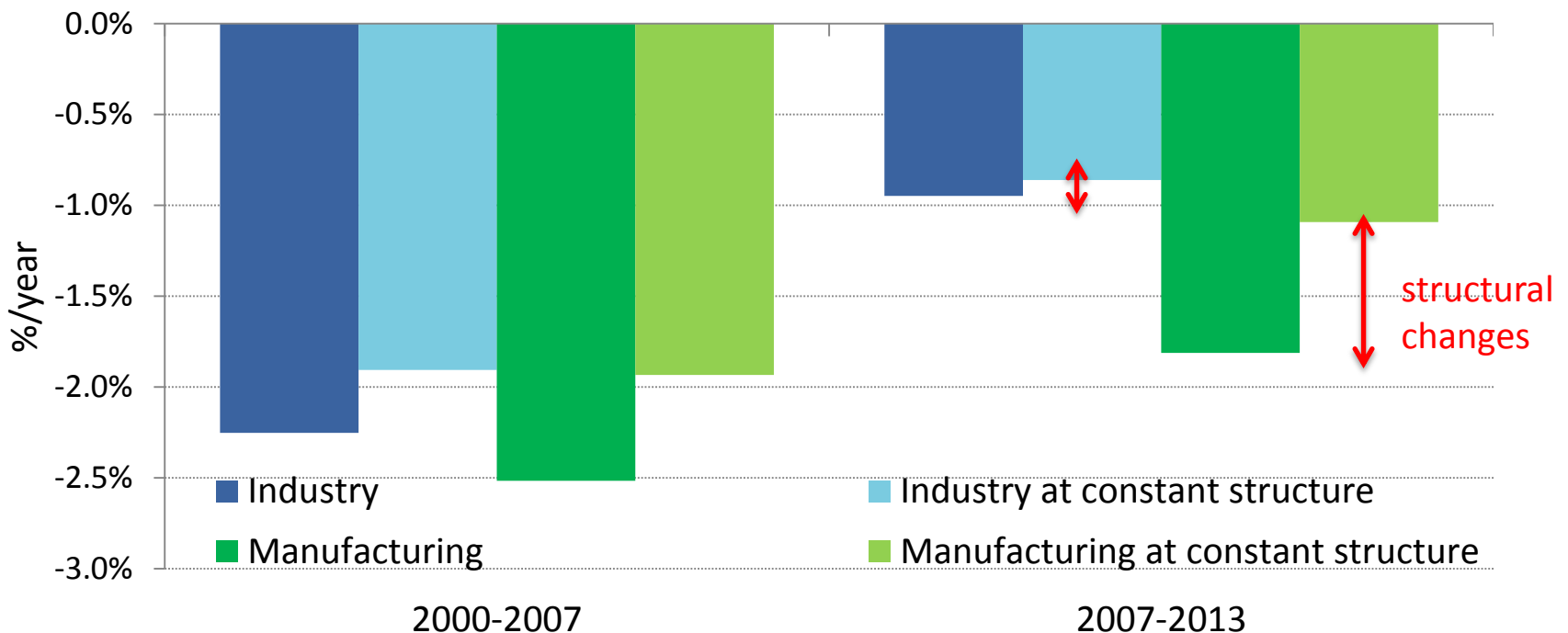
- At EU level, structural changes **explain half** of the energy intensity decrease in manufacturing industry since 2007.
- Structural changes were generally quite **significant in 10 countries** where they explain more than 60% of the intensity decrease (Ireland, Hungary, Greece, Slovakia, Spain, Croatia, Denmark, Norway, Lithuania and Germany)

Impact of structural changes on the energy intensity of manufacturing (2007-2012)



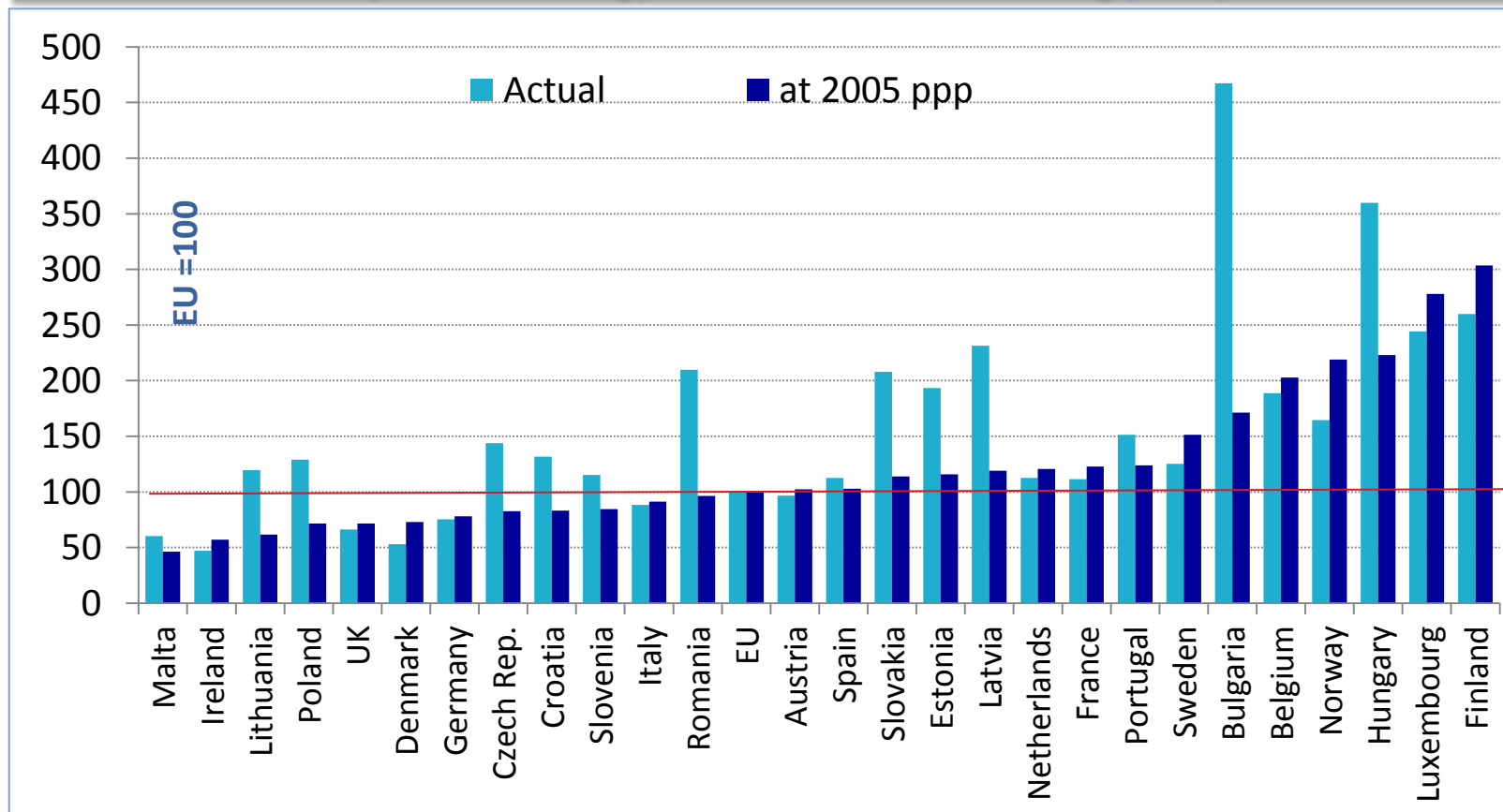
- Reduction of the intensity of manufacturing almost twice faster than for the industry as whole since 2007 mainly due to the strong recession in construction.
- Important impact of structural changes for manufacturing towards less intensive branches, which explain 40% of the intensity decrease since 2000.
- However at industry level structural changes are marginal because the structural changes in manufacturing are offset by a decreasing share of construction in industry value added.

Intensity trends and structural changes in industry and manufacturing (EU)



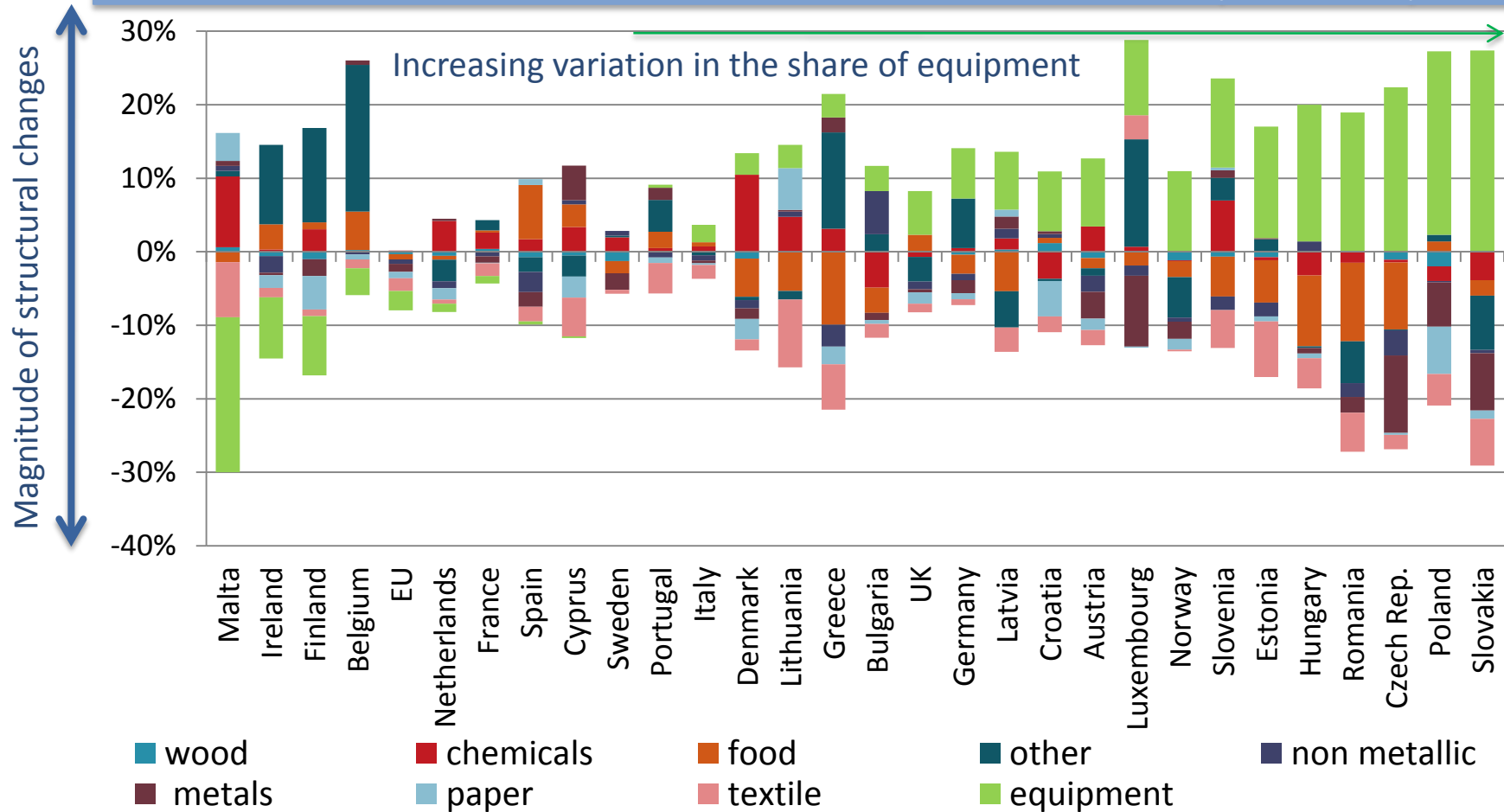
- Very large differences in the energy intensity of manufacturing industry based on market exchange rates
- Comparison at purchasing power parities is more relevant as closer to technical energy efficiency as most of value added is made of salaries, and is thus function of relative values of living costs (i.e. purchasing power parities)

Comparison of energy intensities in manufacturing (2012)



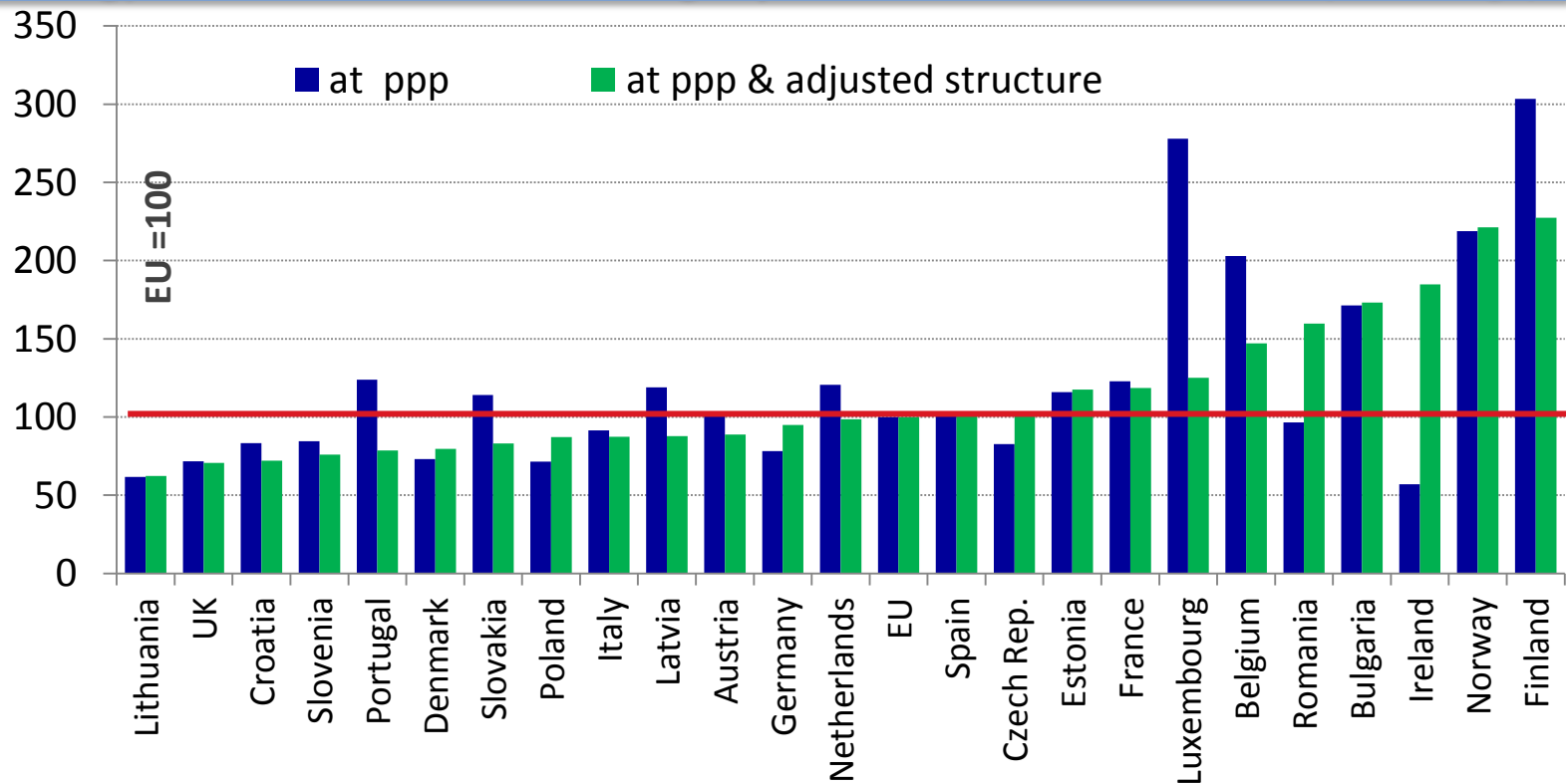
Growing share of equipment, the less energy intensive branches, in most countries between 2000 and 2012

Variation in the share of each branch in total value added (2000-2012)



- Comparisons of energy intensity are more relevant with energy intensities adjusted to the same value added 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, Slovakia, Czech Rep, Romania); for countries with a higher share of energy intensive branches, the adjustment reduces the intensity; for Finland, countries with a very high share of pulp and paper industry, the adjustment through value added is not sufficient.

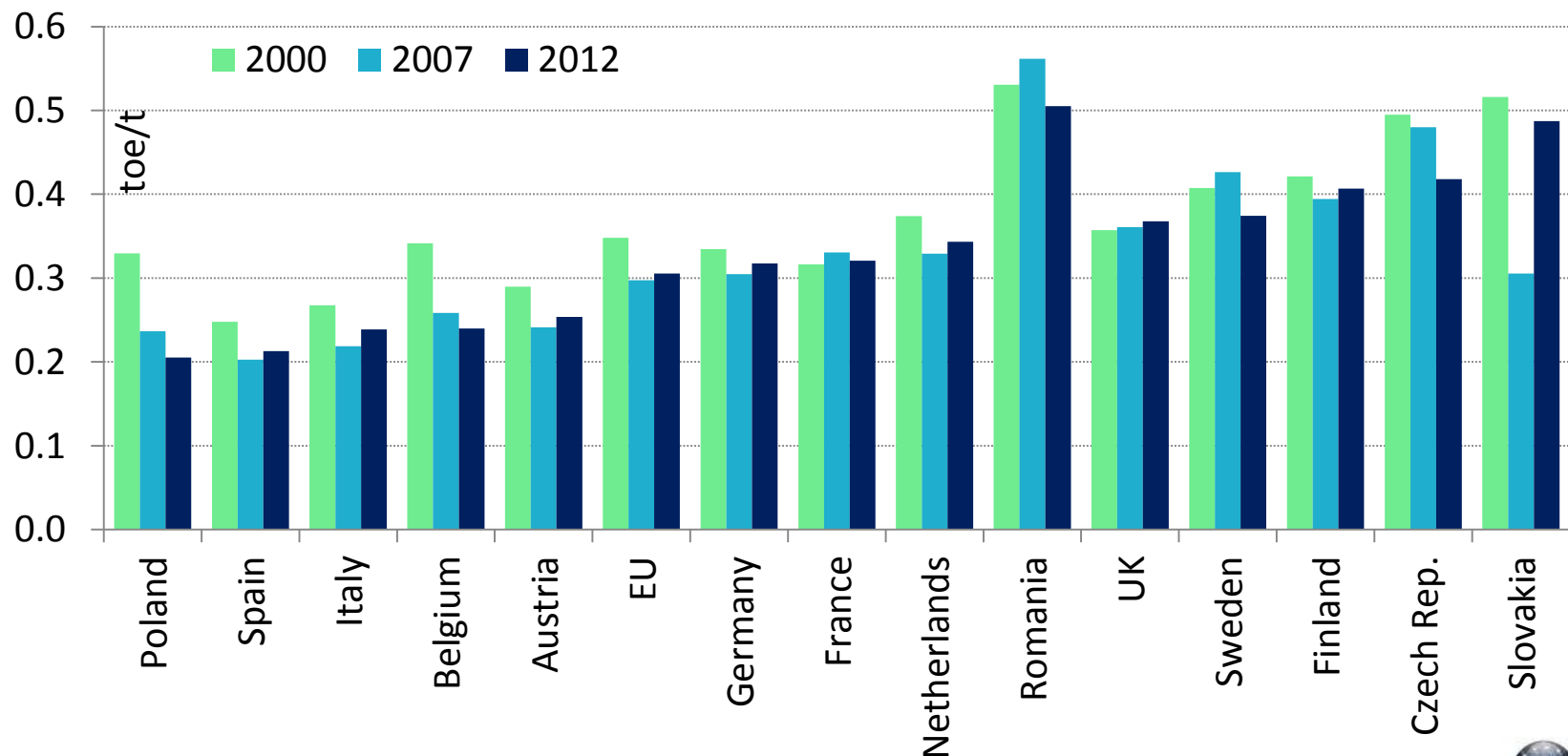
Energy intensities of manufacturing adjusted to the same structure (EU average)



1. Trends in energy consumption
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- **Decreasing** specific consumption **until 2007** in most countries (-2.2%/year at EU level).
- **Since 2007**, slight increase in half of countries and at EU level (by 0.5%/yr for the EU).
- The impact of the crisis on the specific consumption may be affected by changes in the production mix between electric and oxygen steel and by the closure of old steel mills.
- Differences among countries are mainly explained by difference in process mix.

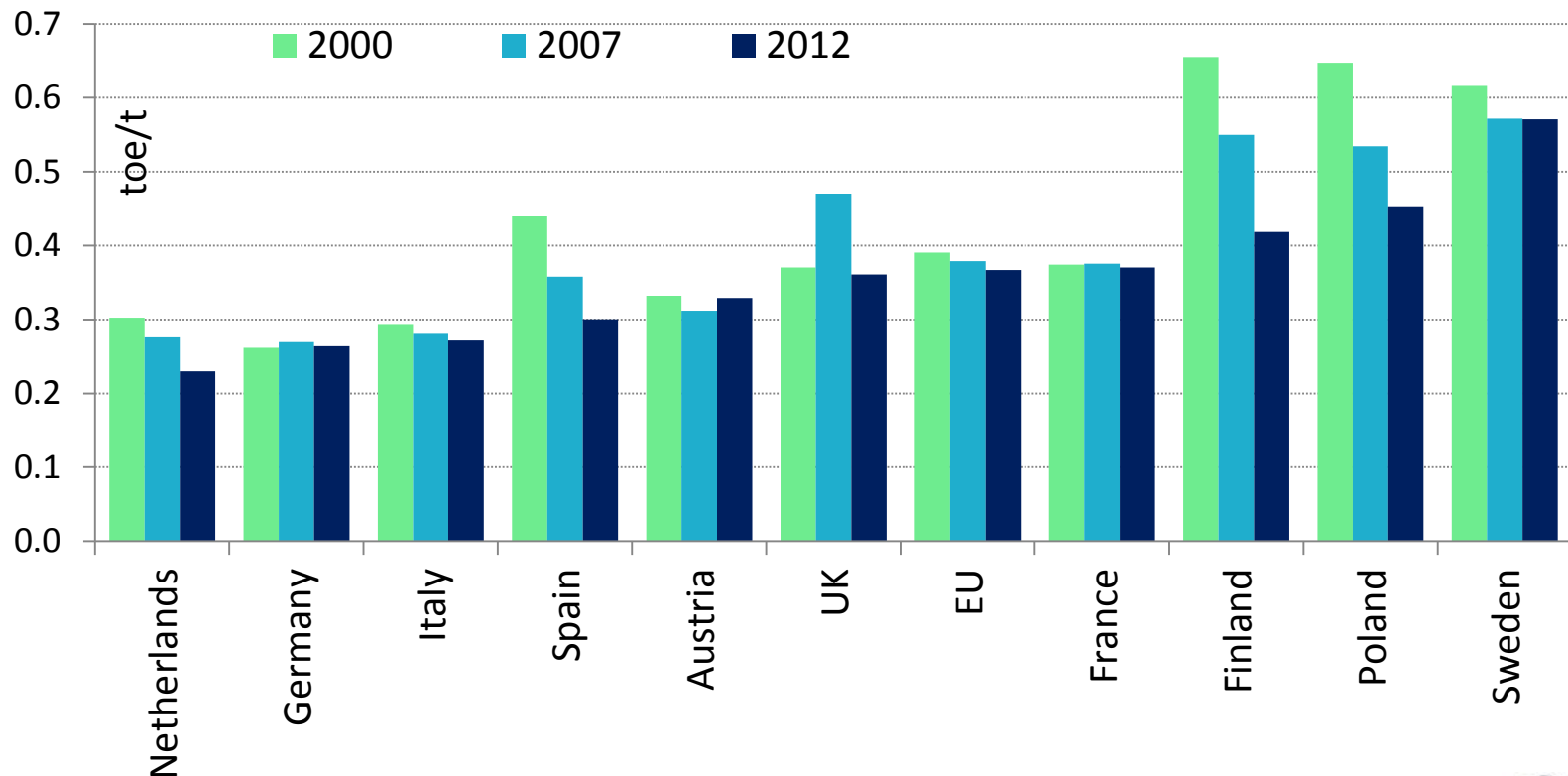
Trends in the specific consumption per ton of steel in EU countries



Only countries with production > 4 Mt are shown

- Regular decrease of the specific consumption per ton of paper in most countries over the whole period 2000-2012 (-0.5%/year at EU level).
- Finland and Spain have the largest reduction since 2000 (by more than 3%/year).
- Differences among countries depend on the level of pulp production.

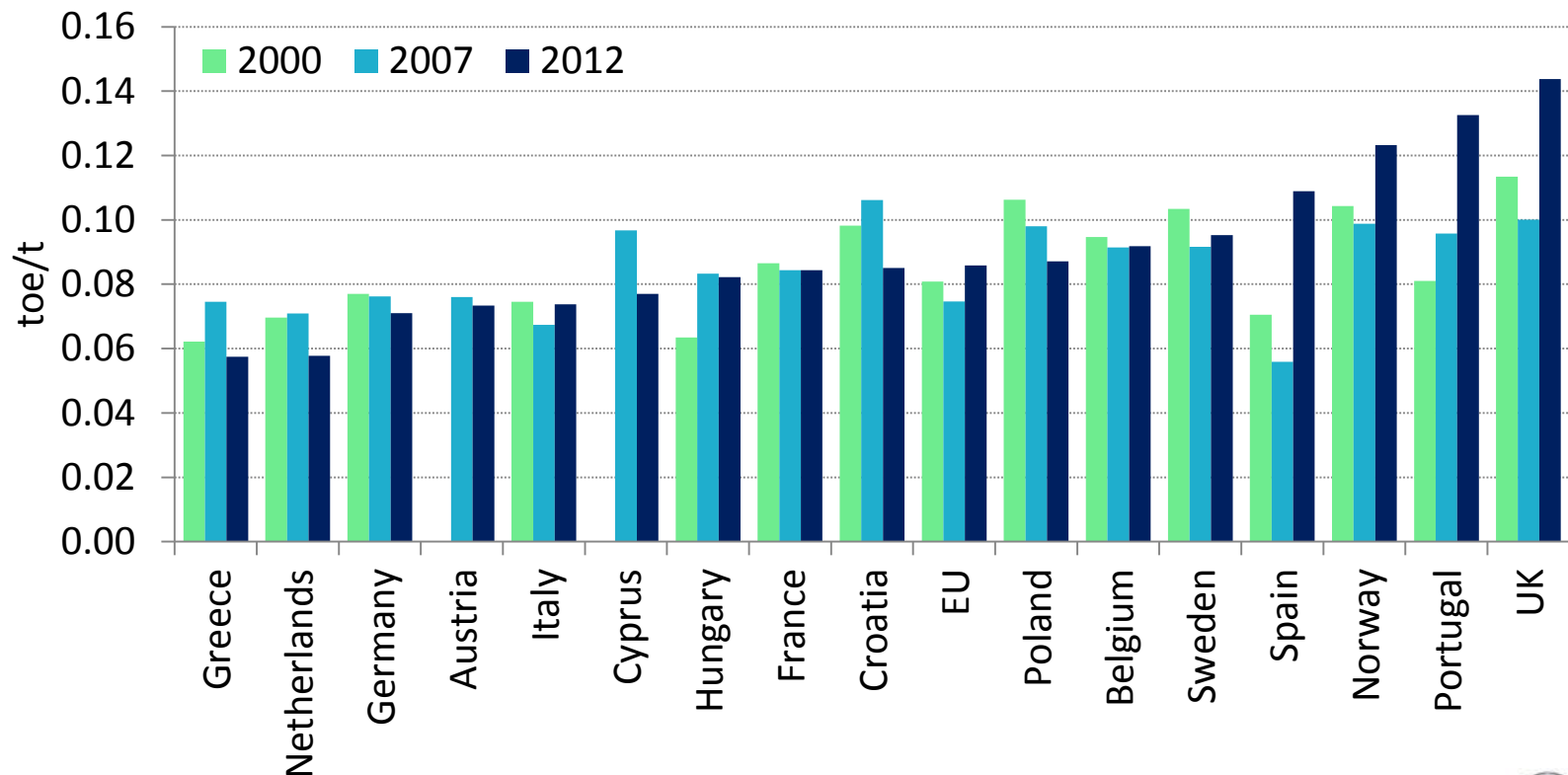
Trends in the specific consumption per ton of paper in EU countries



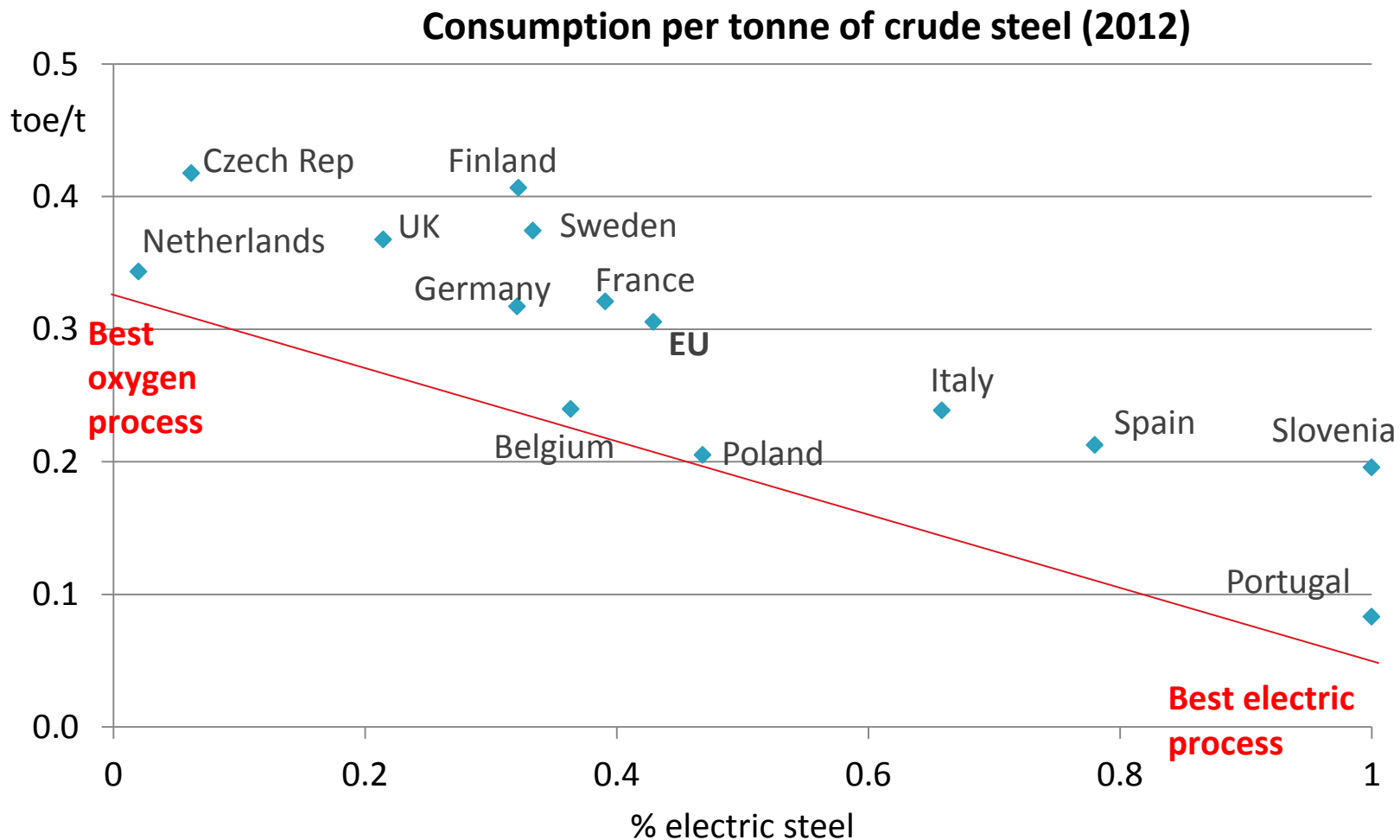
Only countries with production > 2 Mt are shown

- In 6 countries and at EU level, the specific consumption per ton of cement was **higher in 2012 than in 2007**, especially in countries with a deep recession with plants operating at low capacity (e.g. Spain and Portugal, with a drop in production of 70% and 44% respectively).
- In 7 countries, the specific consumption decreased; it remained stable in 3 countries.
- Differences among countries are partly explained by differences in the ratio clinker to cement production and in the efficiency of cement factories.

Trends in the specific consumption per ton of cement

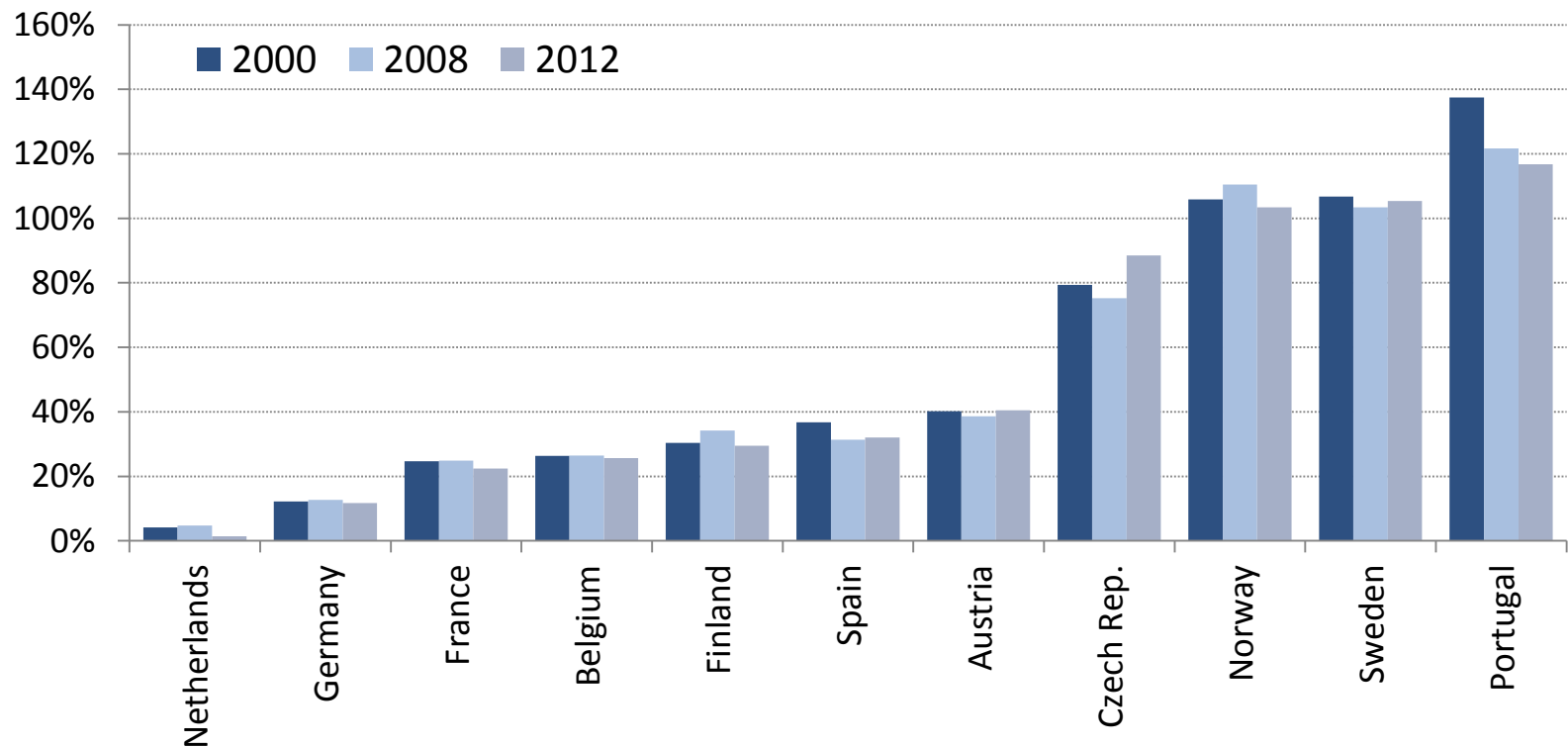


Difference in specific consumption partly explained by differences in process mix; distance to blue line shows possible potential of energy efficiency gains



- Decreasing share of the ratio pulp production over paper production in almost all countries over time except for Czech Rep and Austria.
- The lower the ratio pulp/paper, the lower should be the average energy consumption per ton of paper

Ratio pulp/paper production in EU countries

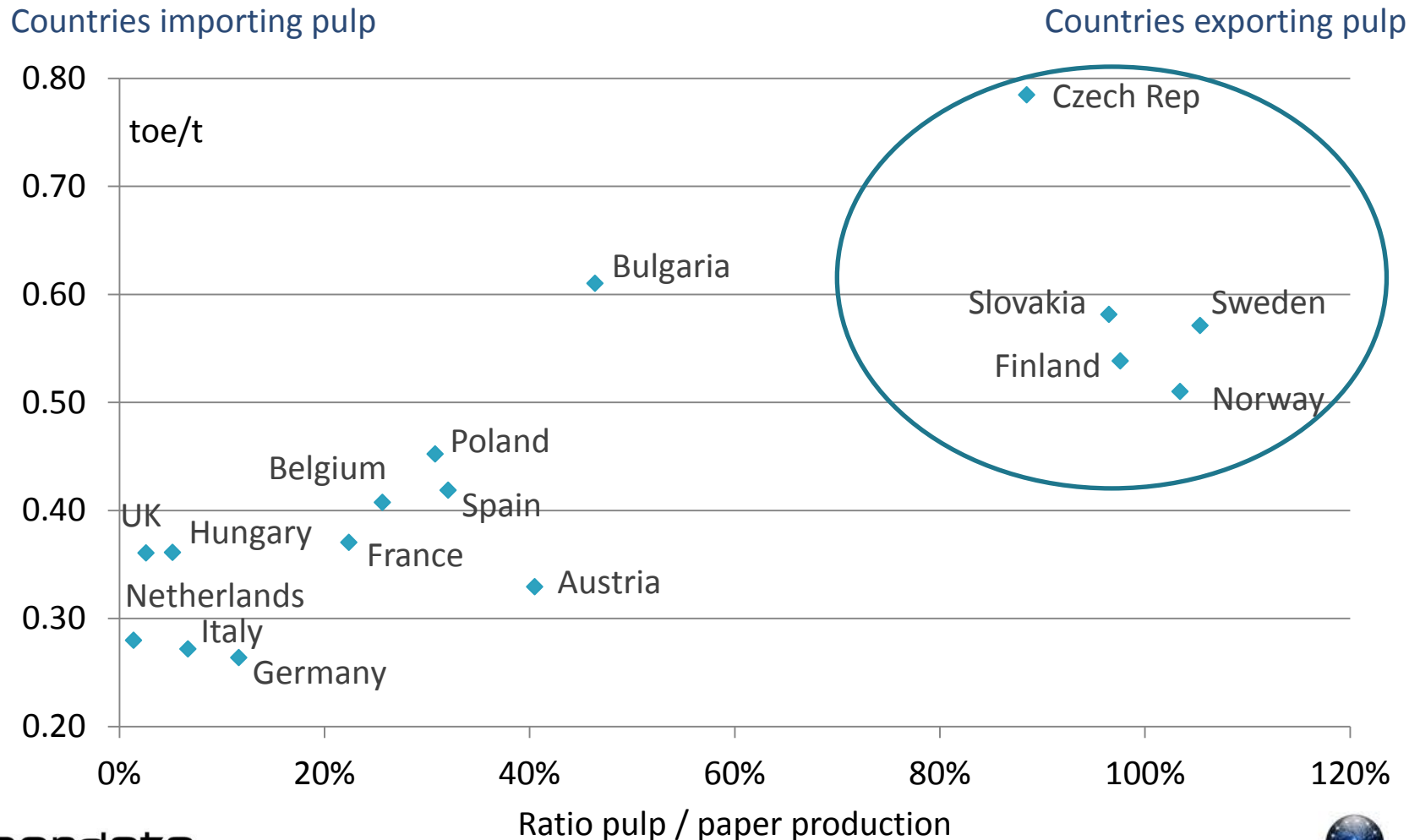


A ratio of 0.5 means that 50% of the paper is produced from imported pulp

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.

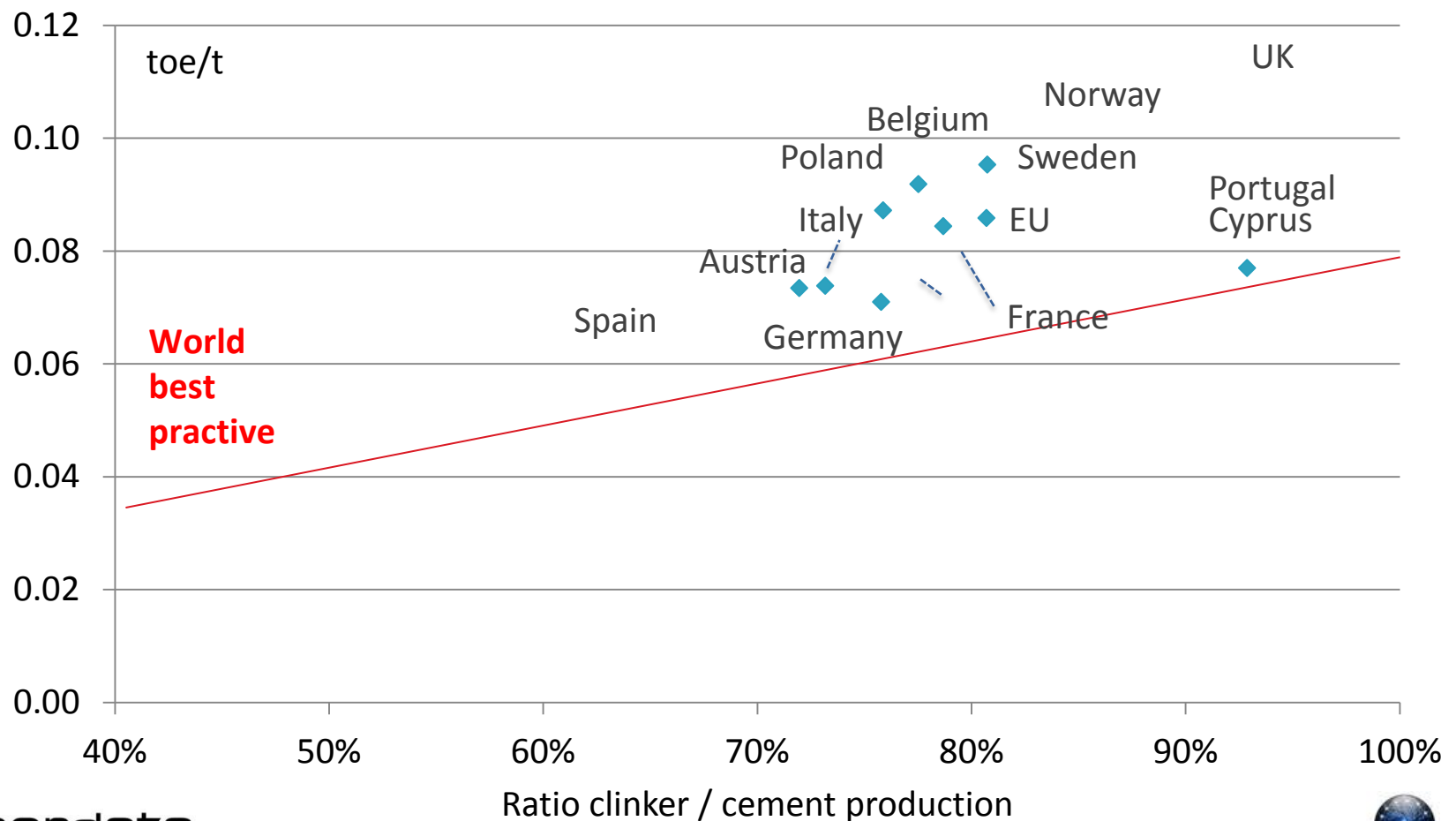
Comparisons should be made at similar level of this ratio: for countries with a high production of pulp, Norway and Finland have the best performance.

Specific consumption per ton of paper



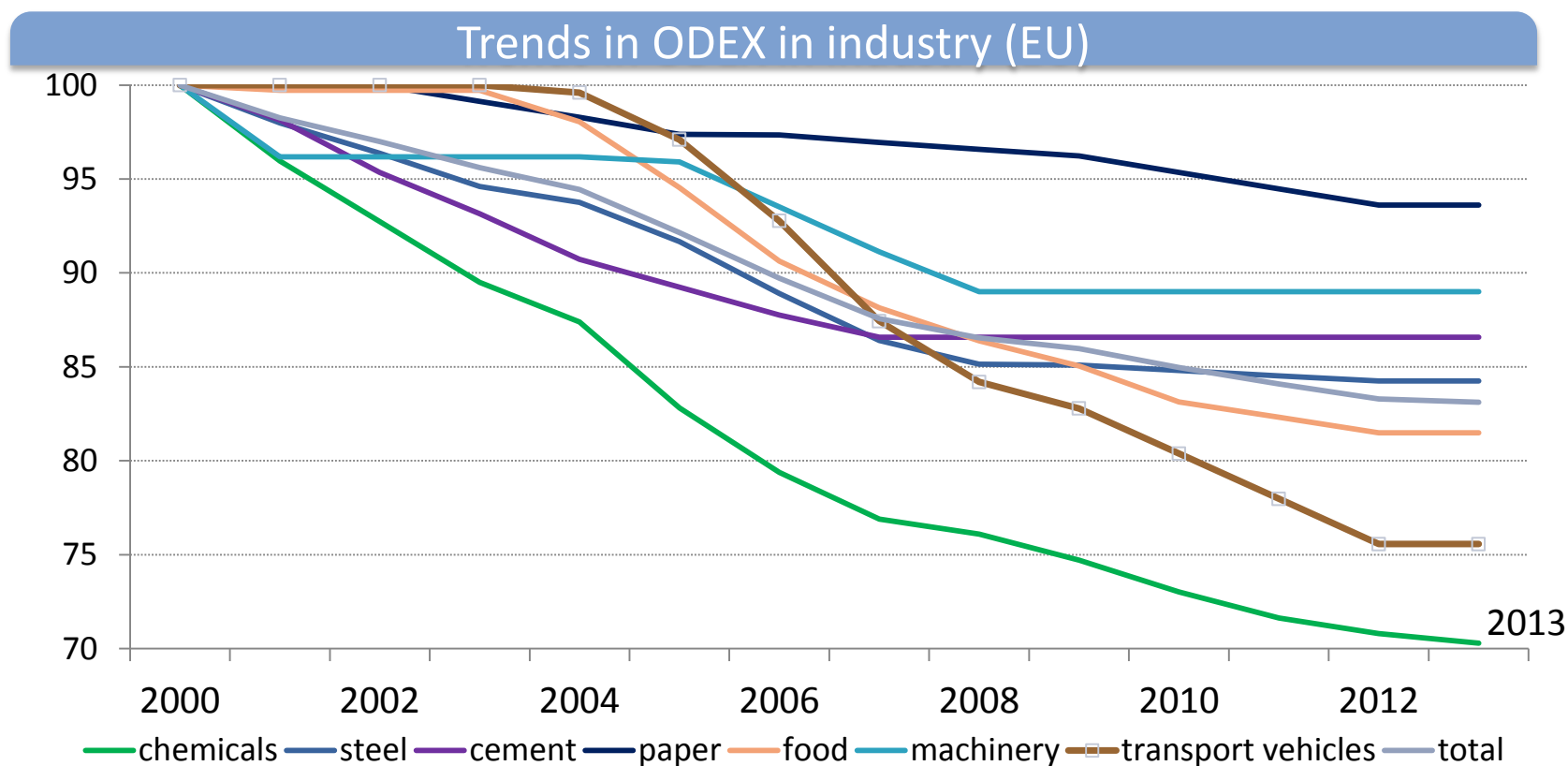
The graph below shows the energy performance of cement production in relation to the share of clinker produced in the country in cement production: the higher this ratio, the higher the specific energy consumption. For a given value of the ratio, the distance to the red line (best practice) indicates the potential of energy savings

Benchmarking of the specific energy consumption of cement



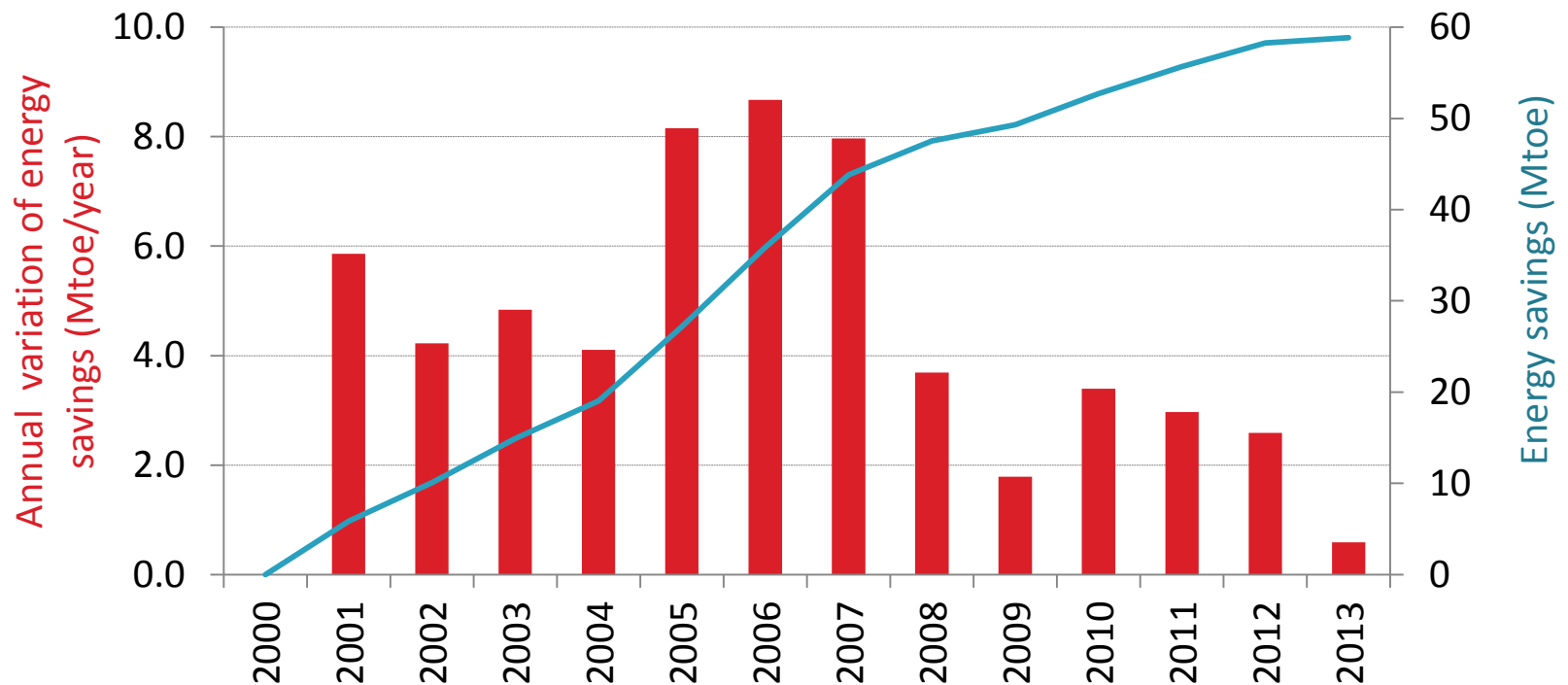
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- ▶ 5. **Energy efficiency trends**
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- Taking into account the trend of the specific consumption for steel, cement and paper and for the other branches, the ODEX decreased by 1.4%/year on average since 2000 (17%).
- Slower energy efficiency progress since 2007 (0.9%/yr from 2007 to 2013 compared to 1.9%/year from 2000 to 2007) be cause of a slower progress in some branches since 2007 and even no more energy efficiency improvement for others because of the recession (e.g. steel, cement, machinery).



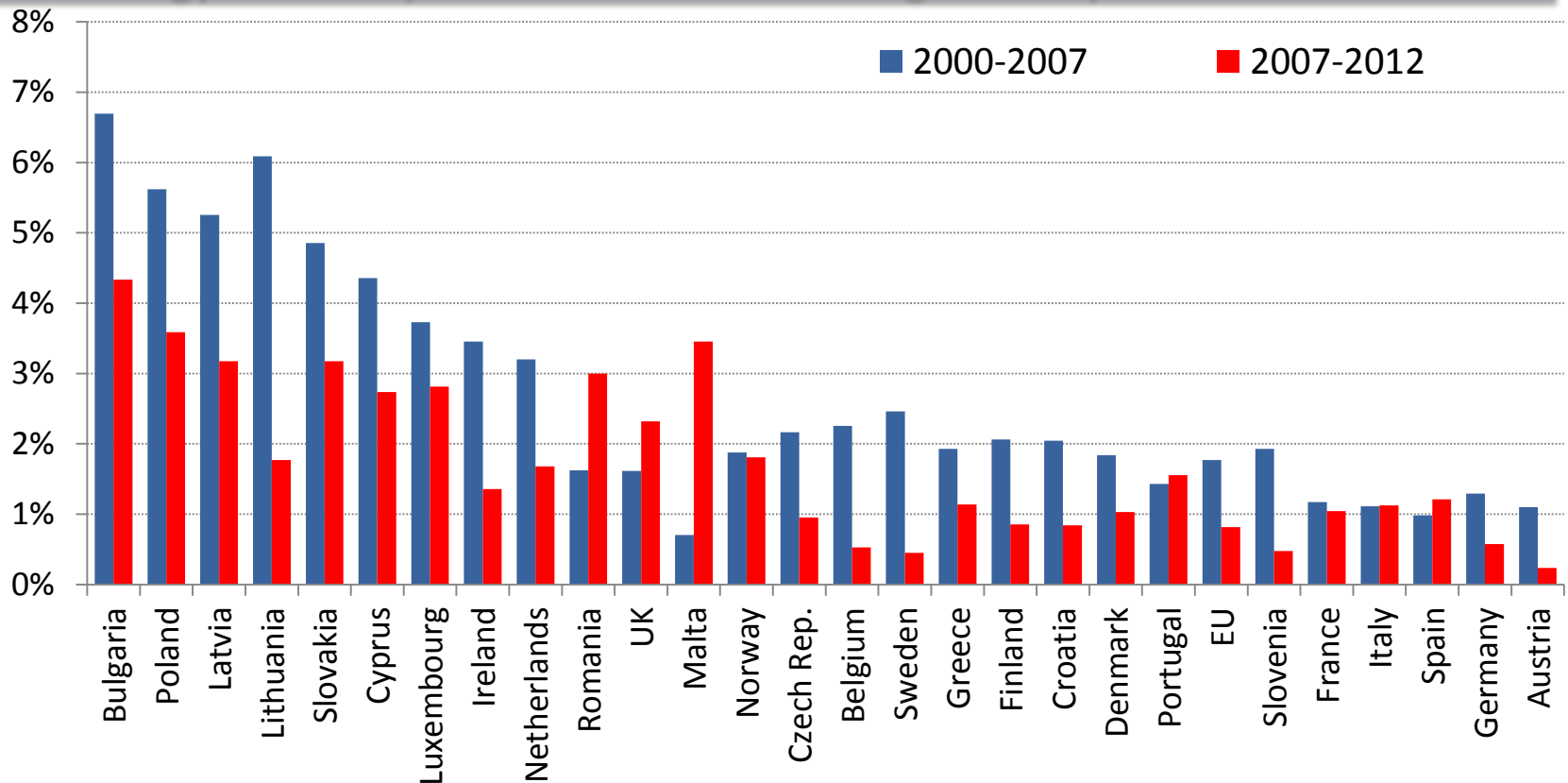
- The annual volume of energy savings in industry has more than halved since 2007 from an average of 6,3 Mtoe/year to 2,5 Mtoe/year.
- In 2013, energy savings reached almost 60 Mtoe compared to 2000: without energy efficiency improvement, energy consumption would have been higher by 60 Mtoe.

Energy savings in industry (EU)



■ Since 2007, a deterioration of energy efficiency is observed in almost all countries due to the recession and the fact that factories do not operate at full capacity and are thus less efficient.

Energy efficiency trends in manufacturing industry in EU countries

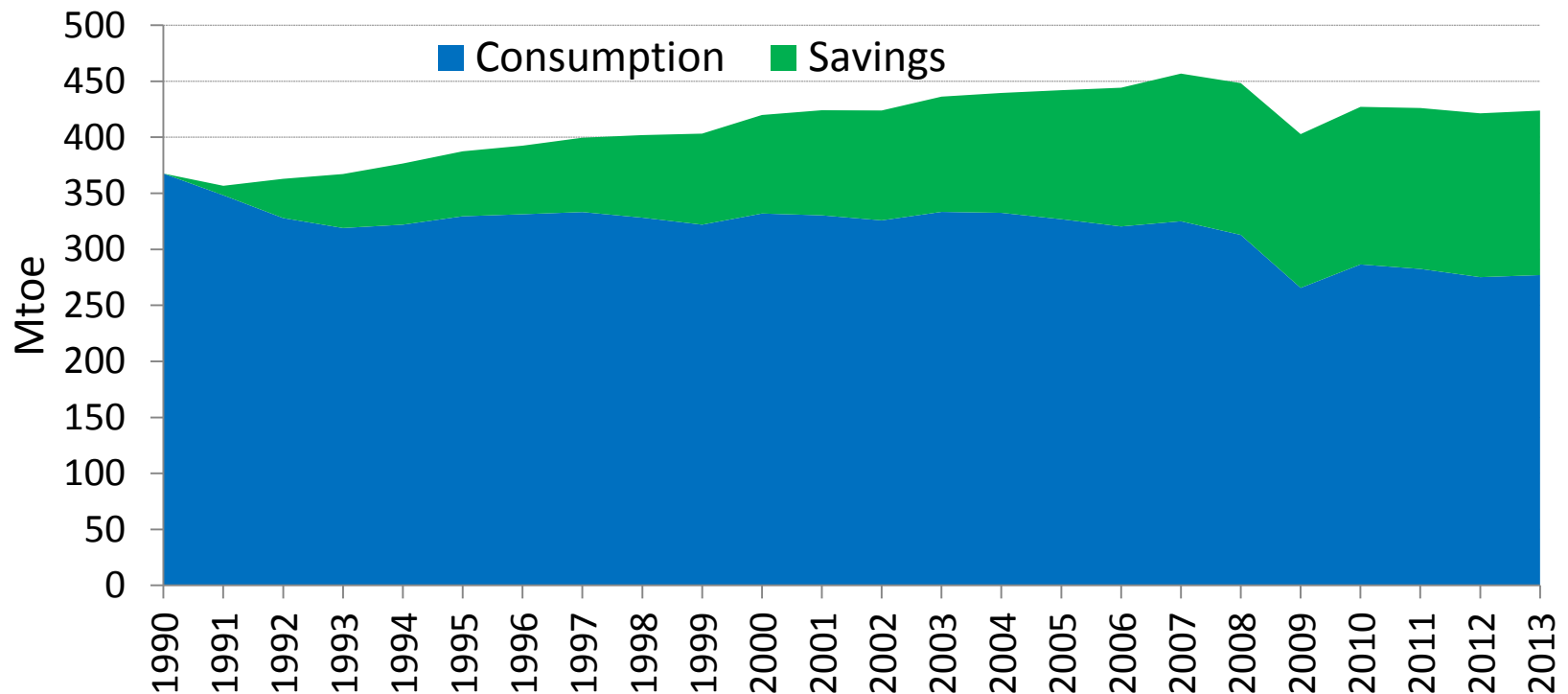


Note: Only “technical savings” are represented, i.e. net of the negative savings due to inefficient operation for industry

In 2013, energy savings in industry reached around 150 Mtoe compared to 1990: without energy efficiency improvement, energy consumption would have been higher by 150 Mtoe.

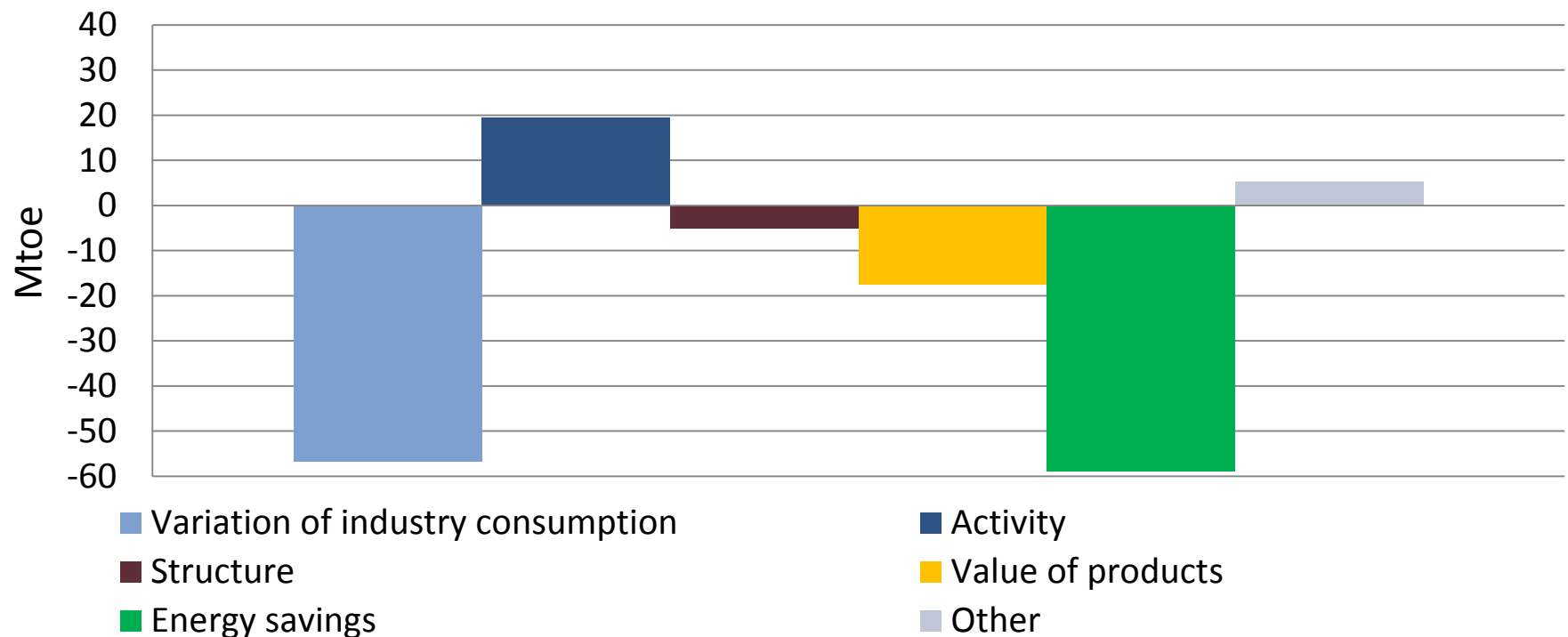
Since 2000 the savings reached 60 Mtoe.

Energy consumption and savings in industry (EU)



- Industrial energy consumption decreased by around 57 Mtoe between 2000 and 2012, which is equivalent to the energy savings achieved .
- The moderate industrial growth only contributed to increase consumption by 20 Mtoe, which was balanced by the effect of the increasing value of production (higher value added per unit of production) has a higher effect.
- Structural effects towards less energy intensive branches had a marginal effect.

Drivers of energy consumption variation in industry at EU level (2000-2012)



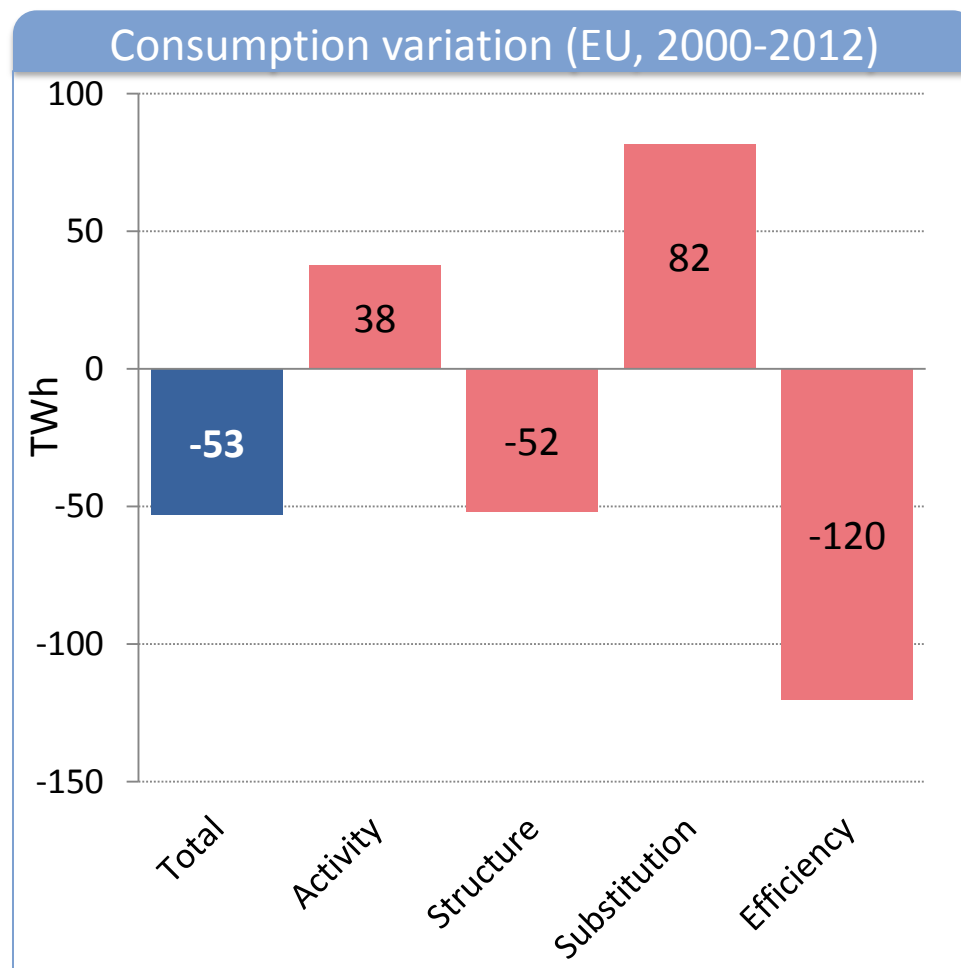
Source: Decomposition facility

Value of product: change in ratio value added over physical production (<0: increasing value);

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



Drivers of electricity consumption variation in industry between 2000 and 2012 (EU)



■ Two factors contributed to increase the industrial electricity consumption between 2000 and 2012:

- Industrial growth (38 TWh)
- Substitution of electricity to fossil fuels (+ 82 TWh) mainly in machinery, food and steel.

■ Their effect was more than counterbalanced by energy efficiency improvements (-120 TWh or 12 TWh/yr), mainly in chemicals and steel.

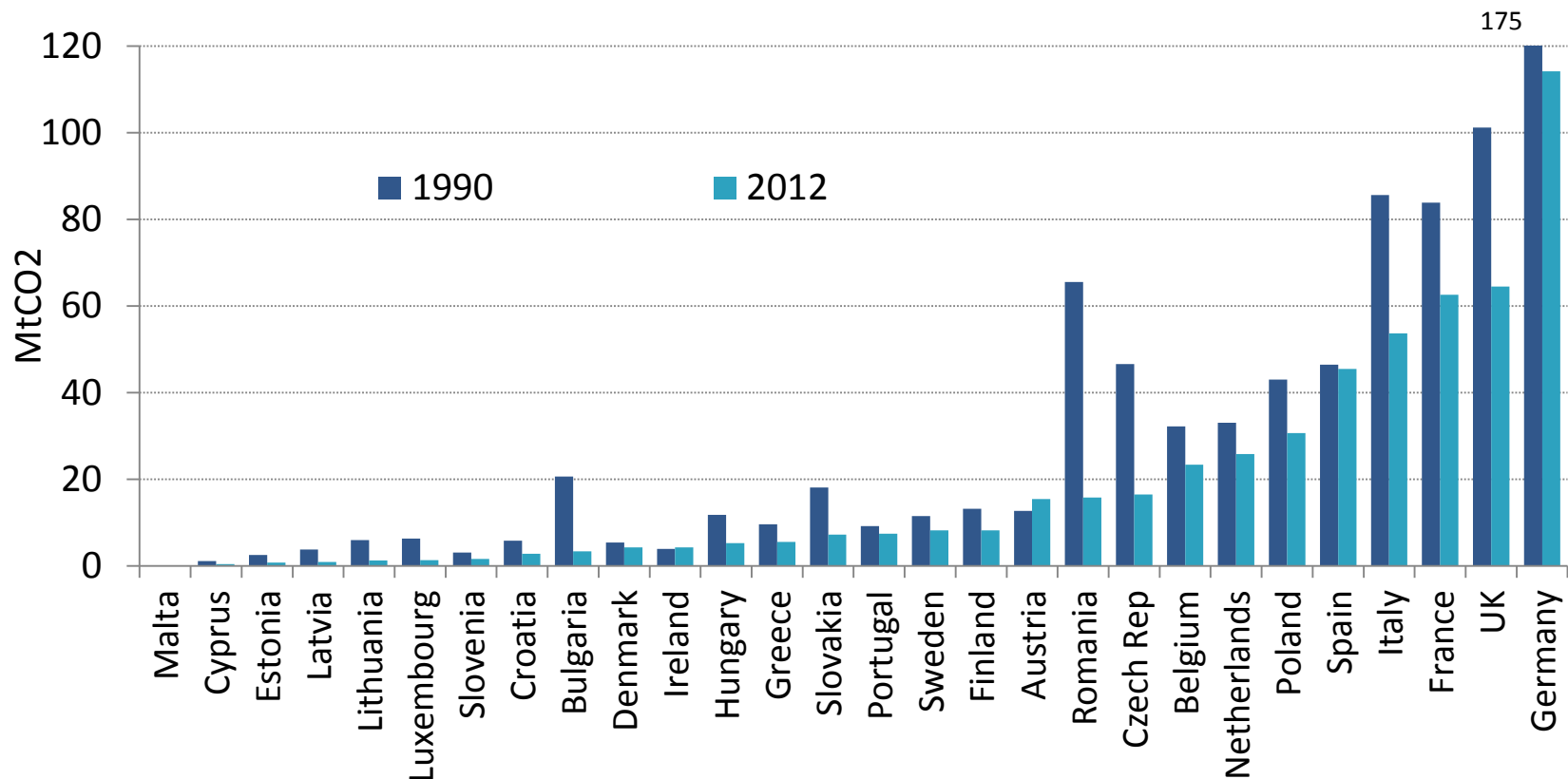
■ Structural changes towards less electricity intensive branches also contributed to lower consumption (-52 TWh) (increasing share of chemicals and machinery in the industrial value added and decrease of non ferrous).

Source: Enerdata

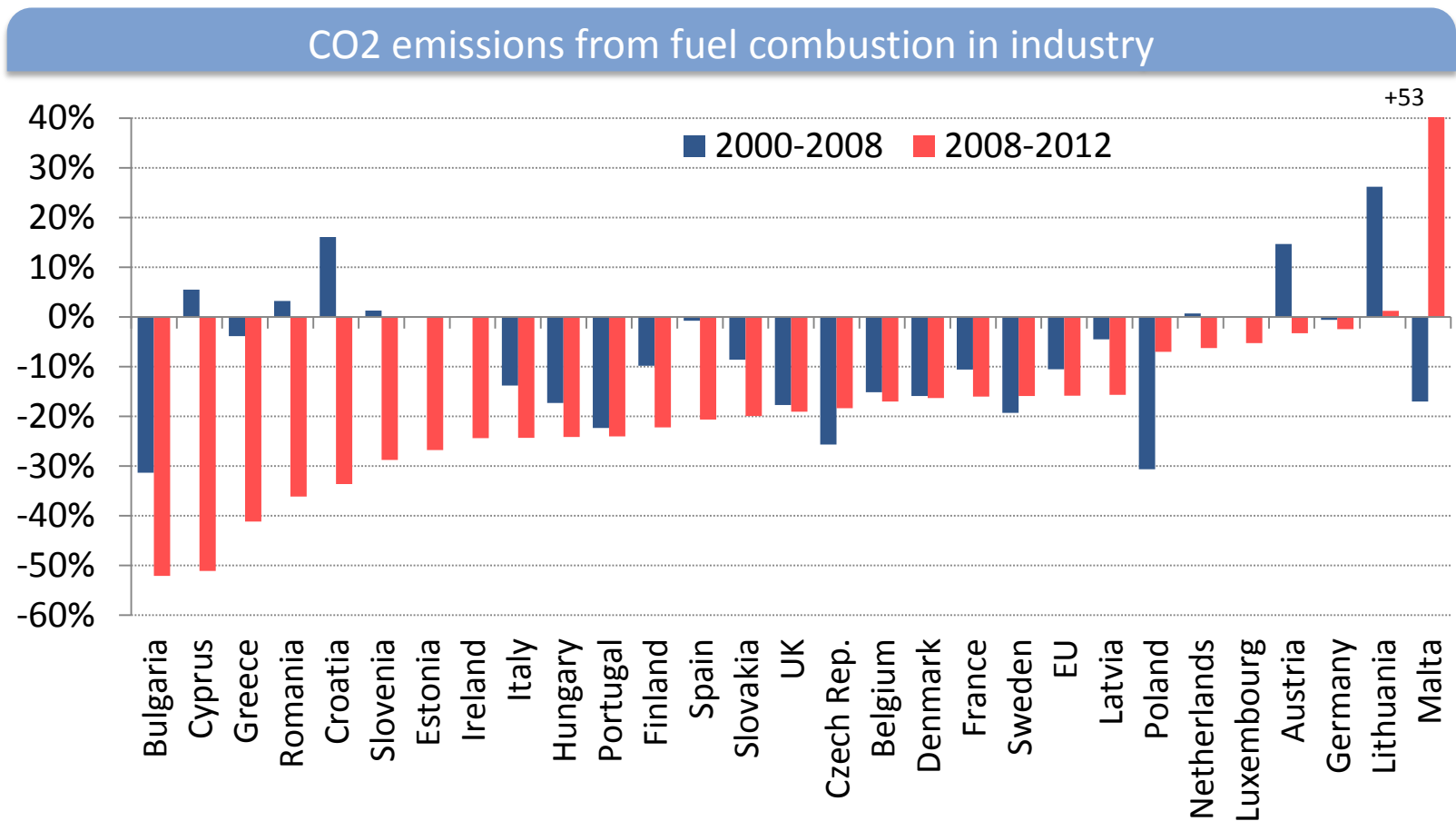
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- Decreasing CO2 emissions from fuel combustion in almost all countries except Ireland and Austria;
- Strong reduction (60-80%) in most new member countries (except Poland, Slovenia, Croatia, Hungary and Malta) and in Luxembourg
- -38% of reduction for the EU as a whole

CO2 emissions from fuel combustion in industry

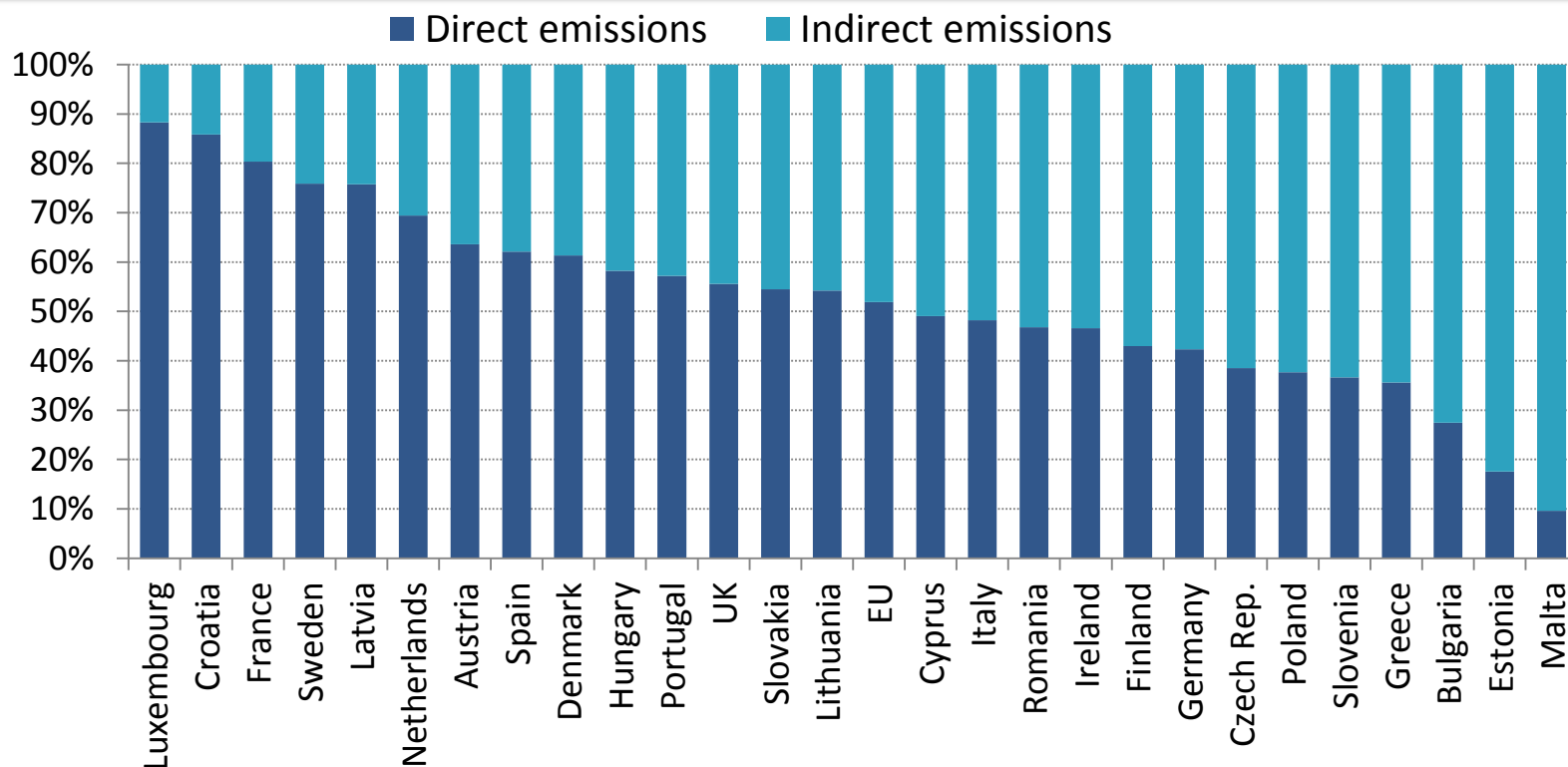


- Higher reduction in CO2 emissions from fuel combustion since 2008 in all countries except Czech Rep., Sweden, Poland, Lithuania and Malta.



- Indirect CO2 emissions of industry are of the same magnitude as direct emissions in the EU in 2012; large discrepancies between countries depending on energy mix for public power generation (16% in France, 53% in Germany)

Direct and indirect CO2 emissions in industry in 2012



Indirect emissions: emissions induced by electricity purchased ; emissions of electricity sector allocated to industry in proportion of its share in electricity consumption