Training Seminar

Evaluation of energy efficiency trends and potentials

Grenoble, 30 January – 10 February 2006

Energy efficiency in industry: policy measures and indicators

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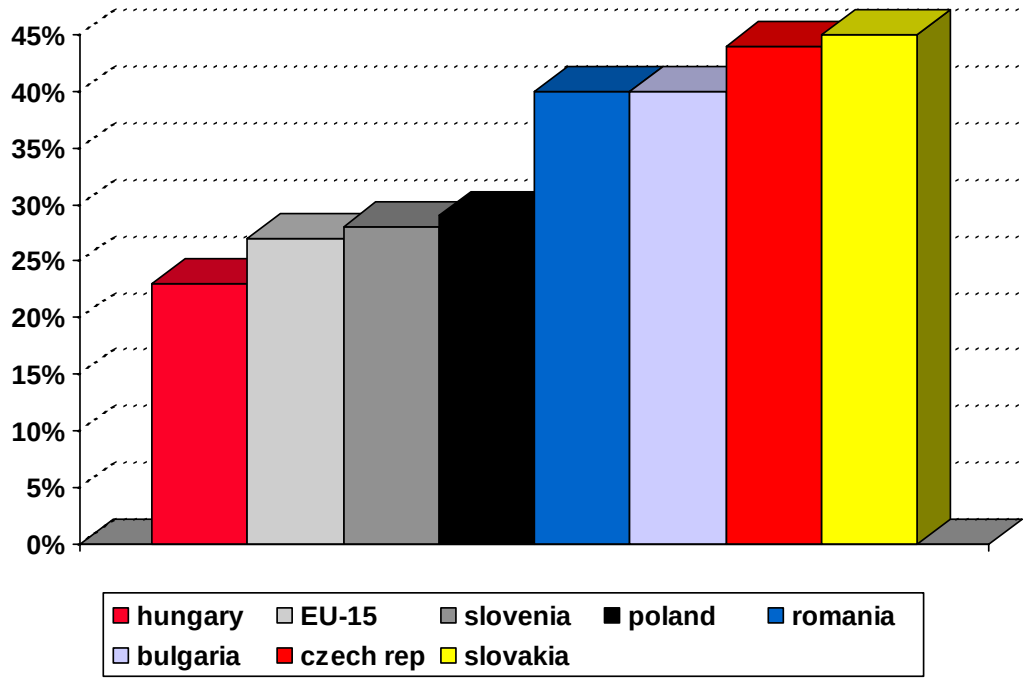
Comparison of industry performance
Target values of energy efficiency improvement by sector

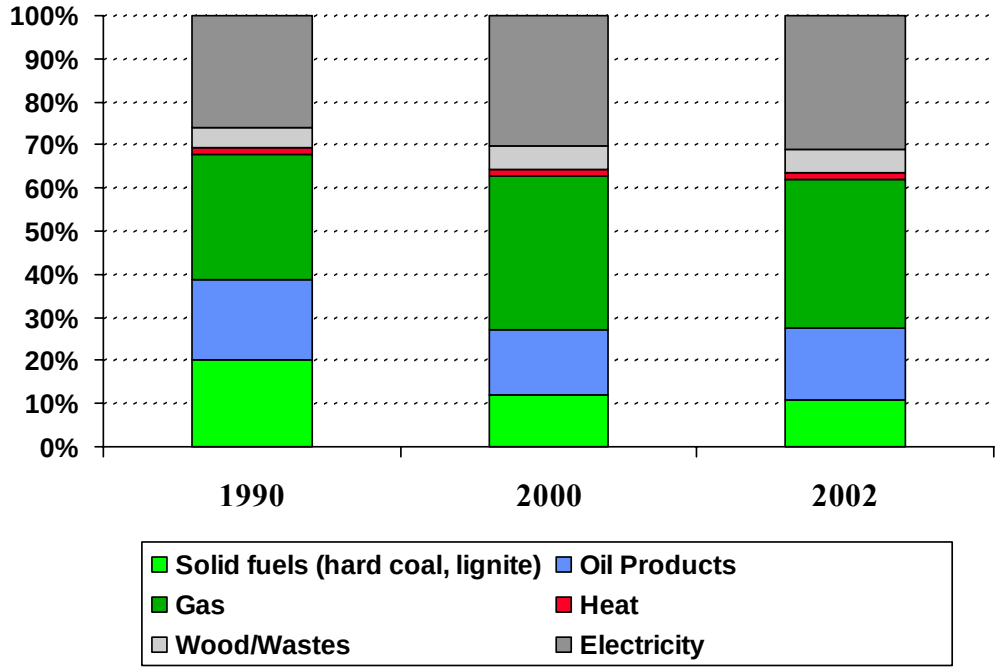
Energy consumption pattern

Share of industry in final energy consumption (2001)

Share of industry in Hungary slightly above 20%, in Poland and Slovenia similar to the EU-15 (just below 30%), in Romania, Bulgaria, Slovakia and Czech Republic above 40%.

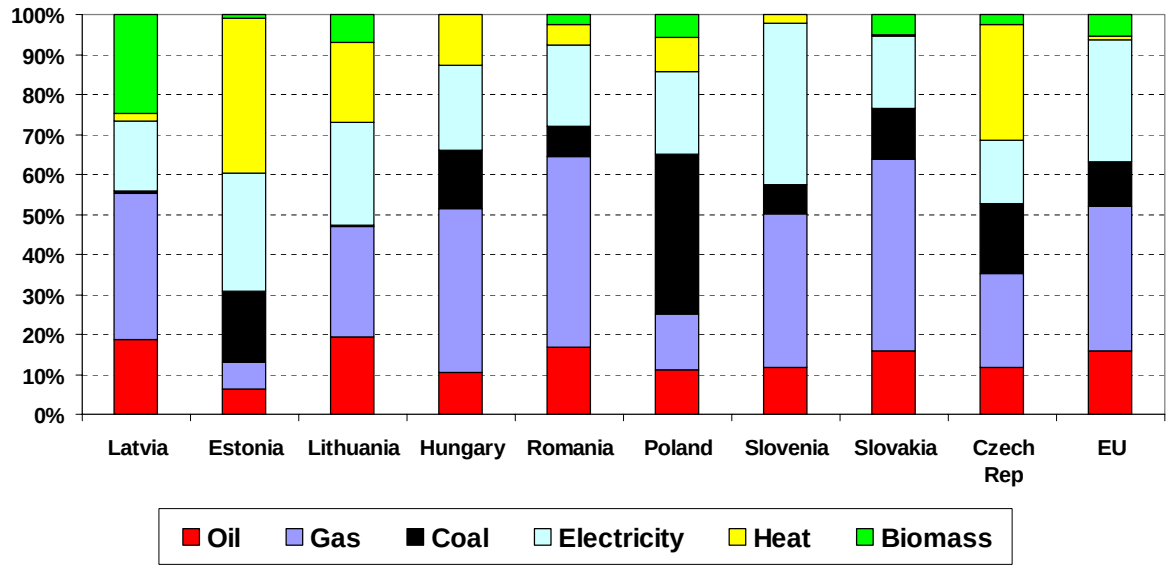


Industrial energy consumption by energy (EU-15)

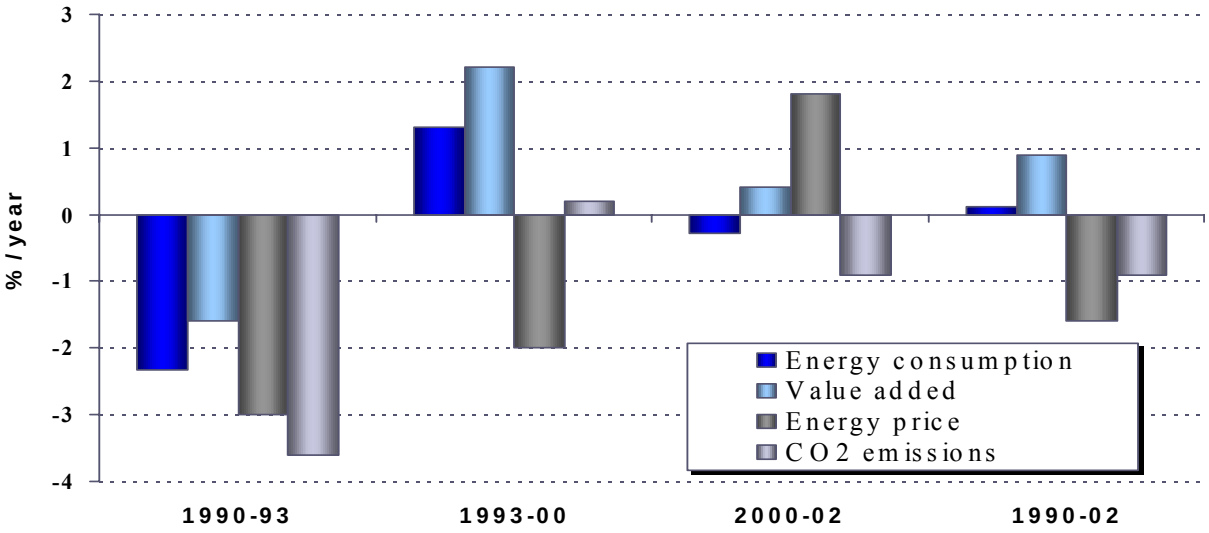


Industry energy use by energy (2001)

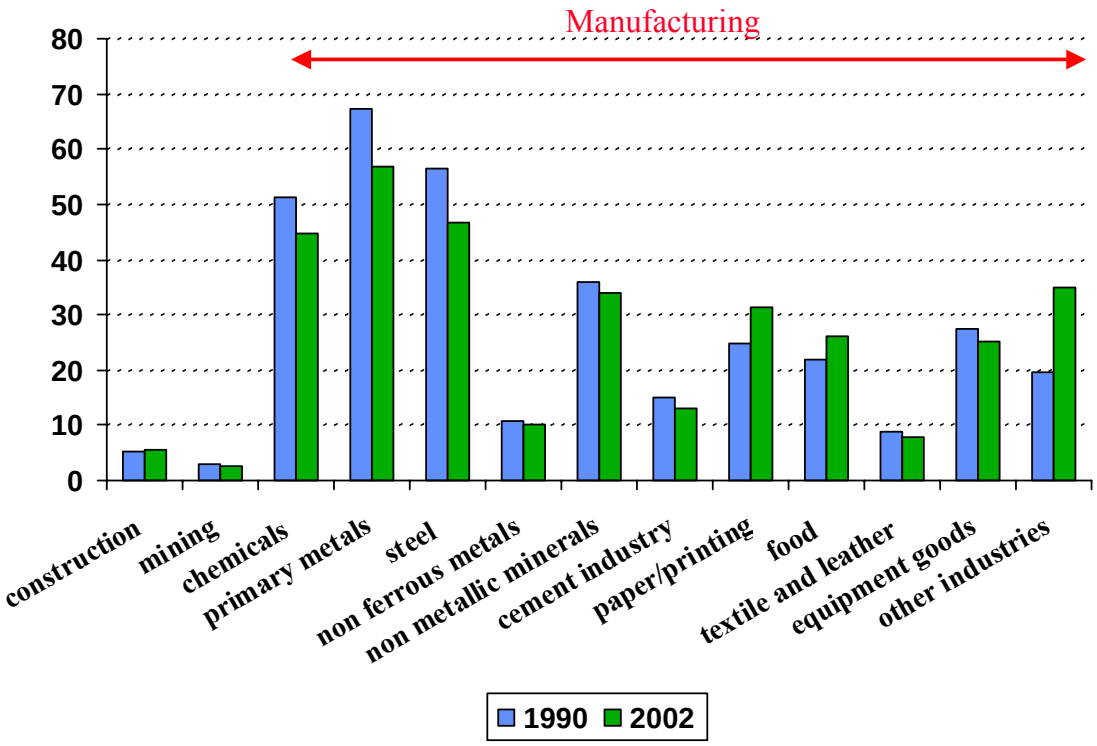
Natural gas is a major energy source for the industry sector in most countries, Poland has a high share of coal (40%). Difference with EU average includes the use of (district) heating in Czech Rep, Poland, Hungary, Lithuania and Estonia. Latvia has a high share of biomass in energy use .



Industrial energy consumption stable despite 1 %/year increase in value added; CO_2 emissions decreasing 1 %/year

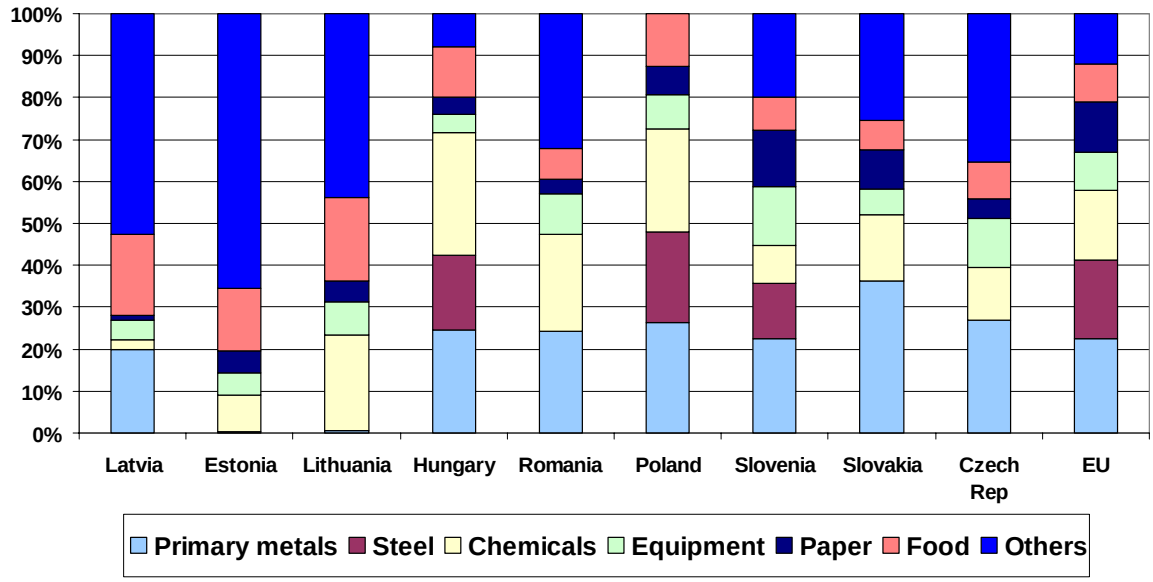


Industrial energy consumption by industrial branch (EU-15) (Mtoe)



Energy use by industrial branch (2000) (%)

The industrial branches responsible for the major share of energy use in both the EU and majority of candidate countries are primary metals, steel and chemicals.



Energy efficiency policies and measures in industry

Different types of energy efficiency policies and measures in industry

Taxes

Regulations : ETS Directive, other regulations

Fiscal and economic incentives

Information of consumers (audits,…)

Voluntary / negotiated agreement

Package of measures

Taxes

• Ecotaxes : carbon tax (eg « climate change levy in the UK)

--- Fiscal neutrality: overall tax level unchanged

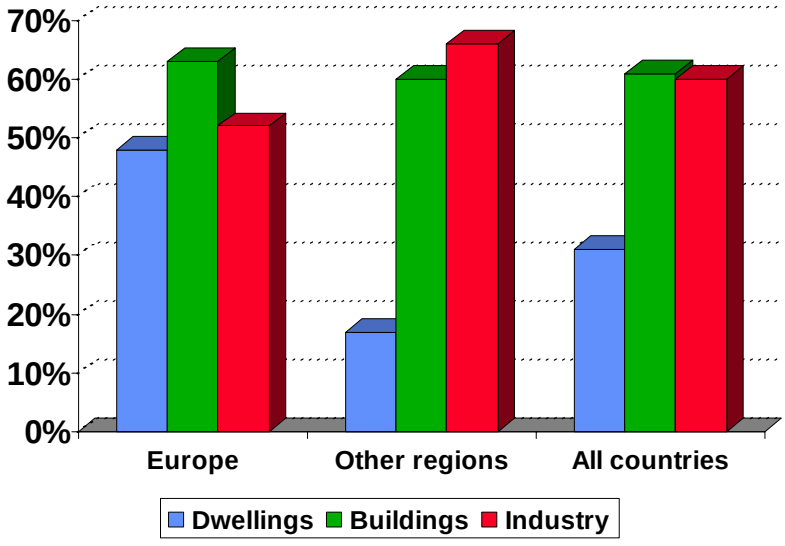
--- Reduction on the tax if commitment on energy savings engagement (eg discount of 80% with climate change levy in UK) Ł association in a package of measures

•Limits for industrialists : distortions of competition

Regulations

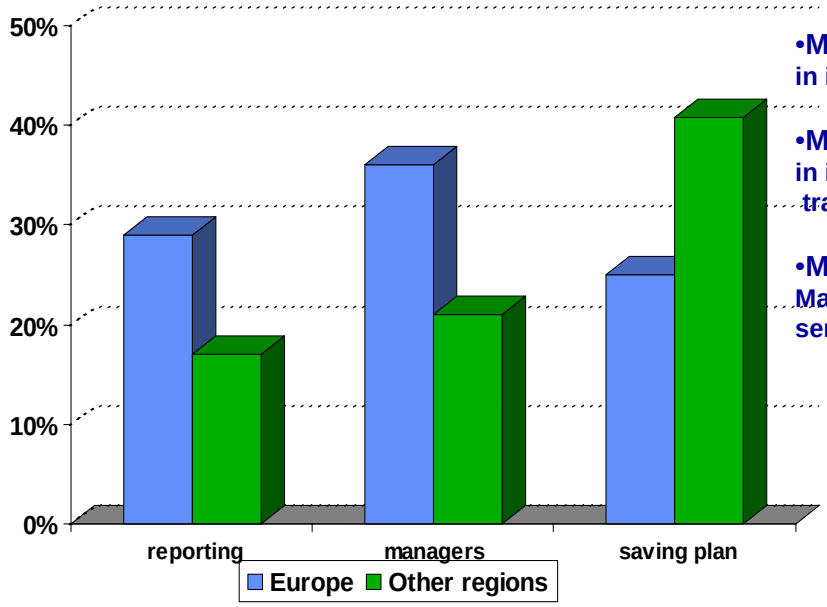
Obligation of making audits
Efficincy standards on equipment (boiler, motors…)
Obligation of reporting energy consumption
Obligation of nomination of an energy man in the company
Obligation of energy savings plans
Caps (eg limits) on CO 2 emissions (ETS Directive)

WEC survey : energy audits



- **Industry and services**
- About 60% of countries with audits programmes
- Mandatory audits in 1/3 of the schemes in Europe (15% for other regions)

WEC survey : other regulations



- **Mandatory consumption reporting**
  in industry & services (10 countries)
- **Mandatory energy managers**
  in industry (11 countries) , services (8) transport (4)
- **Mandatory saving plan**
  Mainly industry, transport in 3 countries, services (5), municipalities (1)

EU-Emissions Trading System (EU-ETS)

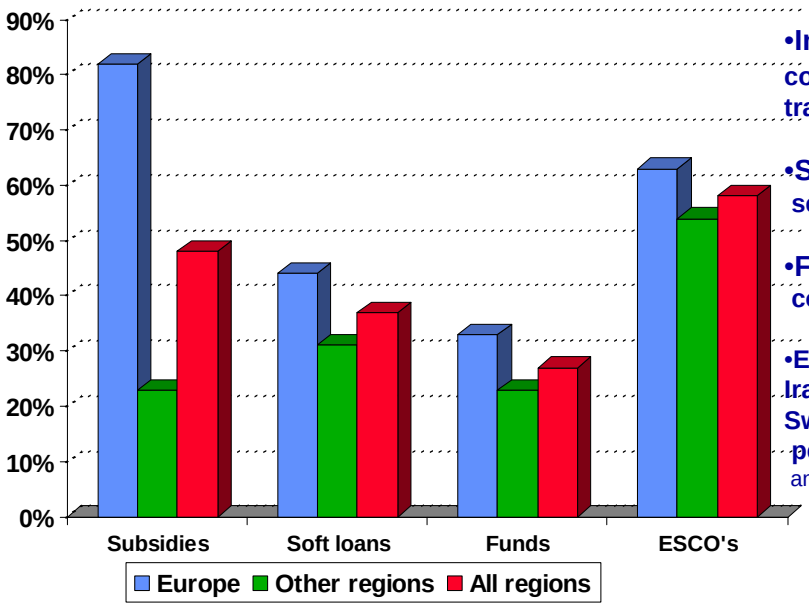
- Start of cap-and-trade system in January 2005 for CO_2
- Cover emissions from combustion and process
- Mandatory participants for large energy consumers: combustion installations (> 20 MW_{th}), coke ovens, refineries, and most energy-intensive installations in industry (steel, cement, glass, ceramics,pulp and paper)
- Member States had to hand National Allocation Plans with: overall targets, individual allocation to installations, rules for new emitters, closures, CHP, national reserve
- Penalty if no respect: 40 /t CO2
- Possibility of trading

Economic & fiscal incentives for energy efficient equipment

- Economic incentives
  - --- Subsidies for audits
  - --- Subsidies for investments
  - --- « Soft loans »
  - --- Guarantee Funds of investments

- Fiscal incentives
  - ---Accelerated depreciation
  - --- Reduction of taxes (VAT, import taxes)

WEC survey : Economic incentives



- **Investment subsidies: Industry (21 countries), services (18),households (14) transport (10)**
- **Soft loans: industry (15 countries) services (11), households (8)**
- **Funds: guarantee funds (2),often combined with environment funds**
- **ESCO's : significant in Germany, Japan, Iran, Australia, Austria, Hungary and Switzerland; average turn over of 0.5 M$ per ESCO** (much higher in Hungary and Canada)

Subsidies on audits in industry:France

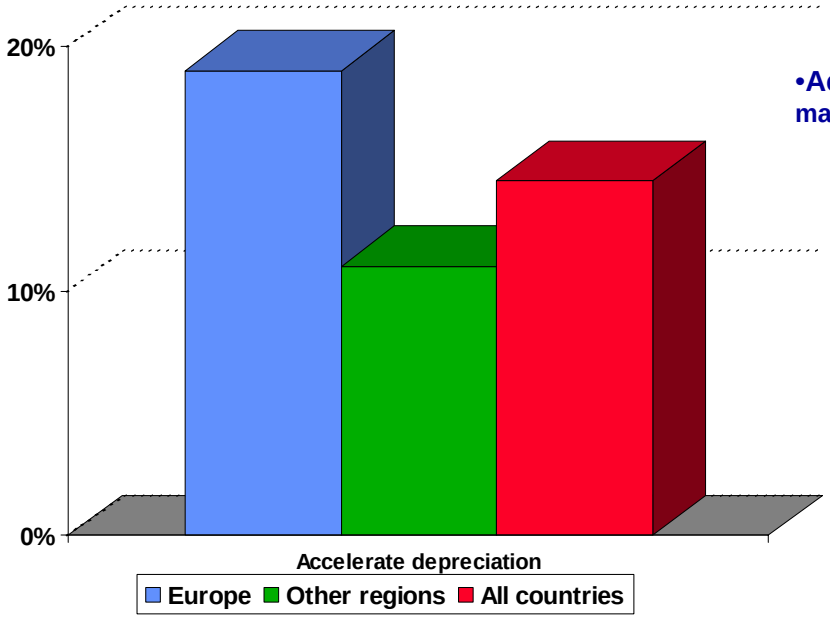
Financial support by ADEME is 70% for a light audit (cost < 2300 euros) and 50% for detailed audit (cost < 30 k) or feasibility studies (cost < 75 k)

	2000	2001	2002	2003	2004
Total audits	**839**	**540**	**764**	**498**	**562**
Prediagnosis	**591**	**342**	**360**	**299**	**418**
Diagnosis	**216**	**162**	**367**	**163**	**106**
Feasability studies	**32**	**36**	**37**	**36**	**38**
Pilot studies	**35**	**60**	**47**	**33**	**26**
Energy savings ktoe	**14**	**10**	**19**	**10**	**9**
CO2 (ktCO2/year	**14**	**10**	**19**	**10**	**9**

Evaluation of subsidies on audits in industry: France

- 78% of audits led to an investment
- 56% of the recommended actions were actually undertaken,
- About 37% of the implemented actions implied an investment,.
- 29% of the investments cost less than 1.5 k (28% with investments between 1.5 k and 7 k , 19% between 7 and 15 k , 10% between 15 and 38 k , 5% between 38 and 76 k , 9% more than 76 k)
- Average investment costs was 36 000 .
- Average pay back time is 2.45 years
- Average energy saving is 285 MWh/company or 24 toe
- Average reduction of CO2 emissions is 16.5 tCO2/ company.

WEC survey : *fiscal measures*



•**Accelerate depreciation:** industry mainly (8 countries)

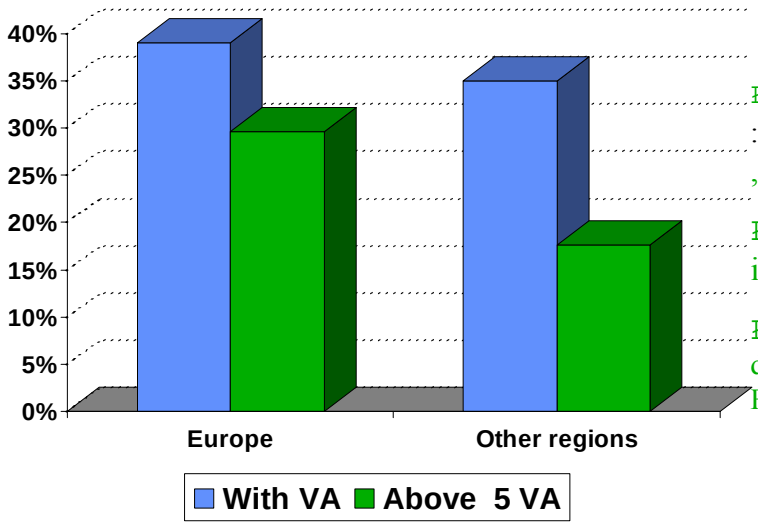
Information of consumers

- Information on « Best practice »
- Technical training

Voluntary agreement

- Covers: voluntary/ negotiated agreement or commitments
- With large consumers (Pechiney, Philips)
- With national or European professional associations
- Low public cost, rapid implementation
- But… potential savings may just correspond to what would have happened anyway?
- Problem of control and sanction

WEC survey : Voluntary Agreements



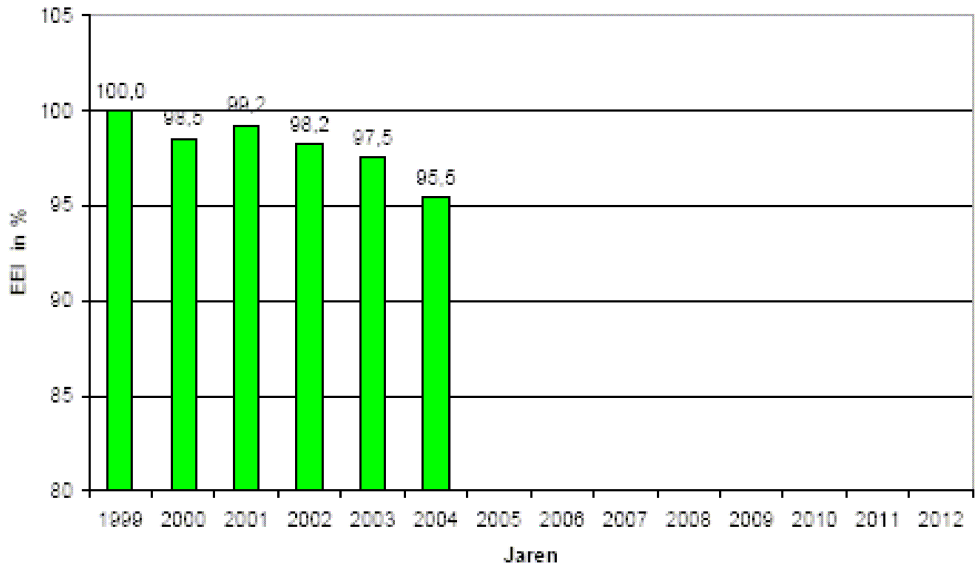
- **Most active countries in Europe:** :Denmark, Finland Netherlands, UK ,Germany, Switzerland, Spain
- **In emerging countries:** significant in Malaysia, Taiwan
- **Usually in industry,**: widely developed in services and transport in Finland, The Netherlands

Voluntary Agreements in the Netherlands

- **Long Term Agreements (LTA):**
  - Target of energy efficiency improvement in industry by 20% in 2000 compared to 1989 ; target achieved in most sectors ; mainly process improvements
  - Fiscal incentives (accelerated depreciation for a list of 450 technologies; fiscal deduction for energy efficiency investment up to 40%)
  - Revision after 2000 (introduction in less energy intensive sectors)
  - LTA-2: 2001 – 2012
- **Benchmarking agreement «** Benchmarking Covenants"
  - Industry should be in the 10% best performance in the world by 2012
  - In exchange no new tax or regulation

Impact of agreements in the Netherlands

Energie-efficiency Index (EEI): metered energy consumption for monitoring year divided by product of production in monitoring year with energy efficiency in reference year



Grafiek 3.1. Energie-efficiency index (EEI) van de industrie per monitoringjaar

Source: Benchmarking Covenant Monitoring Report 2004

EU-CEMEP agreement for electric-motors*

- From 60 to 70% of electricity used in industry for electric motors (France 69%, Japan 70%, Brazil 60%)
- Agreement CEMEP (European Committee of Manufacturers of Electrical Machines and Power Electronics) European Commission in 1999 (CEMEP/EU Agreement)
  - Introduction of a classification of electric motors according to energy efficiency class Ł 3 classes EFF1 (low efficiency) , EFF2 et EFF3 (best)
  - Labelling of motors
  - Reduction of the share of motors sold in class EFF1 by 50% between 1999 and 2003.

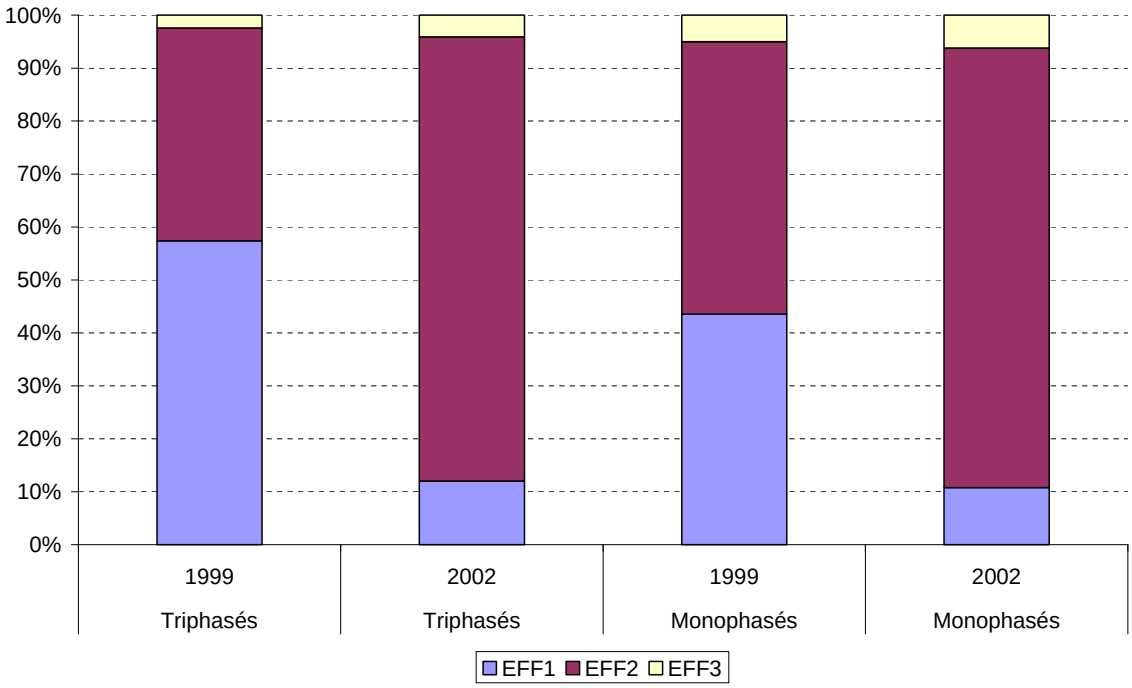
***Agreement for 2-pole- and 4-pole-motors (1.1-90 kW**

EU-CEMEP agreement

: CEMEP Monitoring Report 2003

EU-CEMEP agreement for electric-motors :

reduction of the share of 4 poles motors of class EFF 1 from 57% in 1999 to 12% in 2002 ; from 44% to 11% for 2 poles motors



Voluntary agreement of industry in Finland

- Industry uses approx. 50 % of the total energy use in Finland
- Voluntary agreement covers over 80 % of industrial energy use
- Impact evaluation done with information gained through the yearly reporting
- By the end of year 2004 energy savings in heat and fuels 4,4 TWh/a and in electricity 0,8 TWh/a
- Investments required by the saving measures were 221 million euros.

Package of alternative measures : ecotax in Denmark in industry

- Possibility for the industrial consumers to have a tax reductions if they submit to DEA (Danish Energy Authority) a plan including an audit, a plan of actions and target of energy efficiency gains
- If target not reached consumer has to pay the tax reduction
- More than 60% of industry consumption has signed Ł similar to UK (carbon levy)

Package of alternative measures : case of energy intensive industry: Norway

- Pulp and paper industry (later on all energy intensive industry)
- Full exemption from the electricity tax (0.55/MWh)
- Energy efficiency obligations:
  - Implement a standardised energy management system
  - Carry out energy audit and identify el. red. measures
  - Implement identified el. efficient measures with a payback <3 years within 5 years

Energy efficiency indicators by branch: sectoral indicators

Industry indicators

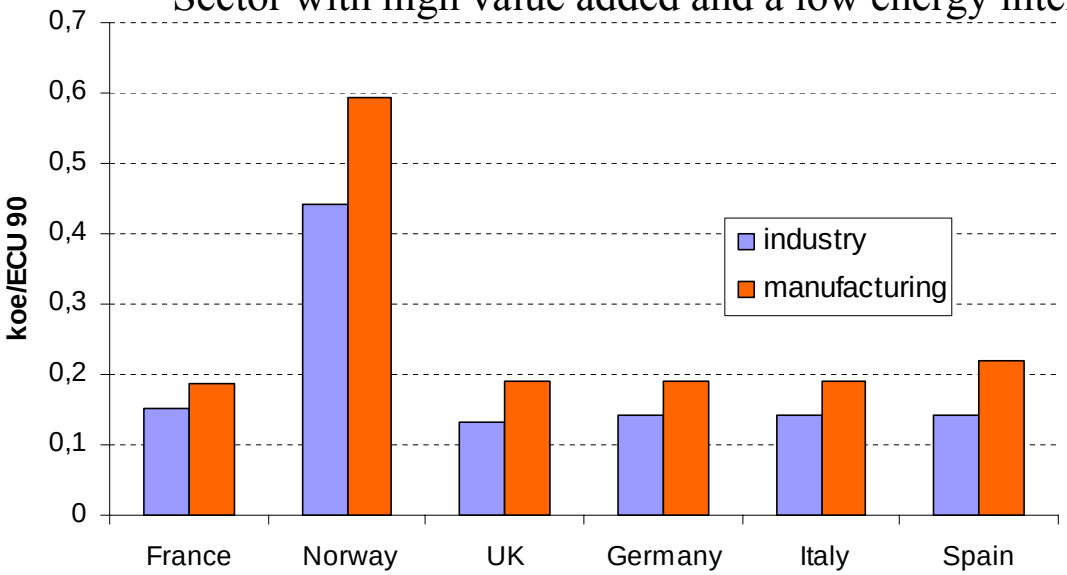
- Sectoral indicators

Energy intensity of industry *(koe/€95)*
Energy intensity of manufacturing *(koe/€95)*
Energy intensity by branch *(koe/€95)*
Unit energy consumption by product *(toe/ton)*

- **Steel**
- **Cement**
- **Paper**
- **Glass**

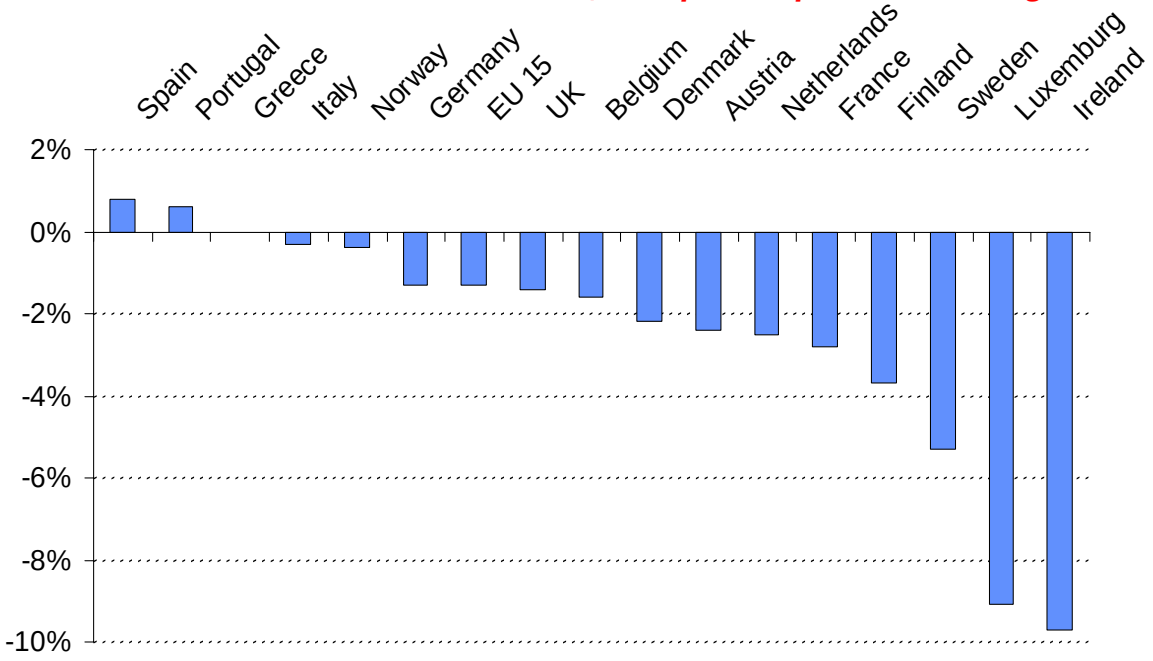
Energy intensity : industry / manufacturing

Industry less intensive because of construction, a Sector with high value added and a low energy intensity



Trends in the industrial energy intensities in EU-15 countries

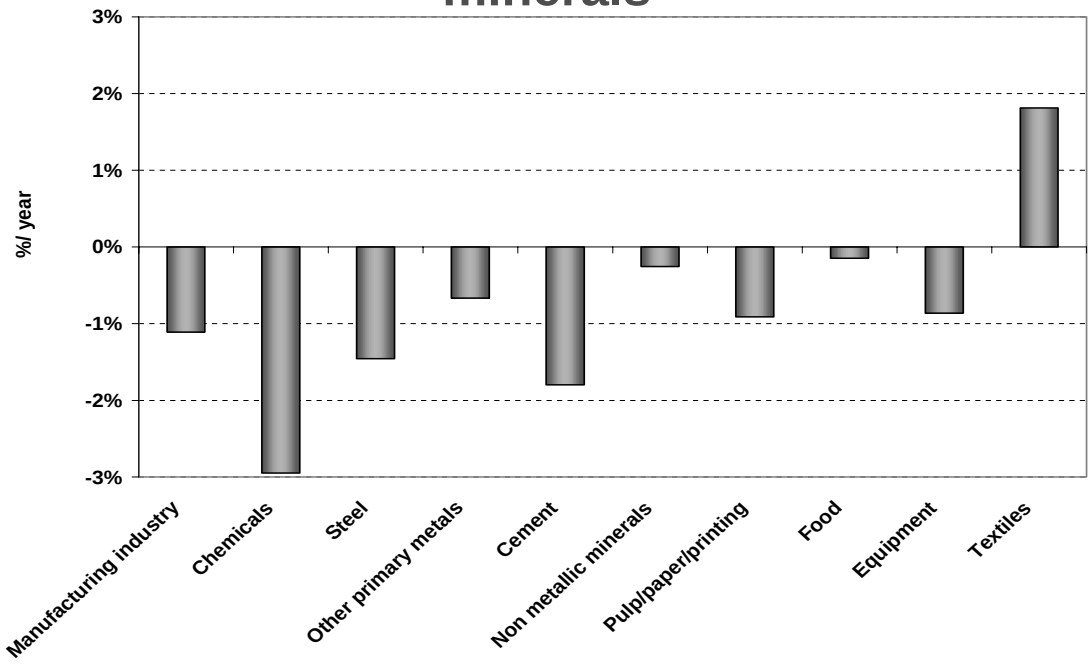
decrease in all countries, except for Spain and Portugal



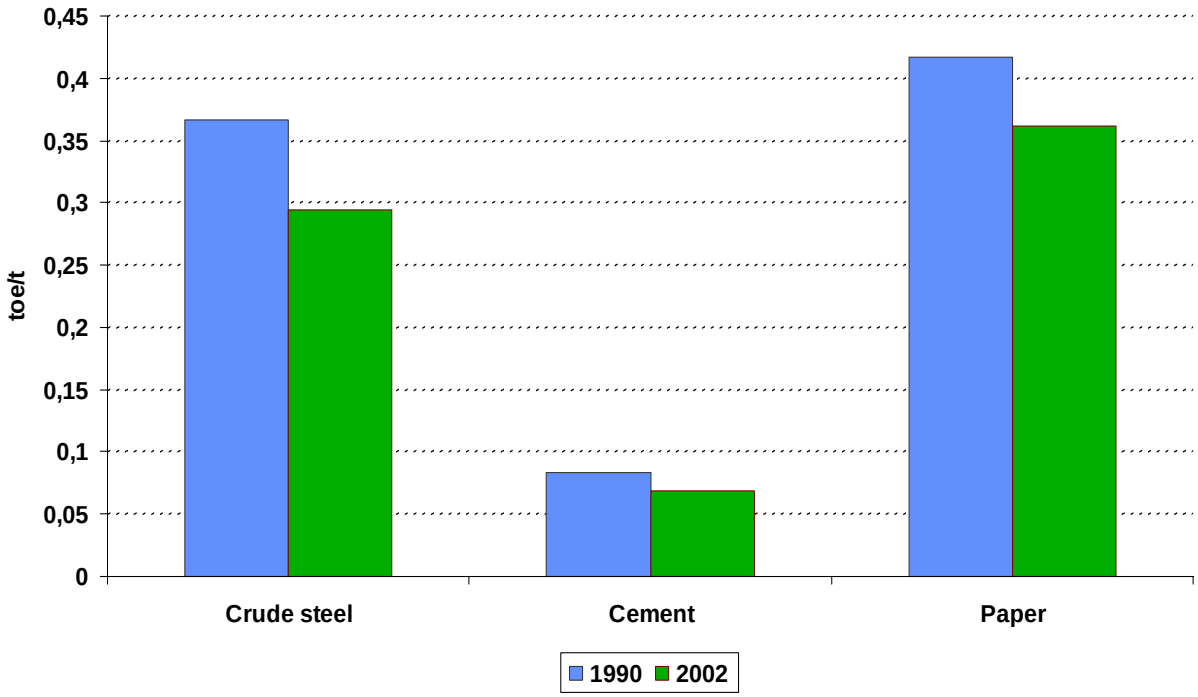
International classification of industrial branches (Nace)

	Nace code (2 digits)	
	10-14	**Mining**
	15-37	**Manufacturing industry**
	15-16	Food (15) and tobacco (16)
	17-19	Textile (17), Leather (18) and
	20	Wood
	21-22	Paper (21) and printing (22)
	23-25	Chemicals
	26	Non metallic Minerals
	27	Primary metals (steel, non ferrous)
	28-35	Fabricated metallic products, equipment
	36-37	Others
	40-41	**Electricity, gas and water**
	45	**Construction**

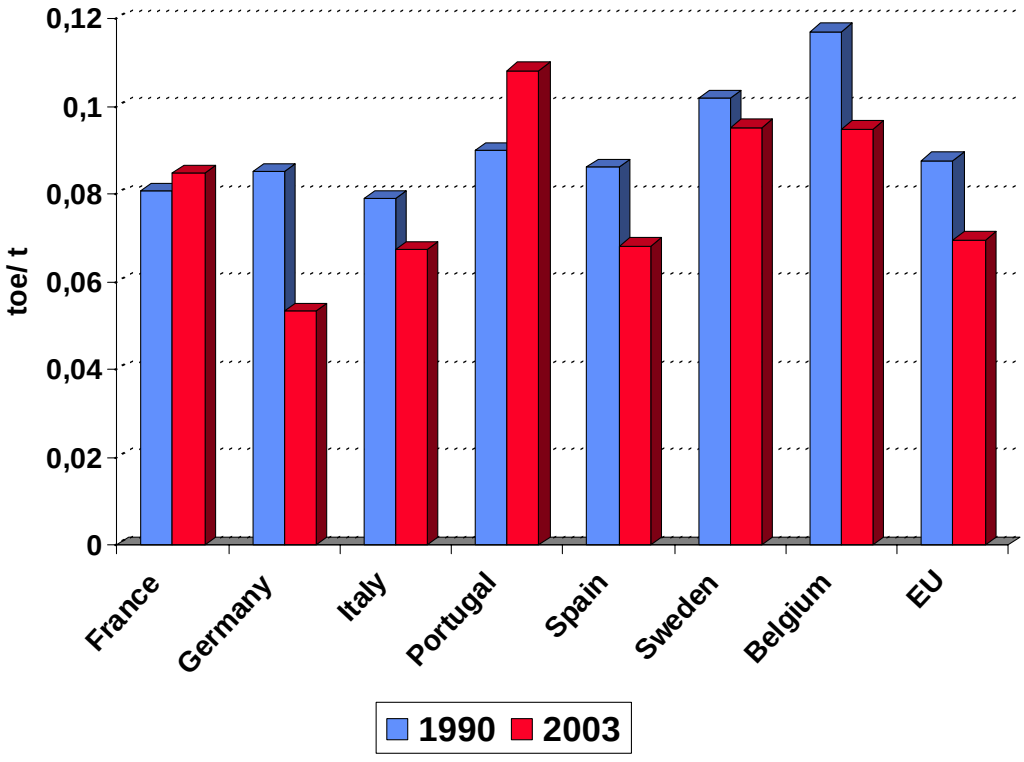
Energy efficiency trends by branch in the EU-15: reduction in chemicals, metals and non-metallic minerals



A regular decrease in the unit consumption of steel, paper, and and cement (EU 15) since 1990



Unit consumption of cement



Variation of energy intensity or unit consumption in industry: influence of business cycles

From one year to the other, energy intensity variation strongly influenced by business cycles (short term variation in activity) :

=Ł reduction in activity => non proportional reduction of energy use as

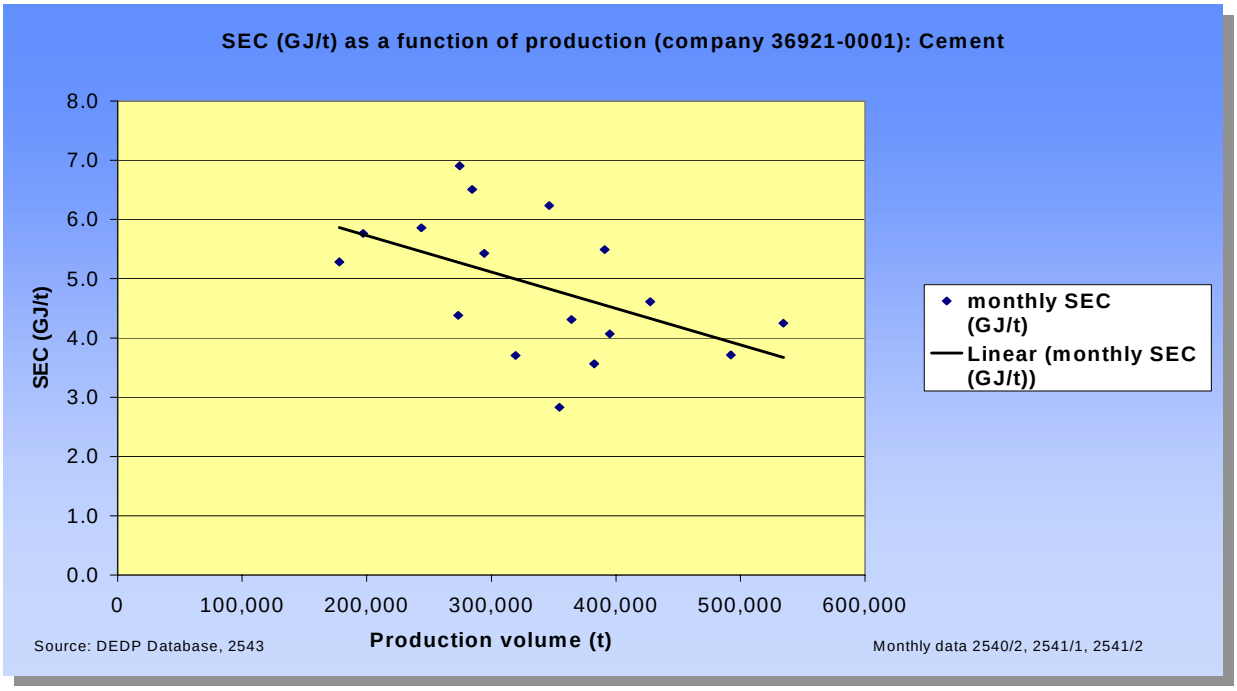
1. part of consumption not linked to level of activity;
2. less energy efficient operation conditions with economic recession

Ł increase in energy intensity

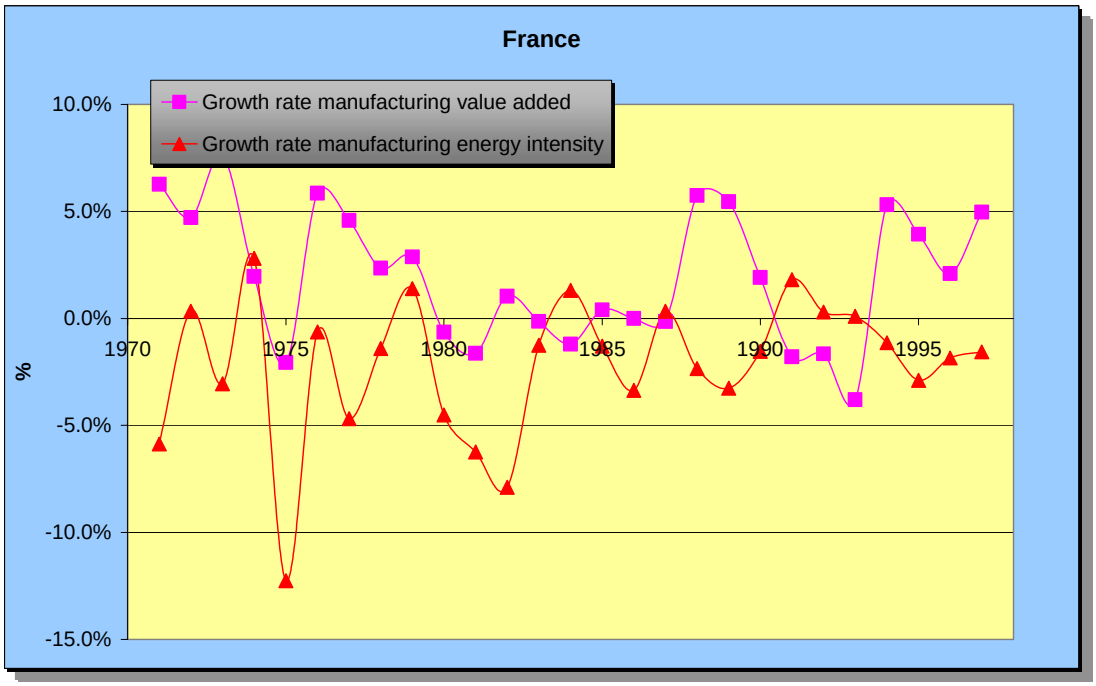
with strong economic growth, reverse phenomenon

Ł decrease in energy intensity

Business cycles: case of cement in Thailand

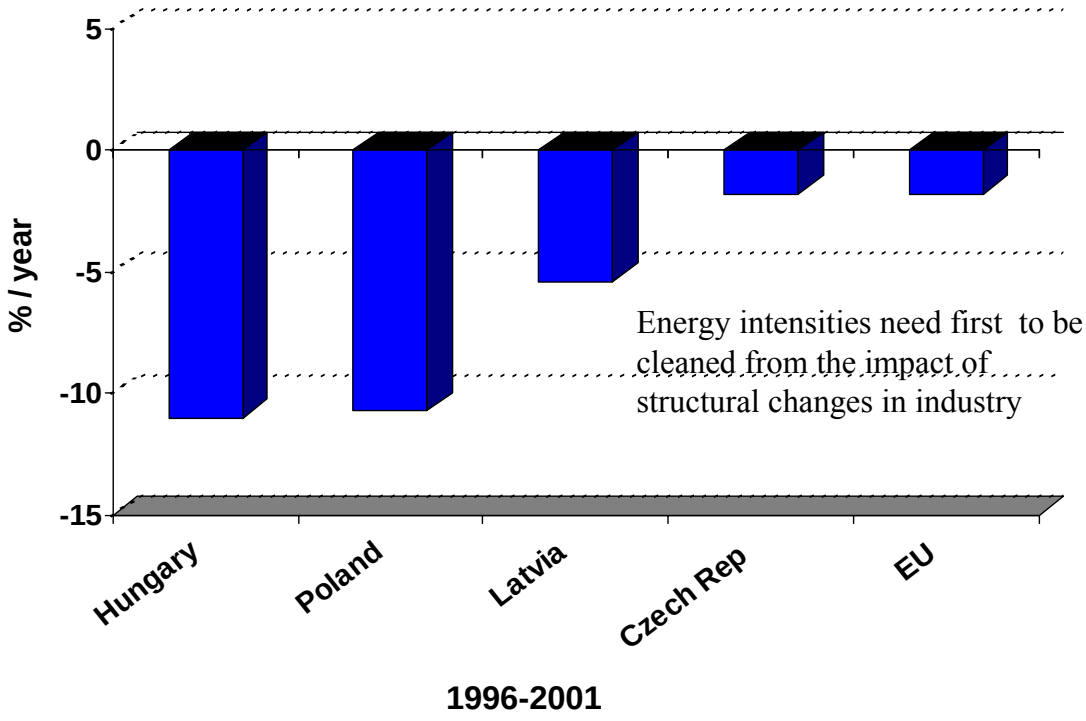


Business cycles :relation value added growth and energy intensity in industry



Intensity at constant structure: explanatory indicator of the overall intensity of industry and manufacturing

Energy intensity of industry : what progress in energy efficiency?



1996-2001

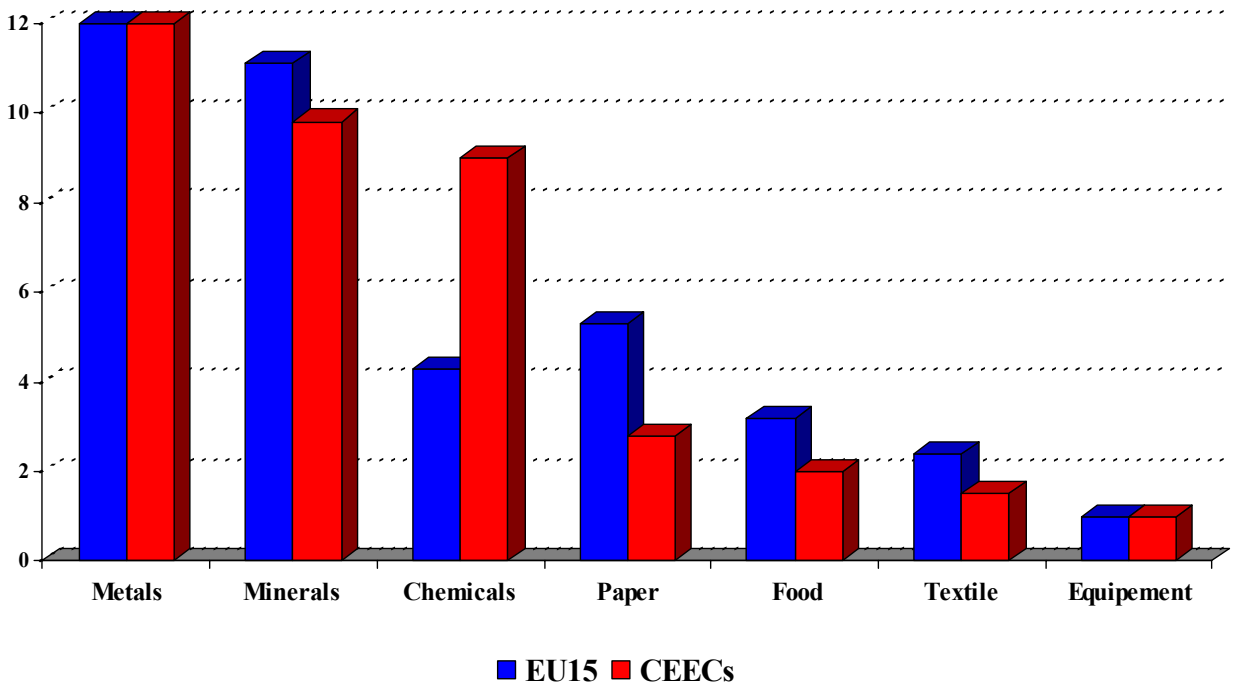
Diversity of energy intensities by industrial branch

All industrial branches do not have the same energy intensity Ł they do not require the same amount of energy inputs to produce 1 of value added

Some industrial branches are more energy intensive than others (e.g. non metallic minerals (cement, bricks, glass), primary metals, chemicals and paper

On the other extreme producing equipment goods (computers…) require muck less energy per of value added (10 times less)

Differences in the energy intensity across industrial branches (equipment= 1)



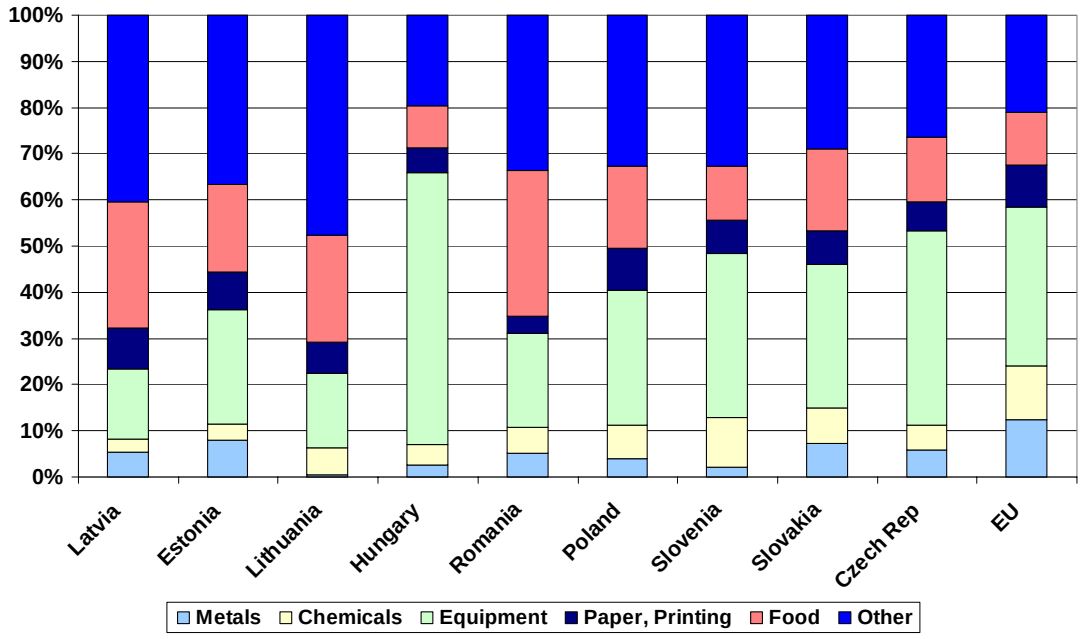
Structural changes in industry

Industrial development is not uniform among branches: some branches grow faster than others

The share of each branch in the industrial production, in the industry value added, change over time Ł industrial structural changes

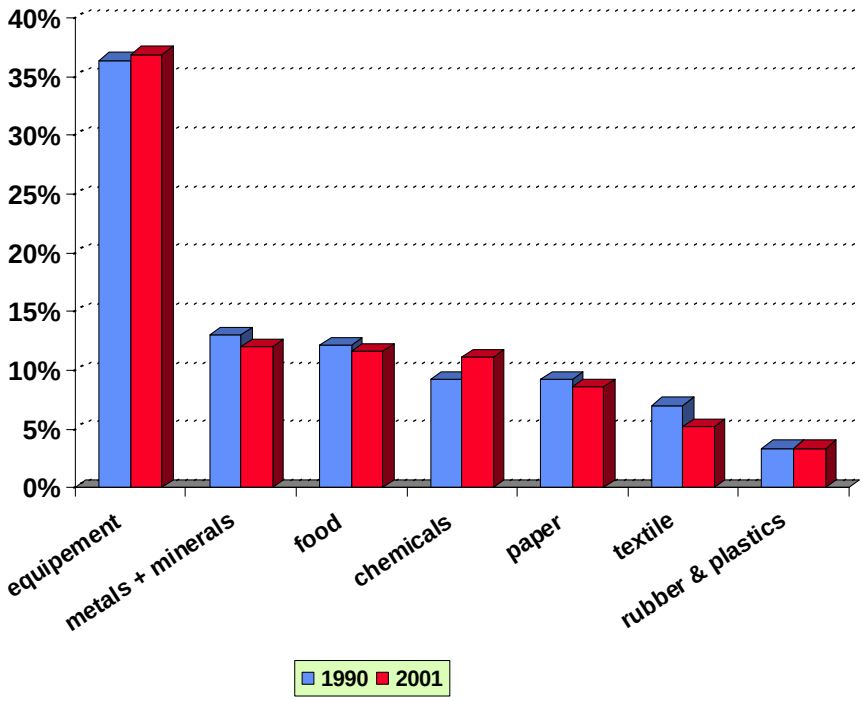
Value added by main industrial branch : the industry structure (%) (2000)

Value added is distributed completely different than energy use. The branches with the highest VA are equipment and food industry (with Hungary as extreme - 60% VA share for equipment)



Structural changes in EU 15 manufacturing industry: mainly concern the less intensive branches

Since 1993, progression of equipment and chemicals Reduction of the role of food, paper and textile



Asssesment of the role of structural changes in industry

-If less energy intensive branches grow faster than other branches, this will reduce the overall intensity of industry all things being equal

-To quantify the impact of structural changes on the overall intensity of industry , calculation of a fictive energy intensity at constant structure , ie assuming that the structure did not change

-Two main methods to calculate this intensity at constant structure , depending on what year serves as reference for the constant structure

- -Use of a fix base year
- -Use of a moving reference year

Intensity at constant structure in industry / manufacturing: use of a reference base year

-Fictive value of energy intensity of manufacturing calculated at year t :

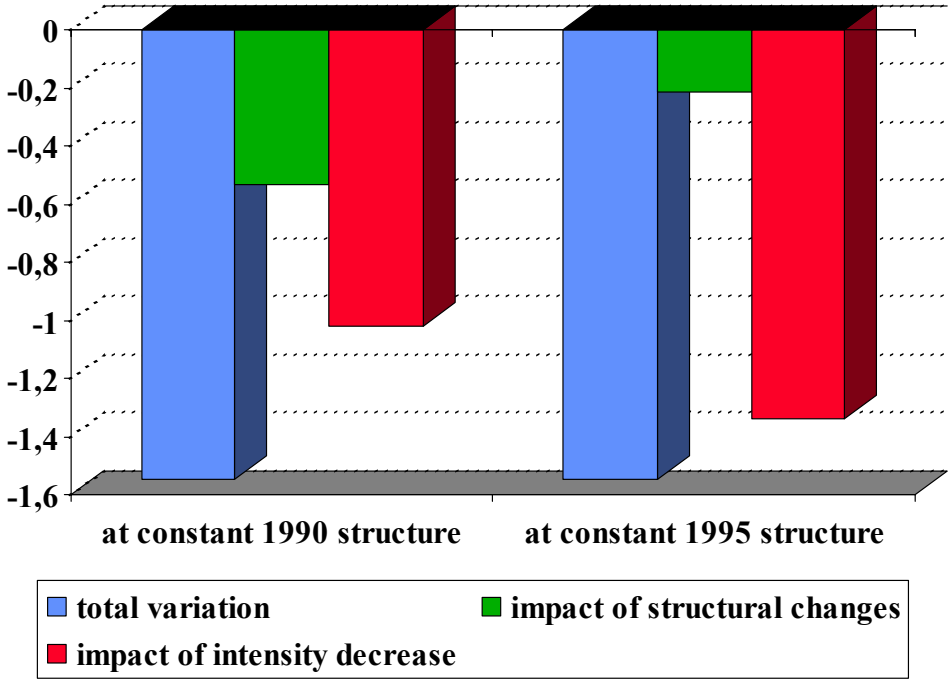
with the sectoral intensities at year t

with the structure of a base year (e.g. 2000)

-Advantage simple to understand

- Drawback : results much influenced by the choice of the reference year

Intensity at constant structure in industry : influence of the reference base year (case of UK)



Use of a moving reference year : the Divisia method

Yearly variation of energy intensity of manufacturing decomposed into two components:

one representing the impact of changes in the industrial branch intensities

one representing the impact of changes in the mix of branch in the total activity (industrial restructuring)

No need of a base year; previous year taken as a reference Ł results more relevant and more stable over time

Decomposition of energy intensity changes : the Divisia method

Decomposition of the annual variation:

$$\ln\left(\frac{ie_t}{ie_{t-1}}\right) = \sum_i w_i \ln\frac{s_{it}}{s_{t-1}} + \sum_i w_i \ln\frac{ie_{it}}{ie_{t-1}}$$

w_i = poids de la consommation d'énergie de la branche i $= E_i / E$

Then calculation of 2 indices:

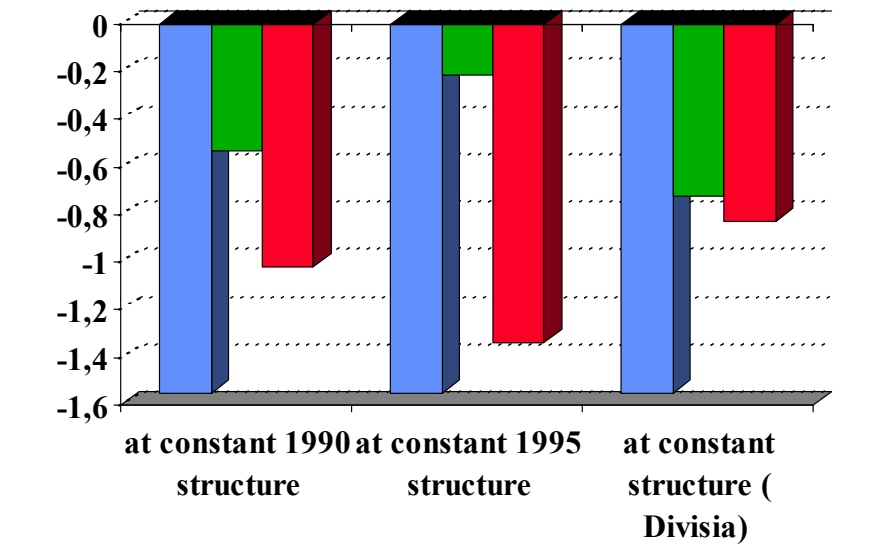
Ie : index of sectoral intensities Ł represents the intensity variation due to changes in branch intensities (= index of intensity at constant structure) Ł proxy fro assessing energy efficiency improvement (from an economic viewpoint

Is :index of structural changes Ł represents the intensity variation due to structural changes

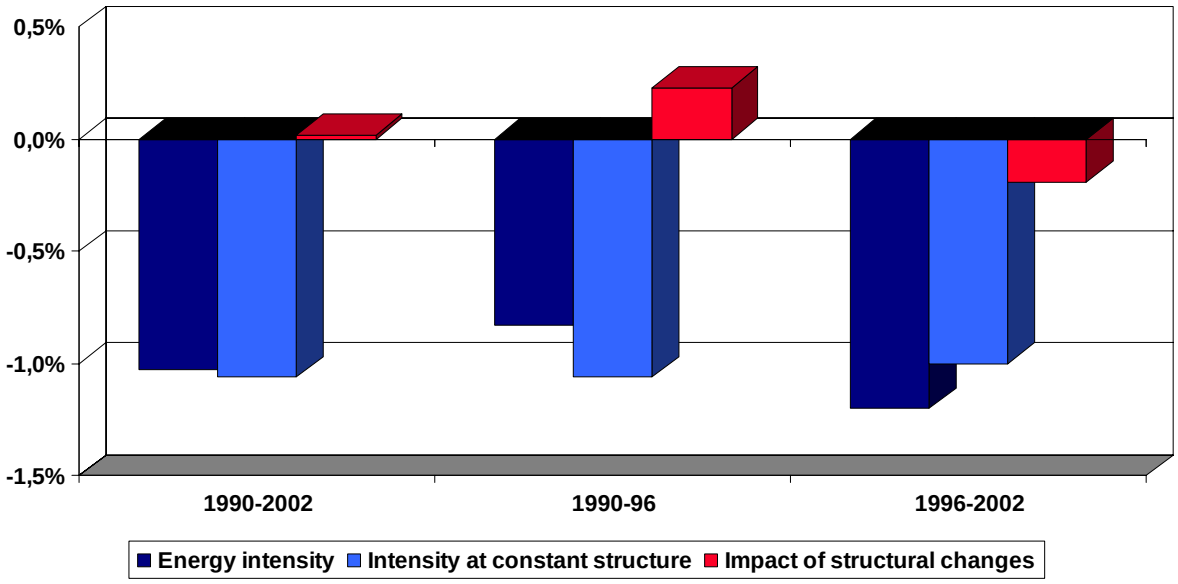
$$Ie = \exp\left(\sum_t \sum_i w_i \ln\frac{ie_{it}}{ie_{it-1}}\right) \times 100$$

$$Is = \exp\left(\sum_t \sum_i w_i \ln\frac{s_{it}}{s_{it-1}}\right) \times 100$$

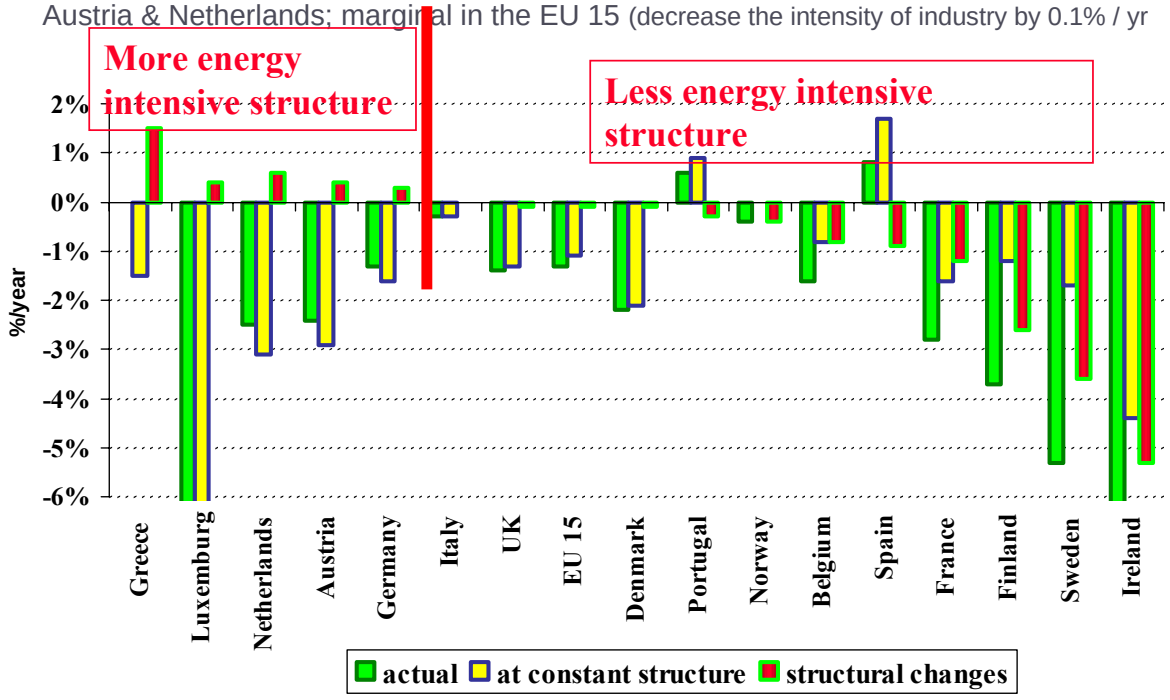
Intensity at constant structure in industry : influence of the method (case of UK) (1990-2002)



Structural changes within manufacturing branches (EU-15) : contributed to the intensity decrease since 1996



Impact of structural changes in manufacturing in the EU15 and Norway: significant shift to less intensive branches in Sweden, Ireland, Finland, France, Spain & Belgium ; towards more energy intensive branches in Greece, Austria & Netherlands; marginal in the EU 15 (decrease the intensity of industry by 0.1% / yr



1993-2002

Technico-economic effects: indicators of energy savings

Indicators of energy savings

Method : Decomposition of the variation of the consumption (in Mtoe or GWh) into 2 explanatory effects :

A quantity effect

A unit consumption effect

Use: assess energy savings

Explanatory effects of the variation of the consumption

- Calculation of the **quantity effect** for each industrial branch i as the variation of the consumption Ei due to a variation of the output Qi measured in physical units (production, index of industrial production) compared to a reference base year 0:

(Qit-Qio)*(Eio/Qio)

- Calculation of a « **unit consumption effect"** for each industrial branch i », as the variation of the consumption Ei due to a variation of the unit consumption Ei/Qi compared to the base year : Qt*(Eit/Qit-Eio/Qio)

- U**nit consumption effect** considered as energy savings

Energy savings for cement

- Calculation of quantity effect, as the variation of energy consumption Ei due to increase in production of cement between reference year (1990) and year t (2002) t (from 10 Mt to 15 Mt)

(Qit-Qio)*(Eio/Qio)

- Calculation of a « unit consumption **effet** », as the variation of energy consumption Ei due to variation in unit consumption Ei/Qi since 1990 (from 0,085 à 0,08 toe/tonne):

Qt*(Eit/Qit-Eio/Qio)

Quantity effect : (15-10)*0,085= 0.425 Mtep

Unit consumption effect : 15* (0,085- 0,08)=- 0.075Mtoe (assimilated to energy savings)

Indicators of energy efficiency progress (ODEX)

Why an energy efficiency index?

- Provide more relevant indicators to describe the energy efficiency trends of final consumers at the overall level or at sectoral level (industry, households, transport), and help in the evaluation of policies and measures
- Therefore, provide alternative indicators to the indicators currently used (energy intensity for all final consumers, for industry and for transport; consumption per dwelling for households)
- More relevant for energy efficiency evaluation as they are based on disaggregated technico-economic indicators,that are more accurate than economic ratios

Energy efficiency index

Aggregation of unit consumption indices by branch in one index for the sector on the basis of the weight of each branch in the sector consumption

Unit consumption by branch can be expressed in different units so as to be a s close as possible to energy efficiency evaluation : toe/ton, toe/index of production

Energy efficiency improvement <=> index decreases (e.g 85 in 2000 Ł 15% energy efficiency improvement)

Index called Odex

Energy efficiency index for industry

Evaluation carried out at the level of 9 branches:

- 4 main branches: chemicals, food, textile & leather and equipment goods;
- 3 energy intensive branches: steel, cement and pulp & paper
- 2 residual branches: other primary metals (ie primary metals minus steel), other metallic minerals (ie non metallic mineral minus cement)

Unit consumption expressed in terms of energy used

- per ton produced for energy intensive products (steel, cement, glass and paper)
- per unit of production index for the other branches

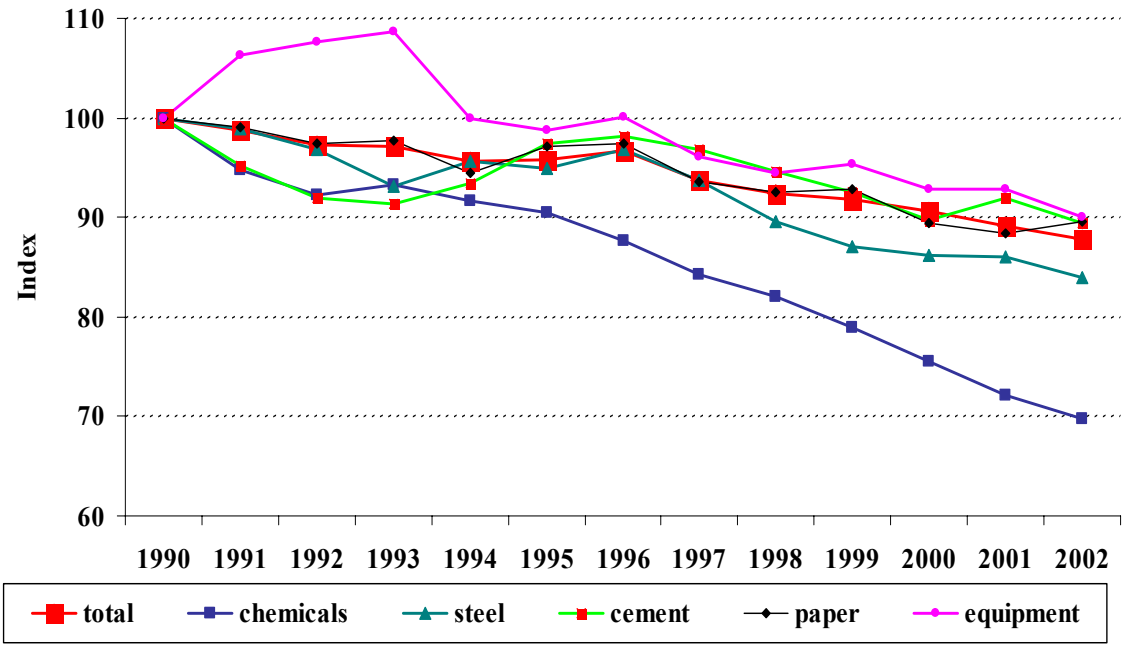
Index of industrial production

Measure the changes in the volume of physical production in relation to a base yearŁ index base 100 in 1995 for instance

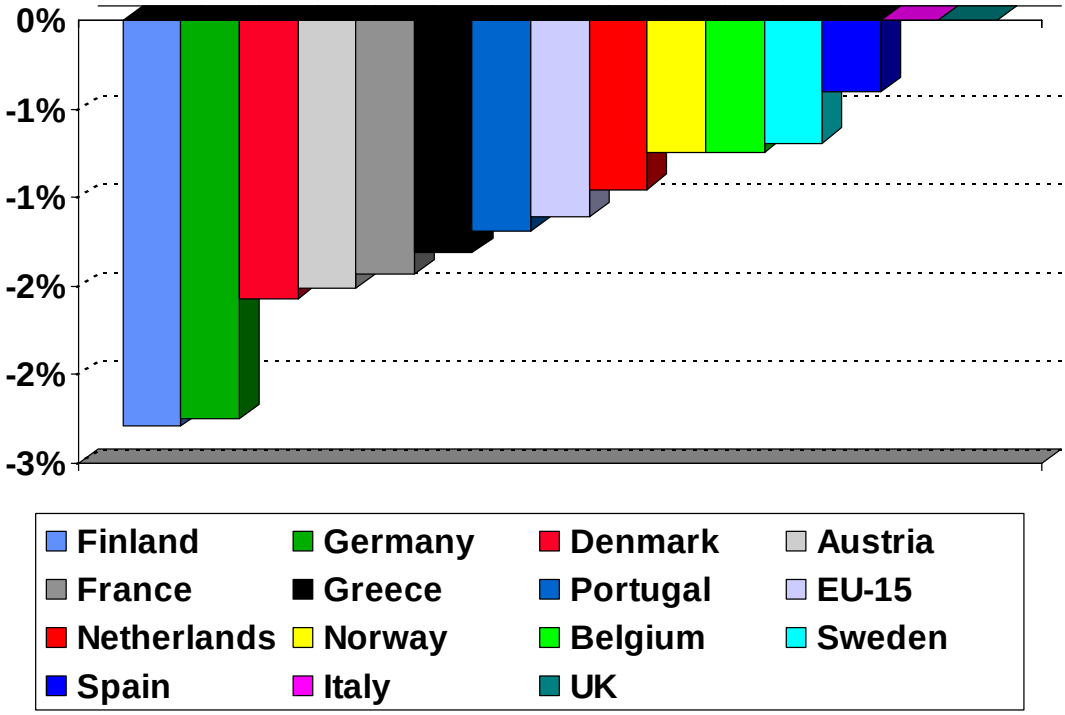
Measured at a very detailed level (4 to 5 digits) on the basis of physical production in

Are aggregated at the branch level (eg vehicle equipment) on the basis of the weight of each sub-branch in the value added of the branch in the base year

Energy efficiency progress : 12% in the EU15 ; increased gain since 1997



Energy efficiency improved unevenly across the countries, typically by 1-1.5 % per year



From energy efficiency index to energy savings

Energy savings can be directly derived from the index

Energy savings =
observed energy consumption x (1-(100/ODEX))

If industry consumption = 50 Mtoe and ODEX =80

- Energy savings =50* (1-(100/80))=-12.5 Mtoe

Energy efficiency index:

Principle of calculation:

1 Calculation of indices by branch and weighting

Energy ratios	1990	1991	1992	1995
Chemicals (toe/100)	8.5	8.3	8.2	8.2
(index)	(100)	(98)	(96)	(96)
Steel (toe/tonne)	0.30	0.29	0.26	0.25
(index)	(100)	(97)	(87)	(83)
Energy consumption	(weight)			
Chemicals (Mtoe)	20	20	20	22
(%)	(50)	(48)	(44)	(46)
Steel (Mtoe)	20	22	25	26
(%)	(50)	(52)	(56)	(54)

Energy efficiency index:

Principle of calculation:

2 Calculation of sector index (year t-1 as reference)

Energy efficiency index	1990	1991	1992	1993
Chemicals	100	98	96	96
Steel	100	97	87	83
Total	100	97,4	90,9	88,6

$IE_{91} = IE_{1990} \times (98 \times 0.48 + 97 \times 0.52) = 97,4$

$IE_{92} = IE_{1991} \times (96/98 \times 0.44 + 87/97 \times 0.56) = 90.9$

$IE_{93} = IE_{1990} \times (96/96 \times 0.46 + 83/87 \times 0.54) = 88,6$

Ł gains of 11.4% in 1993 compared to 1990

Energy efficiency index:
Calculation in ODYSSEE: ODEX

- **System of weighting defined so as to be consistent with the calculation of savings with technico economic effects)**

Energy efficiency index
System of weighting defined so as to be consistent with the calculation of savings with technico economic effects

Energy efficiency index	1990	1991	1992	1993
Chemicals	100	98	96	96
Steel	100	97	87	83
Total	100	97,4	90,9	88,6

IE_{91} =1/ (0.48*100/98 + 0.52*100/97)*100 = 97.5

IE_{92} = 1/ (0.44*100/ 96 + 0.56*100/ 87) =90.7

IE_{93} = 1/(0.46*100/ 96 + 0.54*100/83) = 88.5

Ł gains of 11,5% in 1993 compared to 1990

Comparison of industry performance

Adjustment to same industrial structure

Differences in final energy intensity level for come from:
•different industry structures (% of value added by branch)
•different level of intensities of branches

To leave out difference in economic structures calculation of a fictive intensity with the actual sectoral intensities of each country and the same industry structures (eg the EU average)

Ł **Energy intensity of manufacturing at reference value added structure and current purchasing parities (koe/€ppp)**

Enerdata

Industrial specialisation: share of main branches in manufacturing value added

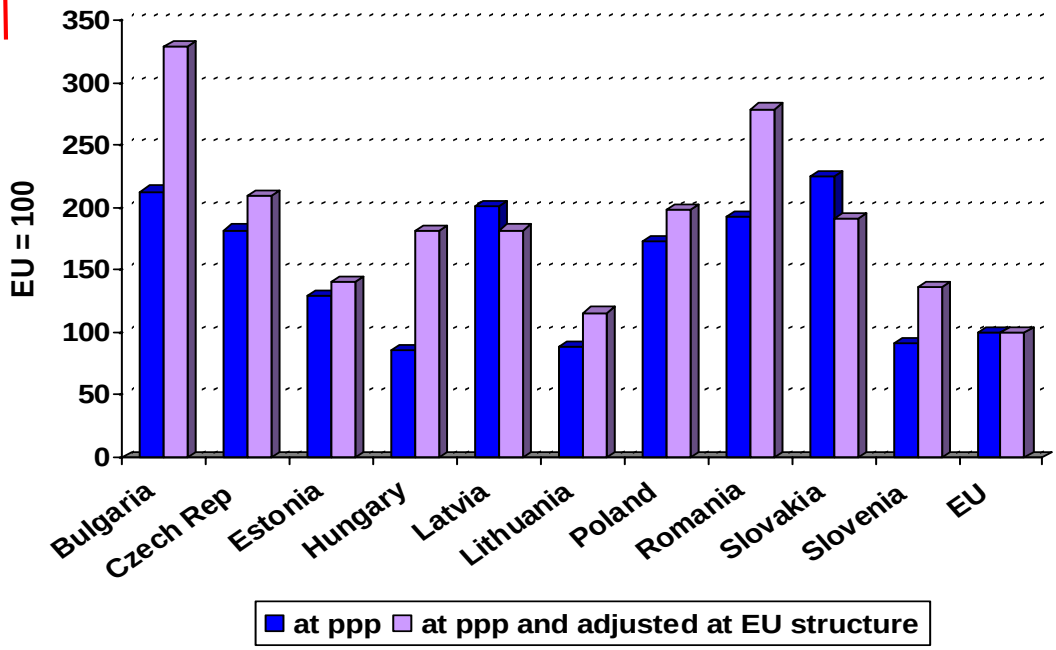
	Equipment	Food	Chemicals	Textiles	Wood	Share
Bulgaria	++	++	+	+		76 %
Czech Rep	++++	+				71 %
Estonia	++	+		+	+	75 %
Hungary	+++++					80 %
Latvia	+	++		+	+	76 %
Lithuania	+	++		+		71 %
Poland	++	+				67 %
Romania	++	+++		+		74 %
Slovakia	+++	+				68 %
Slovenia	+++	+	+	+		74 %
EU	+++	+	+			65 %

EU 15 on average have industry more dominantly specialised on energy intensive branches

+ : 10-20% ; ++ 20-30 %; +++ 30-40%;+++:40-50%

Enerdata

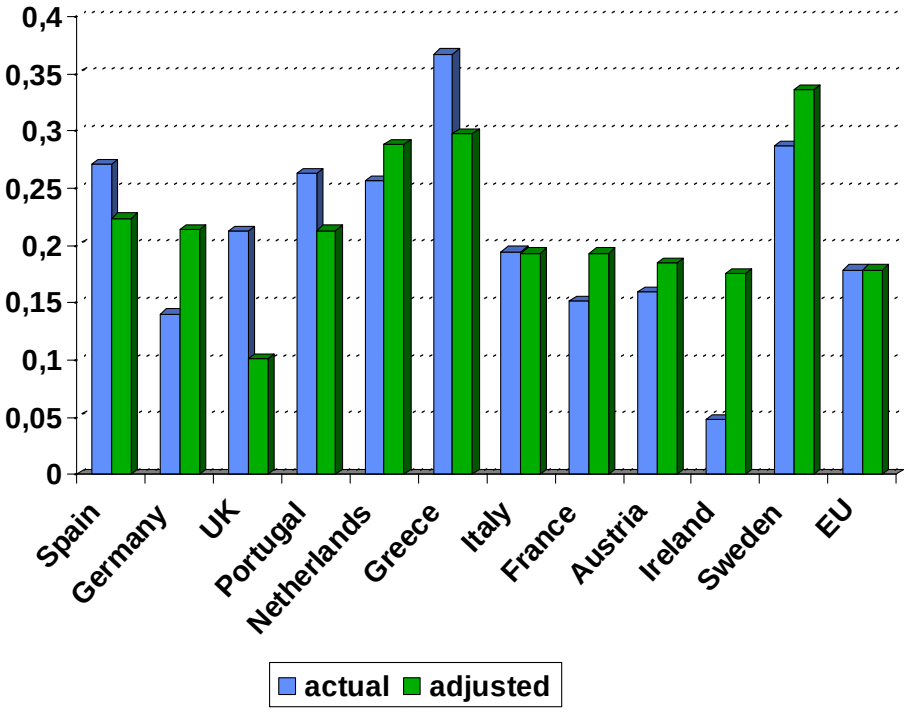
Energy intensity of manufacturing



Energy intensities increase after adjustment as on average structure of manufacturing dominated by less intensive branches in CEEC's than in the EU average

Comparison of energy intensity of manufacturing :

actual values and at EU15 average value added structure



Target values of energy efficiency improvement by sector

Need of target indicators

•The structure of economic activities is quite different in most CEEC's compared to the EU average

Ł adjustments are important to produce comparable indicators

•Such adjustments to EU average may not be useful for individual countries to derive macro economic potential for energy efficiency improvements

Ł it is more interesting to calculate fictive intensities with the actual economic structure of each country and with the energy efficiency performance of the EU average (or of the 3 best countries: "target indicators")

Target/benchmarking indicators

Objective: provide reference values to show possible target of energy efficiency improvements or energy efficiency potentials for a given country

Target/benchmarking indicators by branch and at industry sector level

By branch (steel, cement, …):

§Best value within the EU , once adjusted for all differences between countries (or average of 3 best)

§Best country value at world level

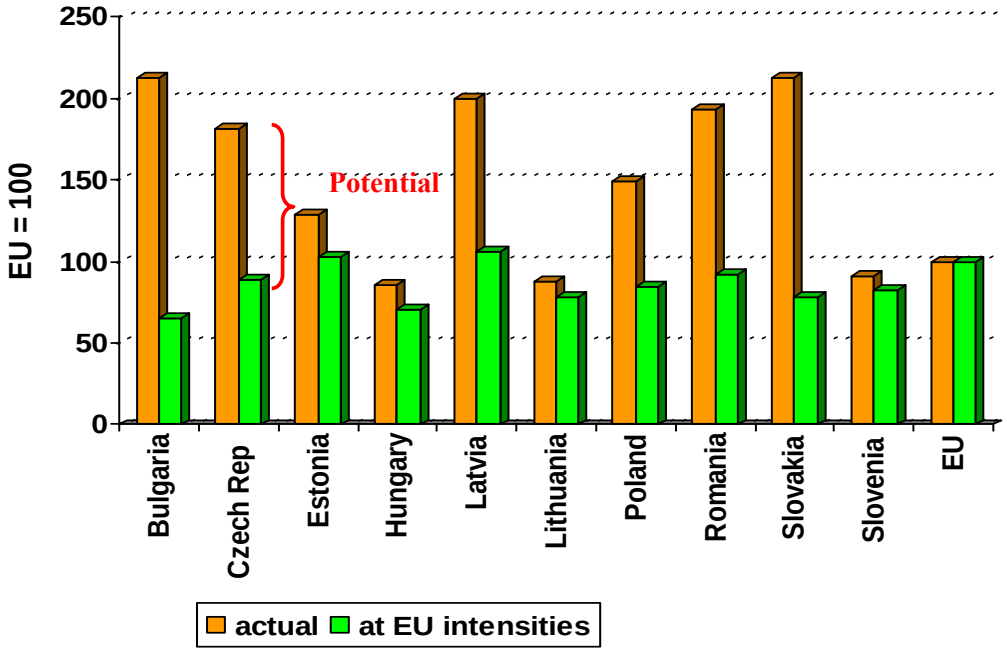
§Best plant, at world level that is commercially available/ cost effective (i.e. excluding prototypes)

For the industry sector , by applying the target value by branch

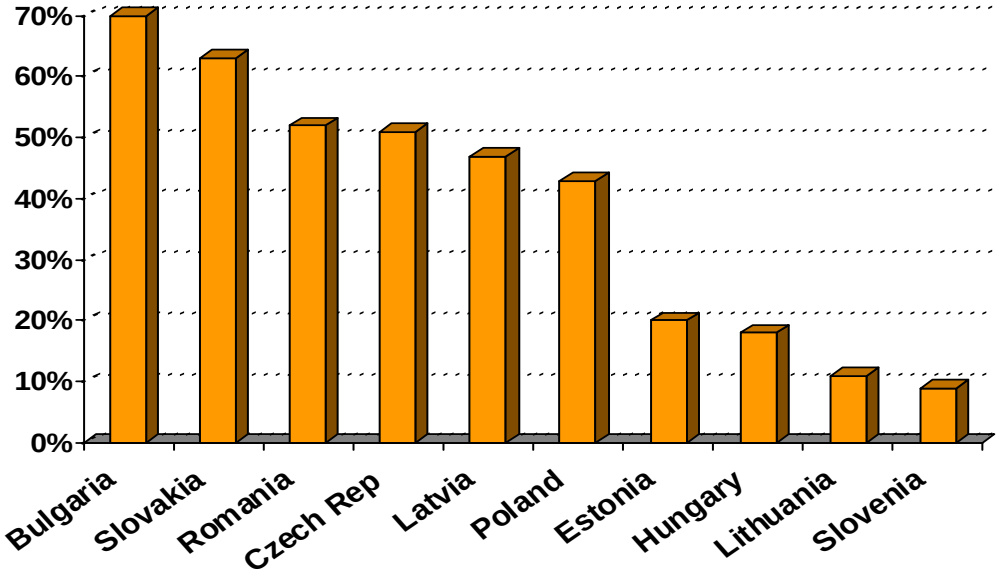
Potential = distance to the target (EU average, average of the 3 best countries/benchmarkŁ shows what gain can be achieved

Target intensity of manufacturing : potential of energy intensity improvement in manufacturing

Difference between these two intensities give the magnitude of the potential



Potential of energy intensity improvement in manufacturing if all countries had the sectoral intensities of the EU



Target indicators can be built for more detailed indicators : space heating, steel, cement, cars

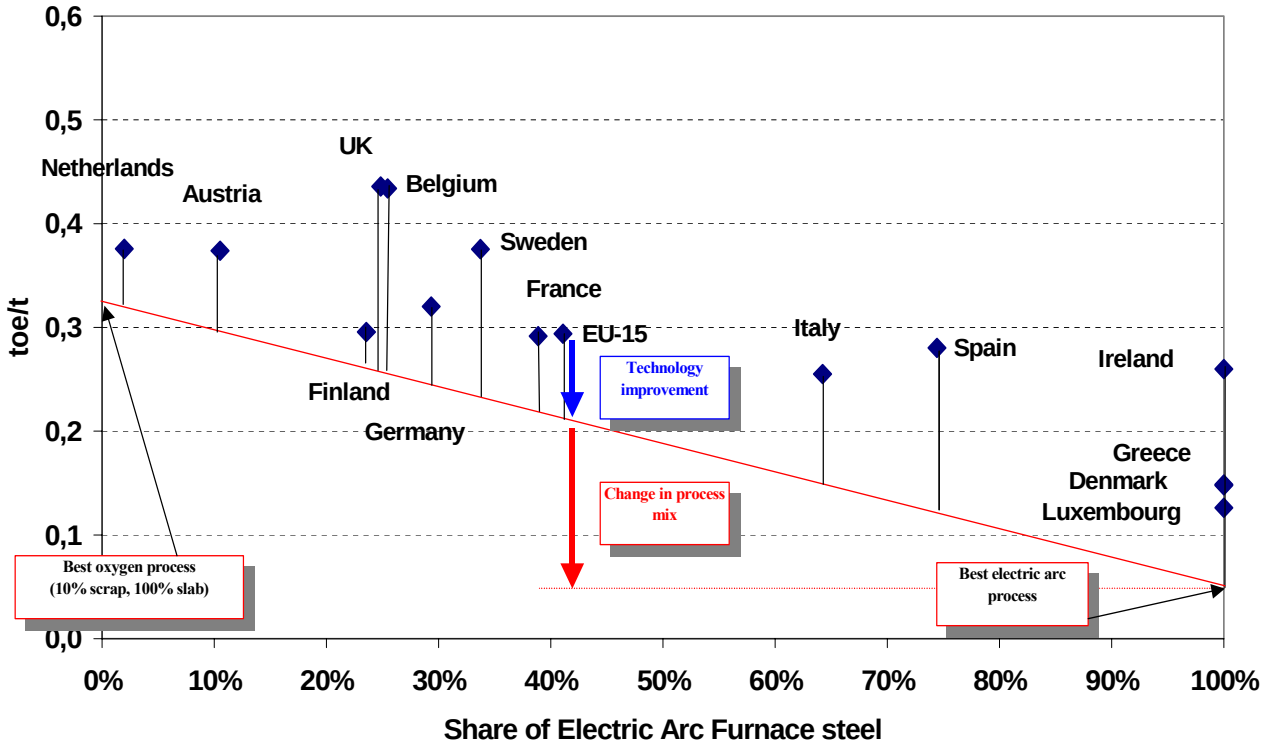
Target/benchmark indicators: assessment of potential of improvement

If indicators not fully « cleaned » of important influence => use of a graphical representation of the indicators as a function of the explanatory factors

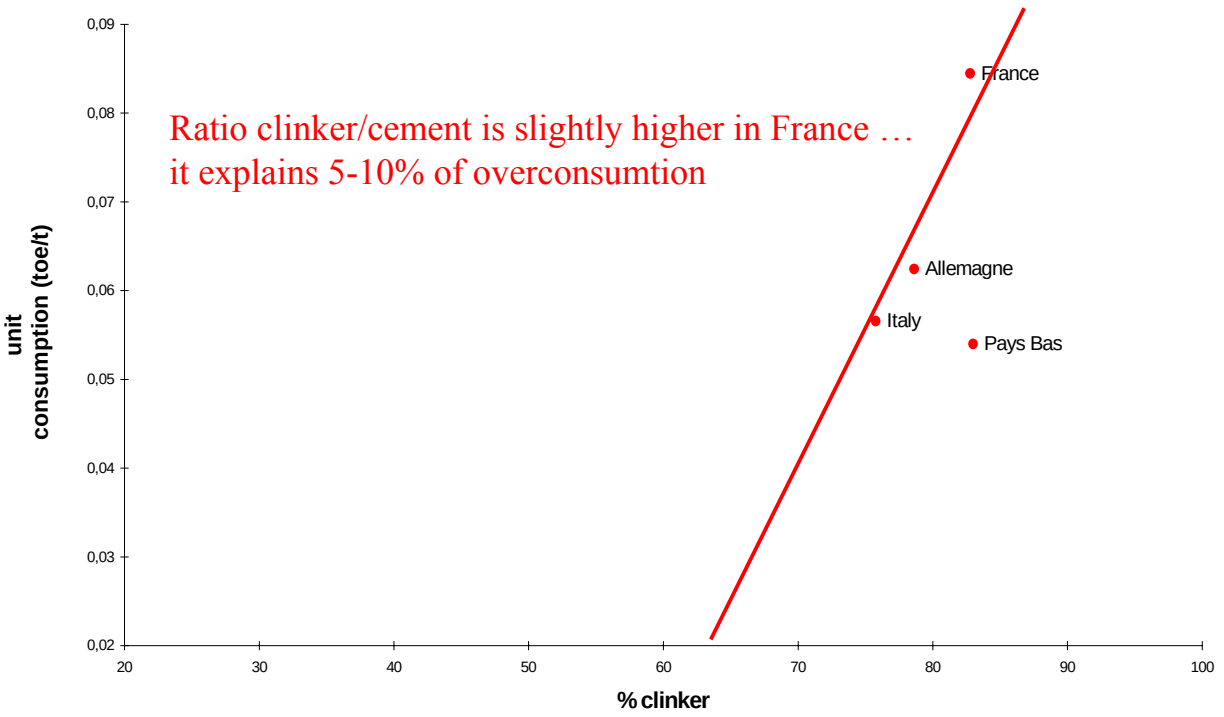
Examples :

- Consumption per ton of steel as a function of the share of process
- Consumption per ton of cement as function of the ratio clinker/ cement

Consumption per tonne of crude steel : difference due to process mix and technological performances

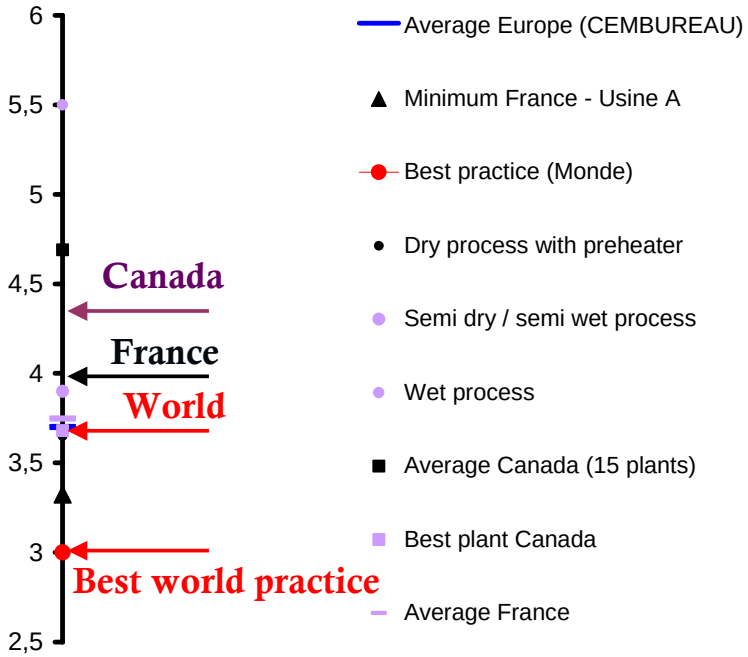


Target for cement: consumption per ton of cement as function of the ratio clinker/ cement



Benchmarking indicators:cement

Unit consumption per ton of clinker (GJ/ton)



Industry data

Value added
(at constant national price)

Mines (Nace 10-14)
Manufacturing industry (Section D) by branch
- **Food, beverage and tobacco (Nace 15 - 16)**
- **Textiles, clothing, leather (Nace 17 - 19)**
- **Wood (Nace 20)**
- **Pulp and paper (Nace 21) or Paper and printing products (Nace 21 - 22)**
- **Chemicals (Nace 24 - 25) (excluding non energy uses)**
- **Non metallic minerals (Nace 26)**
- **Primary metals (Nace 27)**

- **Metal products and equipment goods (Nace 28 - 35)**
- **Other manufacturing (36-37)**

Energy sector (electricity, gas, water)(Nace 23+40-41)
Construction (Nace 45)

Physical production
(tons)

crude steel
non electric crude steel
electric crude steel
cement
paper
glass

Final energy consumption by branch:
the energy sources

Oil products
Gas
Coal ,lignite ,peat, oil shales
Electricity
Heat
Wood, waste and other fuels

Final energy consumption by branch: the industrial branch

- Food, beverage and tobacco (Nace 15 - 16)
- Textiles, clothing, leather (Nace 17 - 19)
- Pulp and paper (Nace 21) or Paper and printing products
- Chemicals (Nace 24 - 25) (excluding non energy uses)
- Non metallic minerals (Nace 26)
- Steel (Nace 27.1 + 27.2 + 27.3 + 27.5)
- Non ferrous metals (Nace 27.4)
- Metal products and equipment goods (Nace 28 - 35)
- Other manufacturing (36-37)
- Non-energy mining (Nace 13 - 14)
- Construction (Nace 45)

  - Cement (Nace 26,51 or 26,5)
  - Glass (Nace 26.1)

Specific consumption of steel industry by process

non electric crude steel (incl blast furnace)

electric crude steel

- **fuel = coal, oil, gas, heat, waste & other**
- electricity