

Regional workshop WEC-ADEME
“Evaluation of Energy Efficiency Policies in the MENA Region”
organised by ANME with the support of UNDP
Tunis, 15-16 March 2010

Overview of WEC energy efficiency indicators

Bruno Lapillonne
Karine Pollier
Enerdata

WEC energy efficiency/CO2 Indicators: what are they?

Four types of indicators:

1. Indicators of energy intensities to GDP, value added (economic indicators in toe/\$)) → indicators of energy productivity (all measured at purchasing power parities);
2. Indicators of unit consumption (or specific consumption) in physical units: toe/ tonne, toe or kWh/household, toe/employee, toe/vehicle, efficiency of power plants;
3. Indicators of diffusion of energy efficient technologies (e.g., cogeneration, electric steel, solar water heaters) and practices (e.g. share of public transport);
4. Indicators of CO2 emission from energy combustion by sector

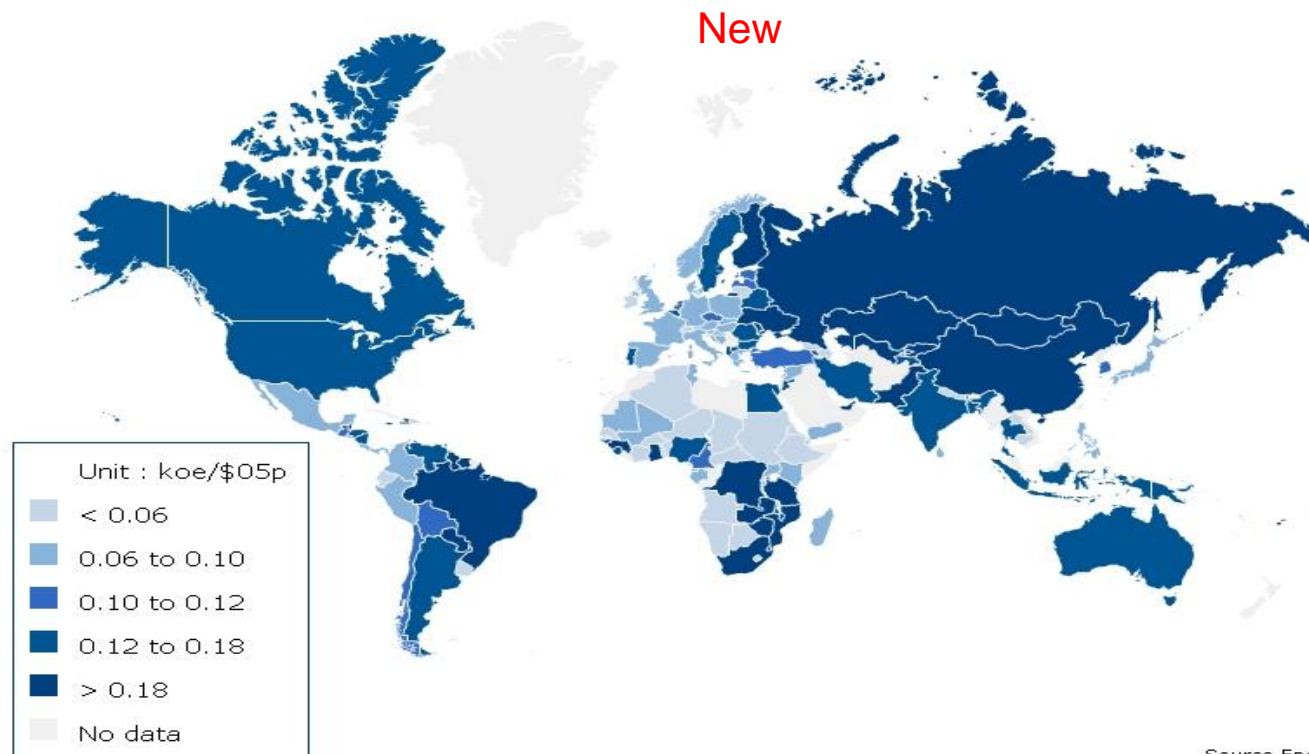
WEC energy efficiency/CO2 indicators: dissemination

- Data tables by WEC member country and for 8 world regions for 1980, 1990, 2000, 2008 on WEC web site

http://www.worldenergy.org/publications/energy_efficiency_policies_around_the_world_review_and_evaluation/1230.asp

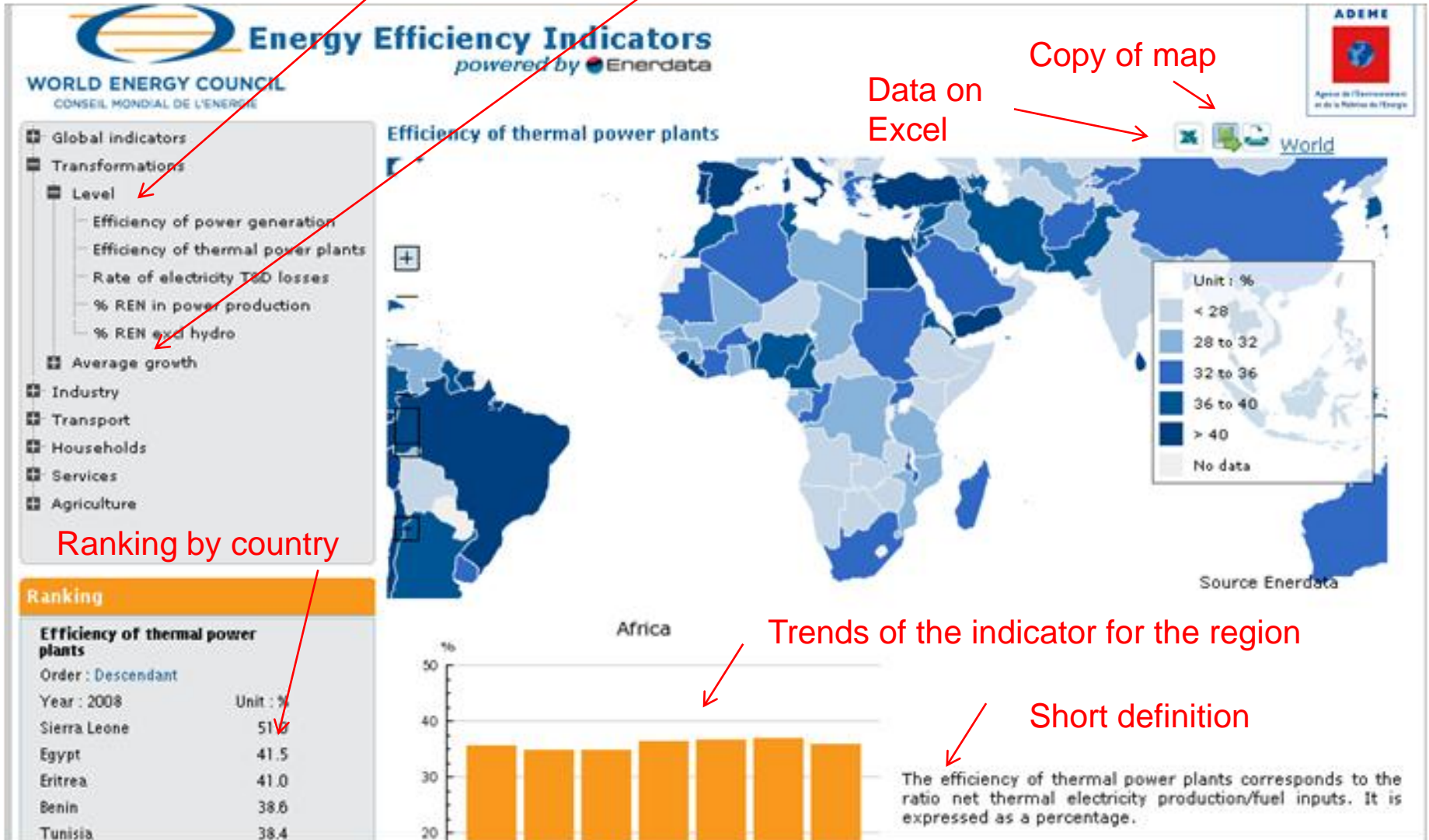
- Interactive query and mapping by indicator at <http://wec-indicators.enerdata.eu/>

Energy intensity of industry (to value added)



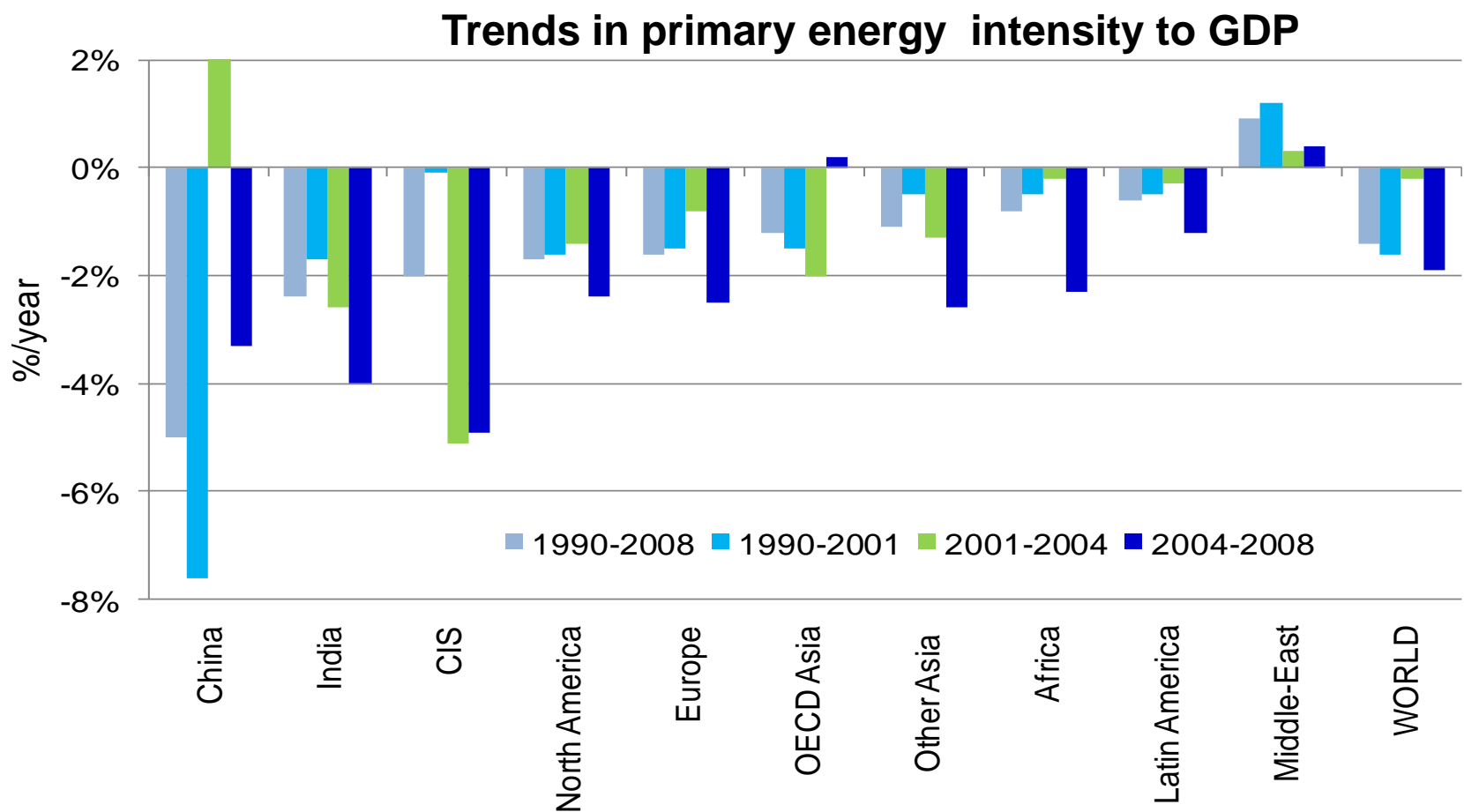
WEC indicators: interactive query and mapping by indicator

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



In all world regions, except The Middle East, the amount of energy used per unit GDP (“primary intensity”) is decreasing steadily since 1990 (1.4%/year on average at world level), with an acceleration in all regions since 2004 due to oil price increase.

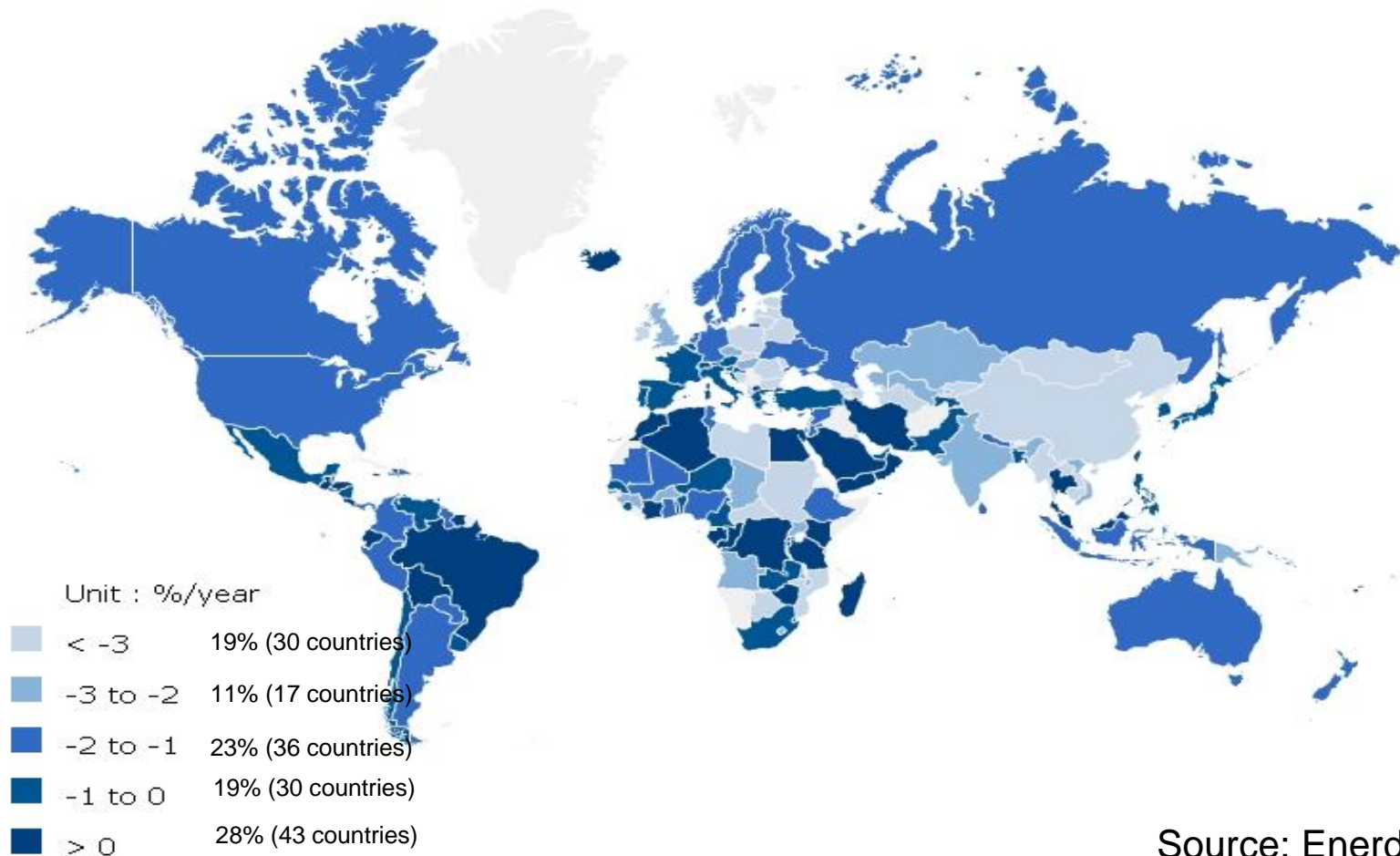
Countries or regions with the highest primary intensity in 1990 experience the largest reduction (China, CEI, India)



Almost 70% of the countries in the world (113 countries) have decreased their primary energy intensity since 1990:

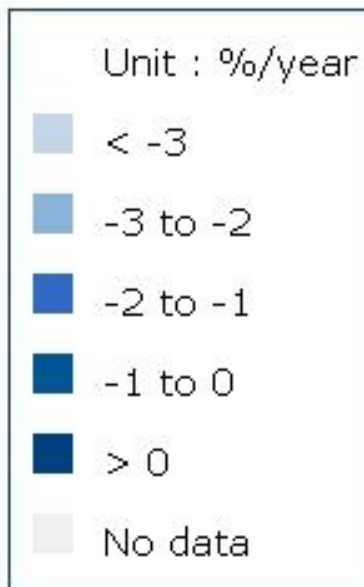
- 80 countries (around 50%) by more than 1%/year,
- 30 countries (20%) have experienced a rapid decrease above 3%/year

Variation of primary energy intensity by country (1990-2008) (%/year)

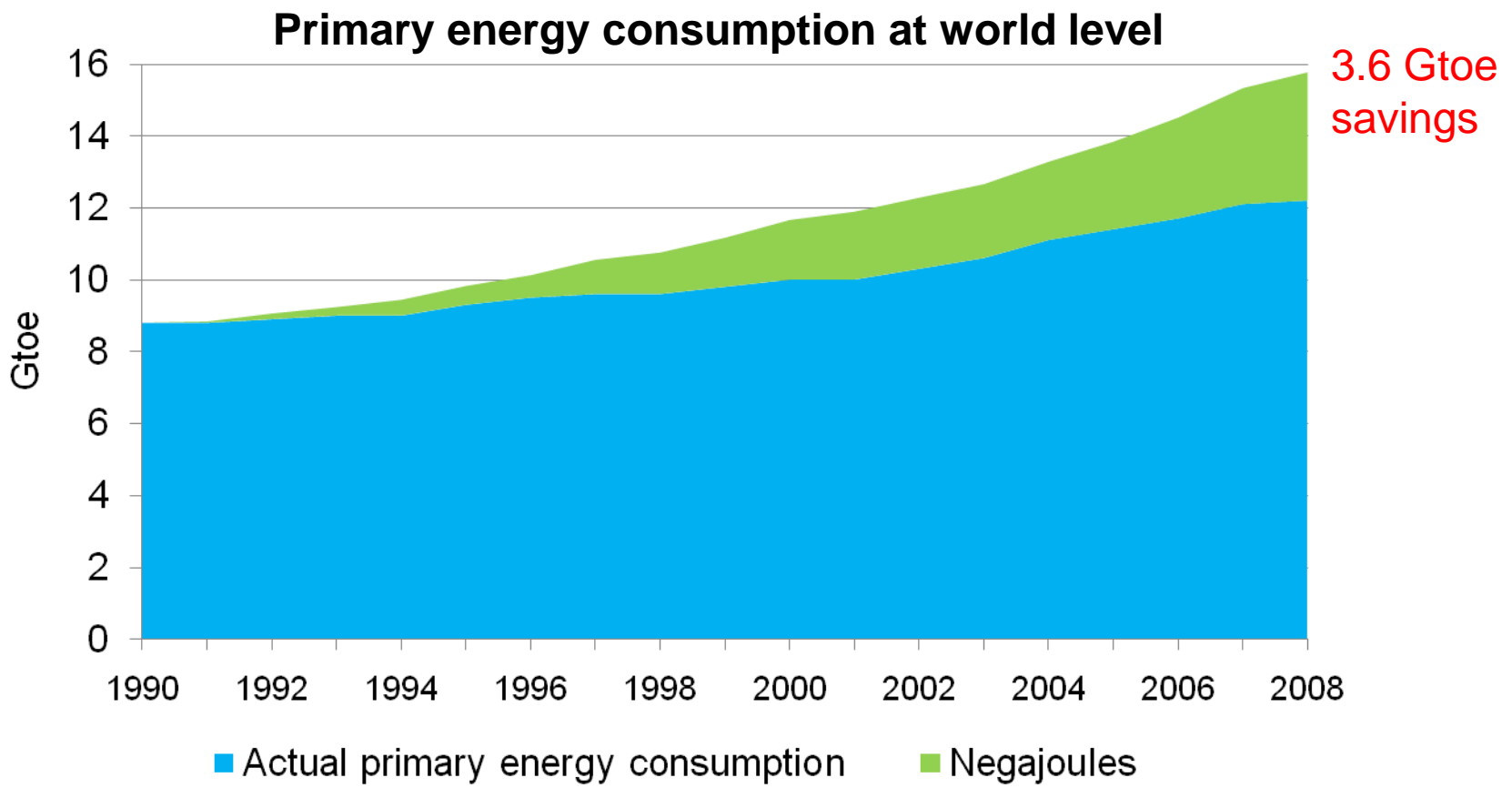


Increasing primary energy intensity in the Middle East and North Africa , as opposed to other regions (respectively by 1%/year and 0.2 %/year from 1990 to 2008 , with exception of Tunisia (and Libya))

Primary energy intensities trends in the Middle East & North Africa (1990-2008)



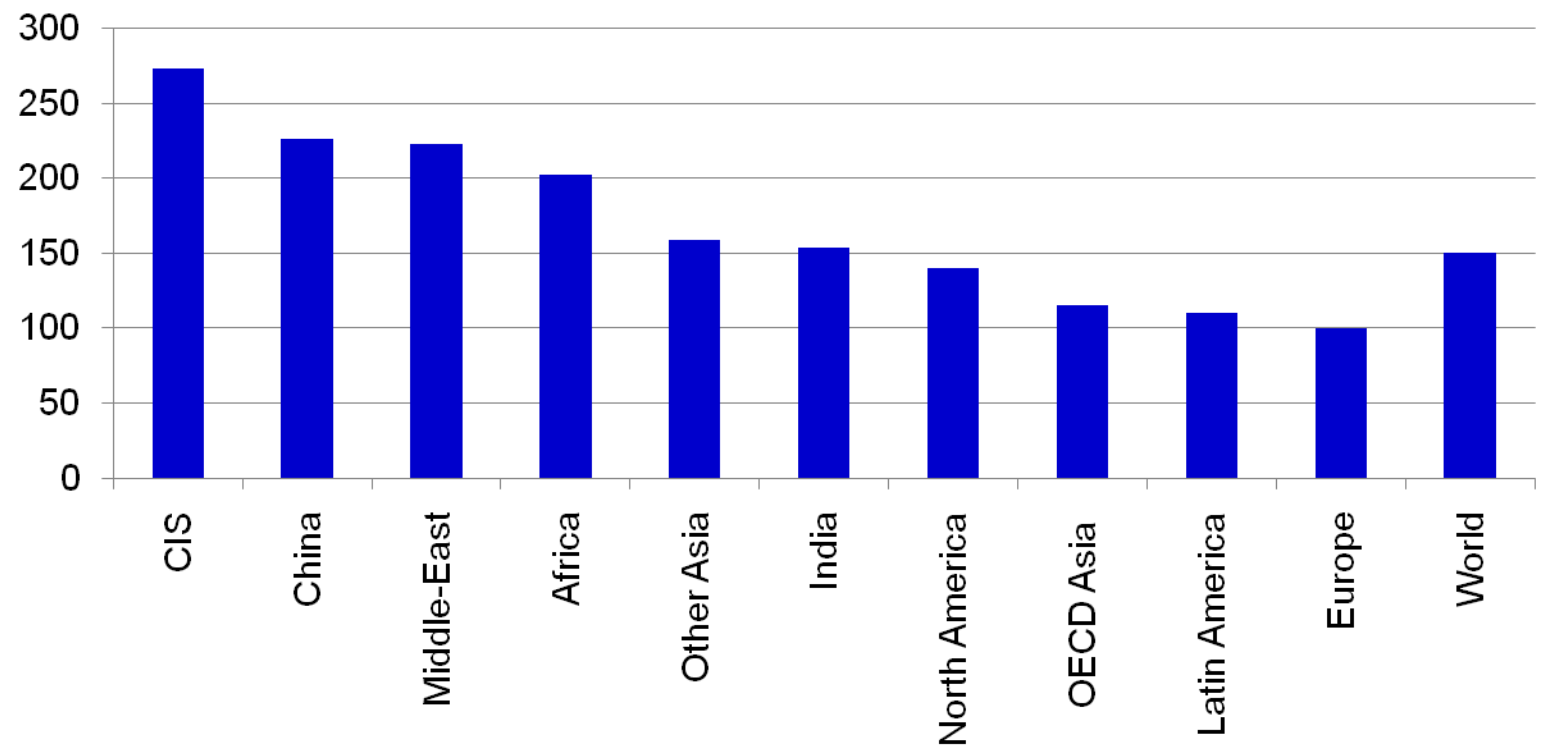
At 1990 energy intensity (i.e. at 1990 technologies and economic structure), world energy consumption would have been higher by 3.6 Gtoe in 2008. In other words, “energy savings” from energy productivity improvements (“Negajoules”) represent 3.6 Gtoe at world level, or almost 30% of the primary consumption in 2008; 8 Gt of CO₂ emissions avoided



Large disparities by region in the amount of energy used per unit GDP (“primary energy intensity”):

- A factor 2.7 between CIS and Europe, the region with the lowest value
- OECD Asia, Latin America 10% above Europe.
- North America, India and other Asia: about 50 % above Europe, same as world average
- Africa, Middle East and China: twice the European level

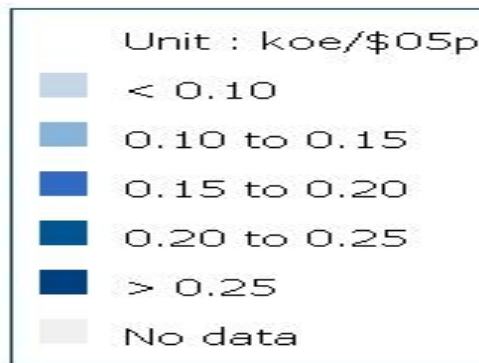
Primary energy intensities by world region (at purchasing power parities) (2008)



OECD Asia: Japan, Korea, Australia & New Zealand;
Other Asia: Asia without China, India, Japan & Korea

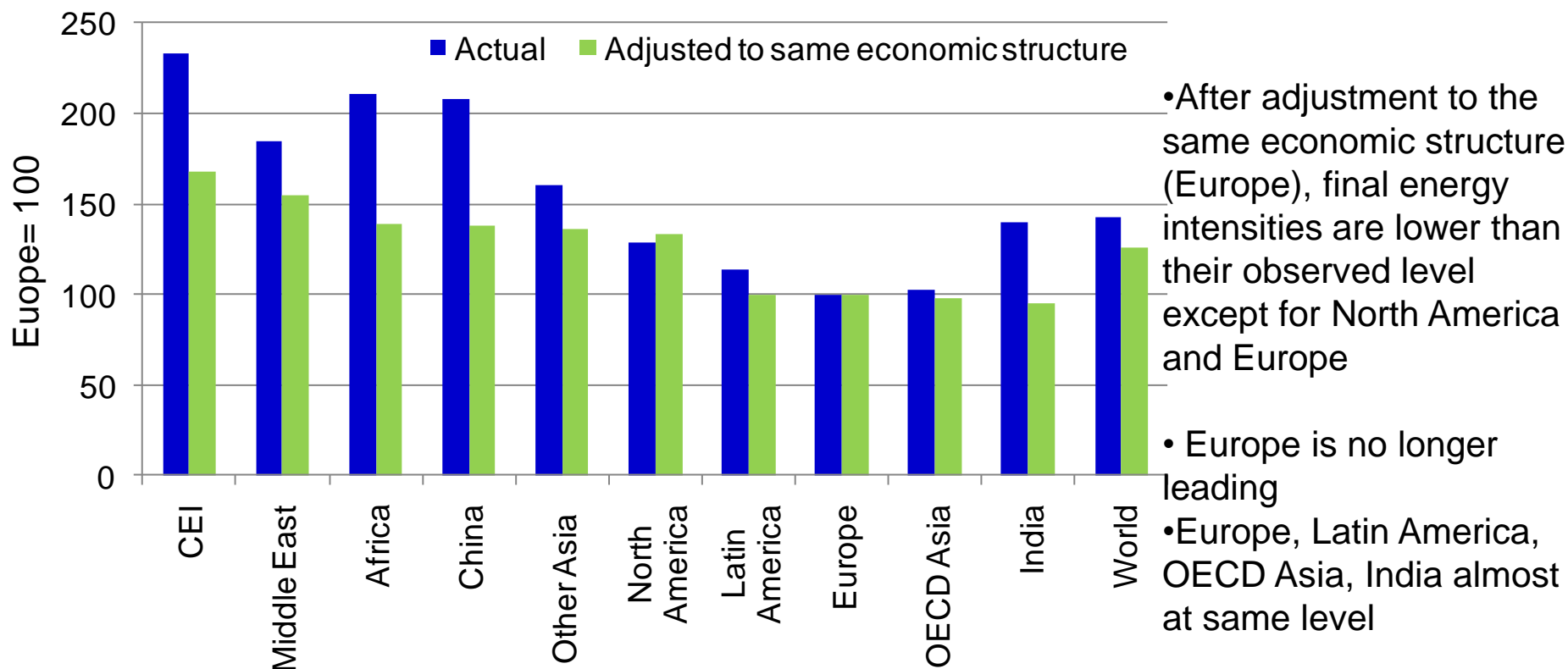
The primary energy intensity is almost twice lower in North Africa than in the Middle East (respectively 0.17 and 0.28 koe/\$05 at ppp).
It is the lowest in Tunisia, Morocco and Lebanon (0.10 koe/\$05 at ppp).

Primary energy intensities in the Middle East & North Africa (2008)



- Same ranking of region in terms of final energy intensities (blue bar)
- However, as Europe has a high contribution of services in the GDP, this, all things being equal lower its final energy intensity.
- To make the comparison more meaningful, final energy intensities should, be compared at same GDP structure (green bar).

Final energy intensities: actual and adjusted at same GDP structure



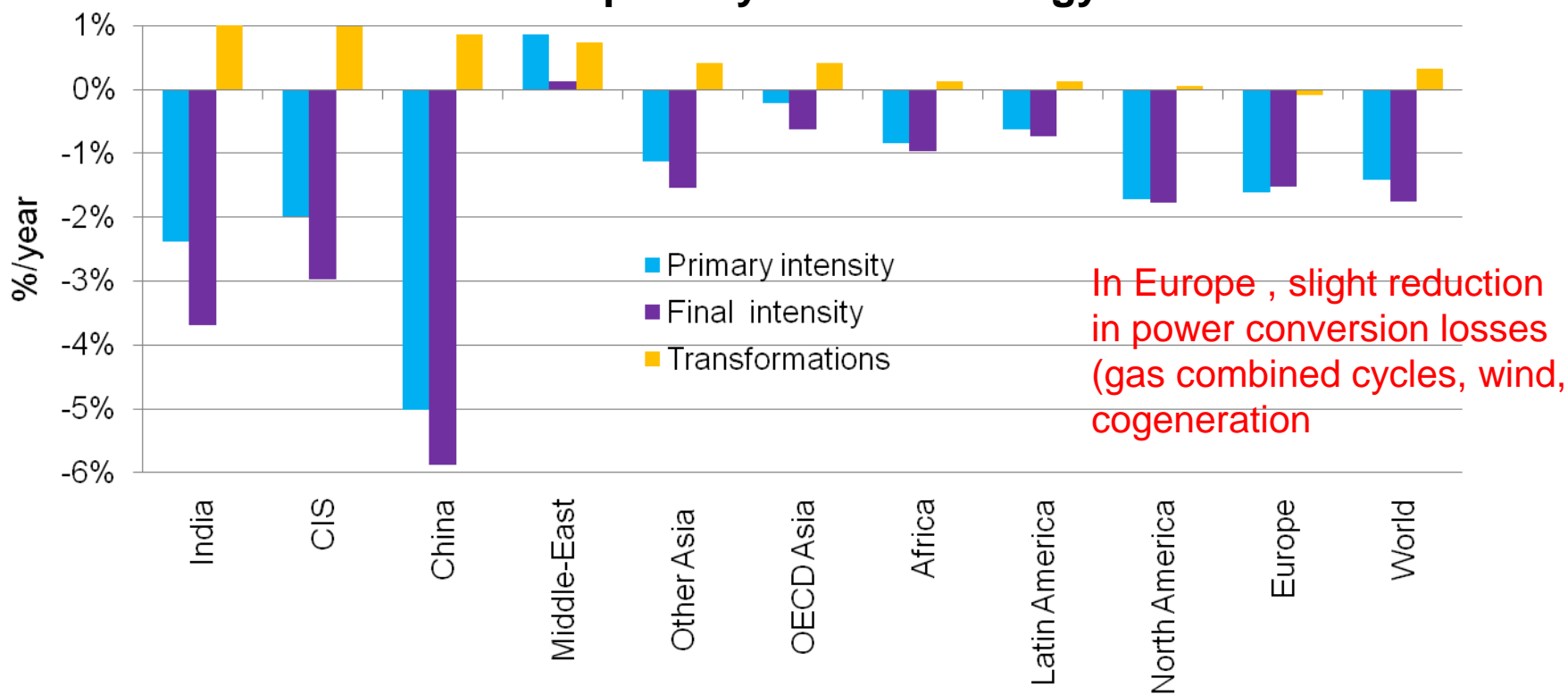
Source: Enerdata

Economic structure: share of GDP between agriculture, industry and services

Higher energy intensity reduction for final consumers in all regions, except Europe, because of increasing losses in power conversion, due to a higher share of electricity in final consumption (from 13% in 1990 to 16% in 2008 at world level), that is predominantly produced from thermal power plants (i.e. with 60-70% losses).

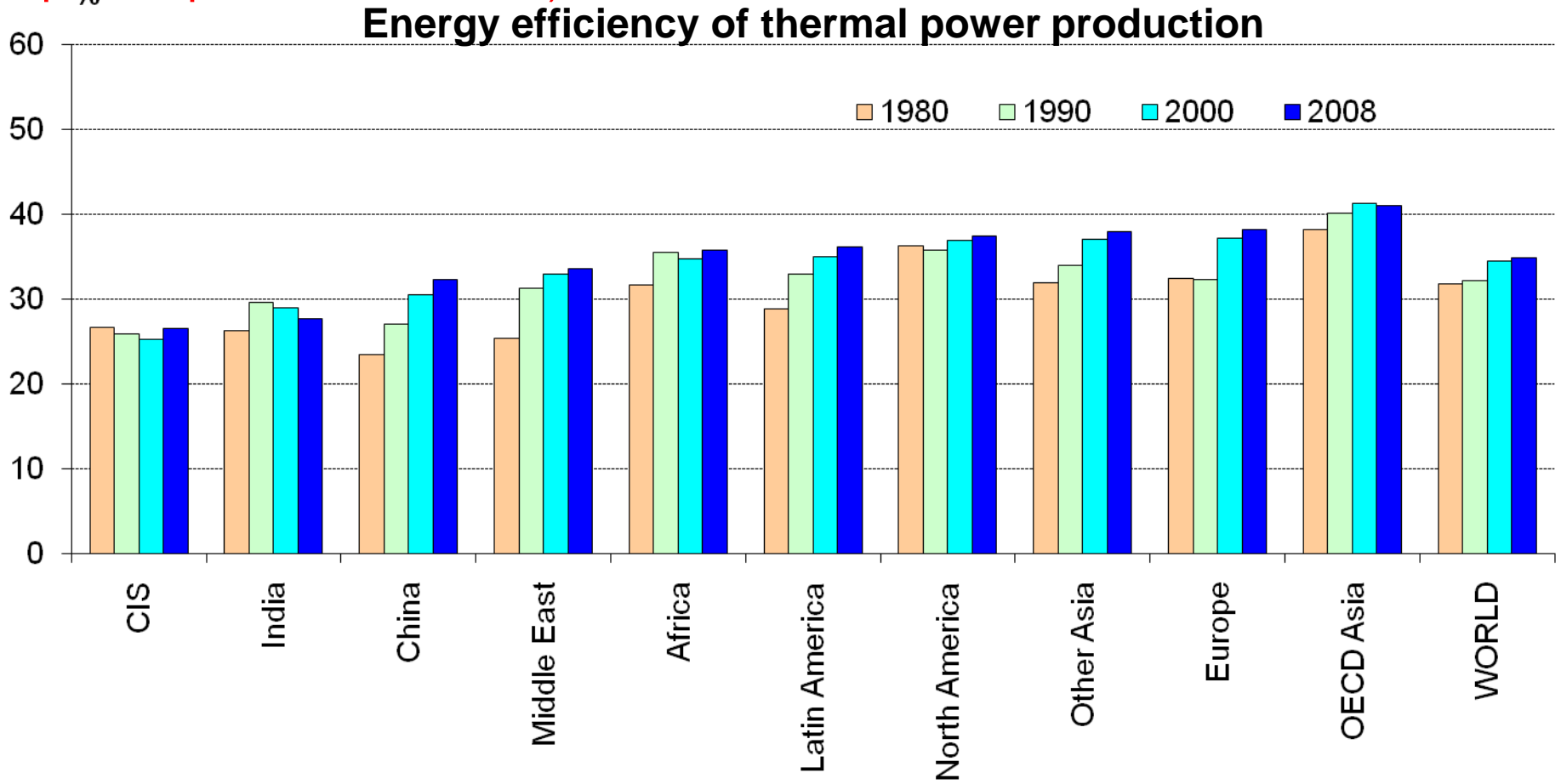
This trend has offset almost 20% of the energy productivity gain of final consumers at world level (66% in OECD Asia, 33% in CIS, 36% in India).

Trends in primary and final energy intensities

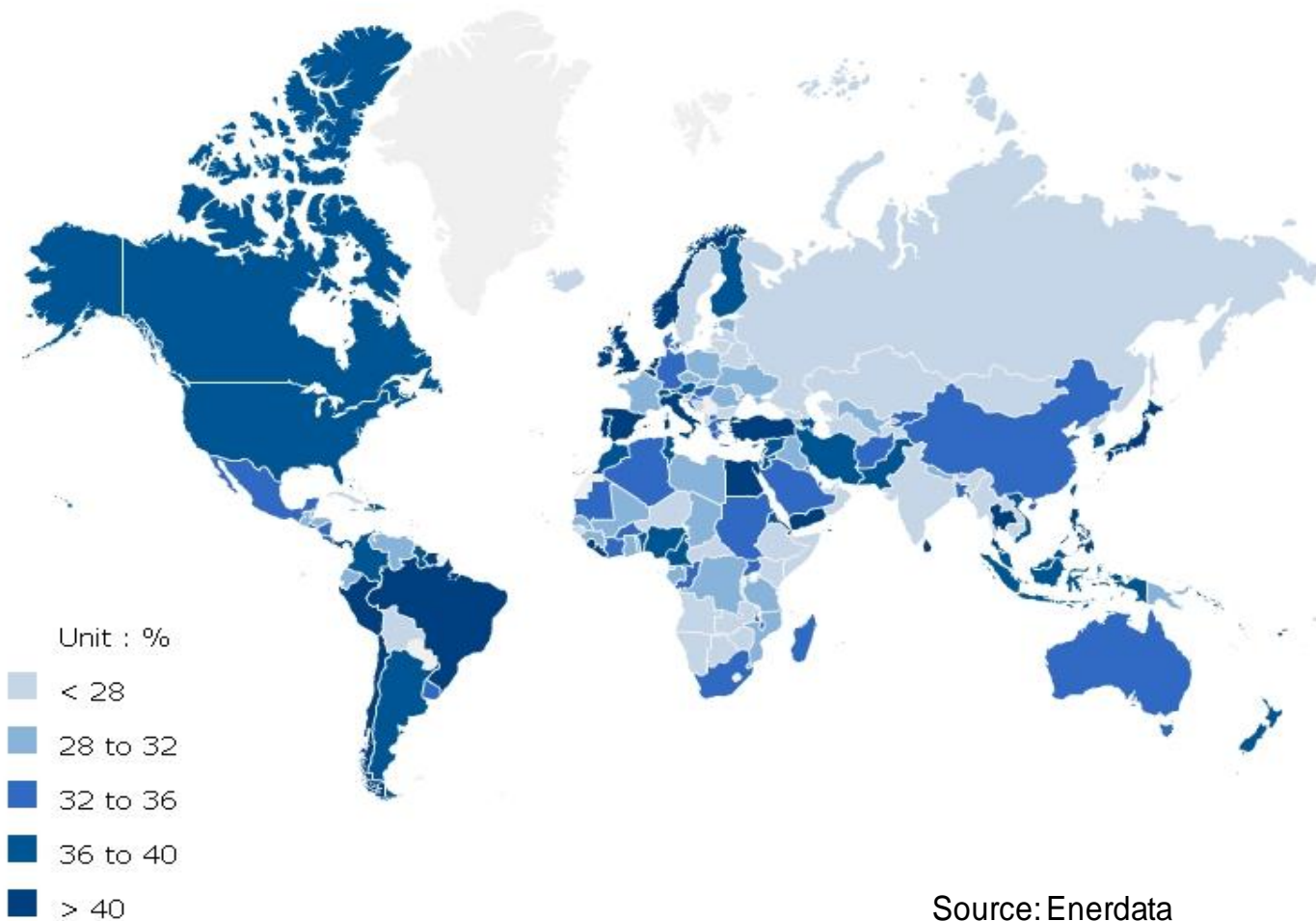


Slow improvement in the energy efficiency of thermal power generation at world level (+ 2.6 points efficiency gains, equivalent to 280 Mtoe energy savings since 1990).

The average world efficiency in 2008 (35%) is far from the EU average (40%) or EU best practice (Spain with 47.5%). If all regions were at 2008 EU level → 450 Mtoe savings (1.3 Gt CO₂) (920 Mtoe or 2.6 Gt CO₂ at Spanish performance level)



Average energy efficiency of thermal power production (%) (2008)



Top ten

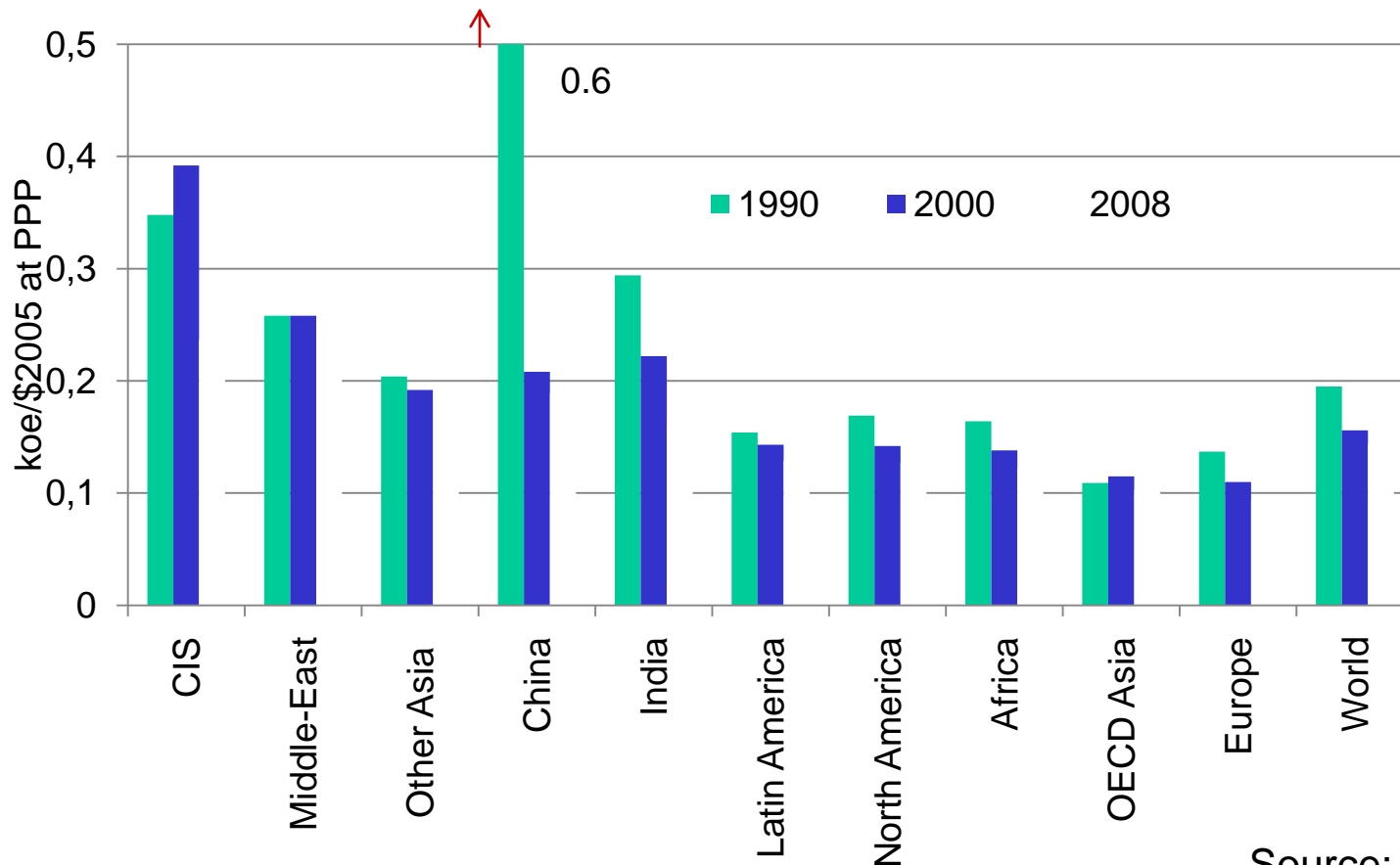
Spain,	47.5
Luxembourg	47.2
Portugal	46.4
Italy	45.9
Japan	44.9
Ireland	44.6
Norway	44.4
Panama	44.1
UK	44.0
Brazil	43.9

Source: Enerdata

Slow down in energy intensity of industry since 2000 in all regions;
convergence of performance in industry because of globalisation

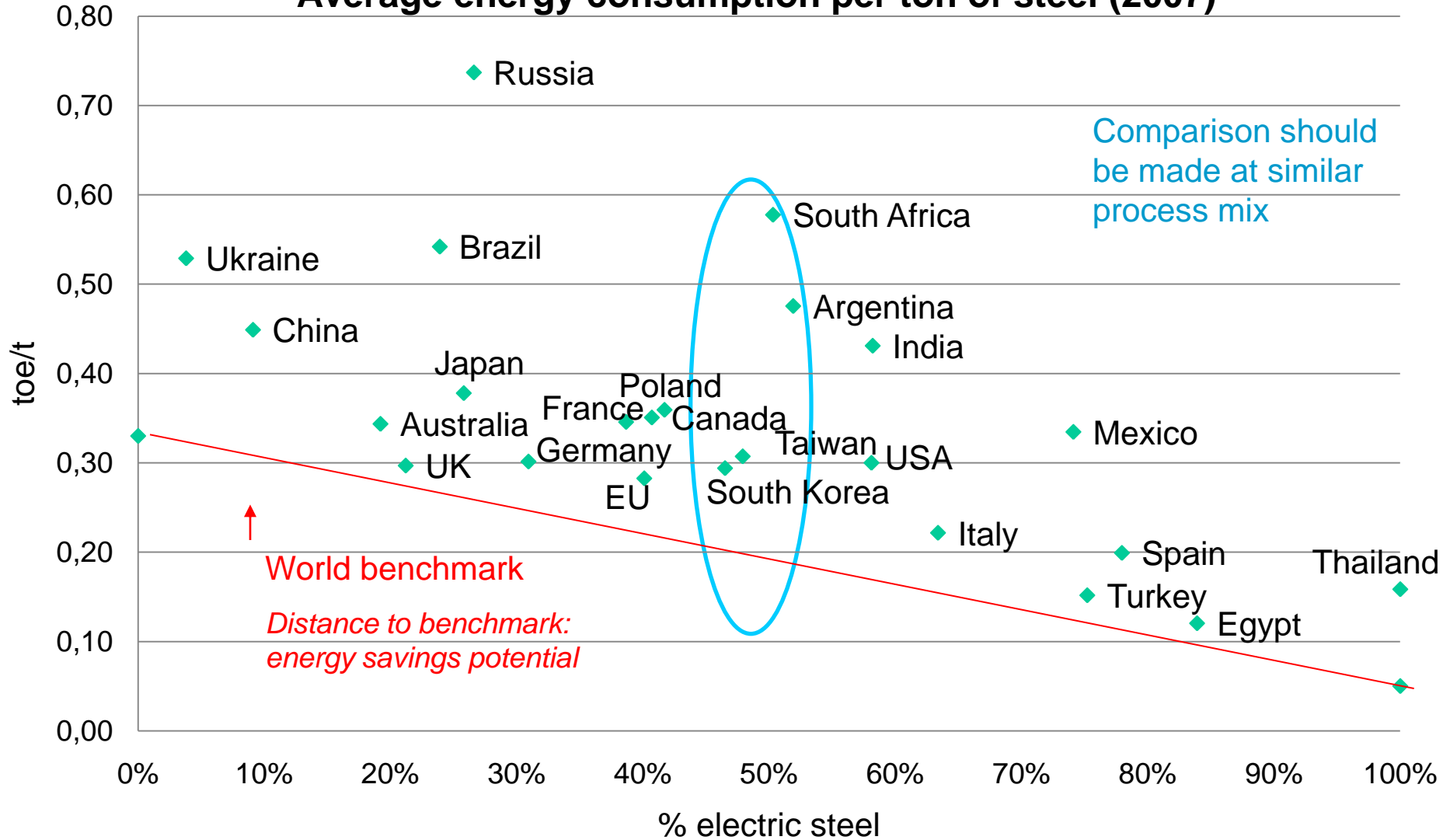
Part of the variation due to structural changes in industry

Energy consumption of industry per unit of valued added

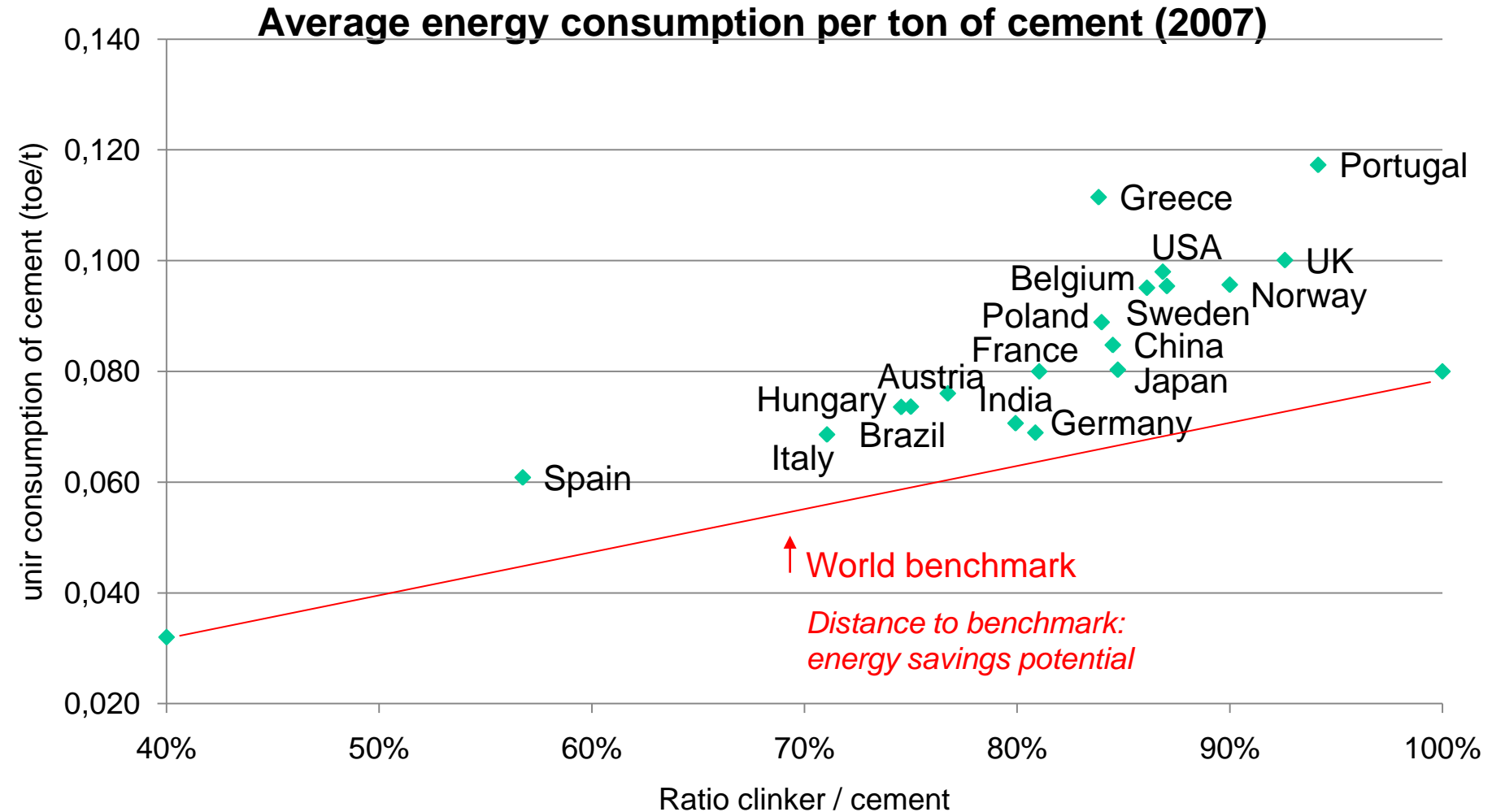


In industry, the best world practices are no longer found in the most developed countries. Comparisons of energy performance for energy intensive product should take into account differences in process mix

Average energy consumption per ton of steel (2007)



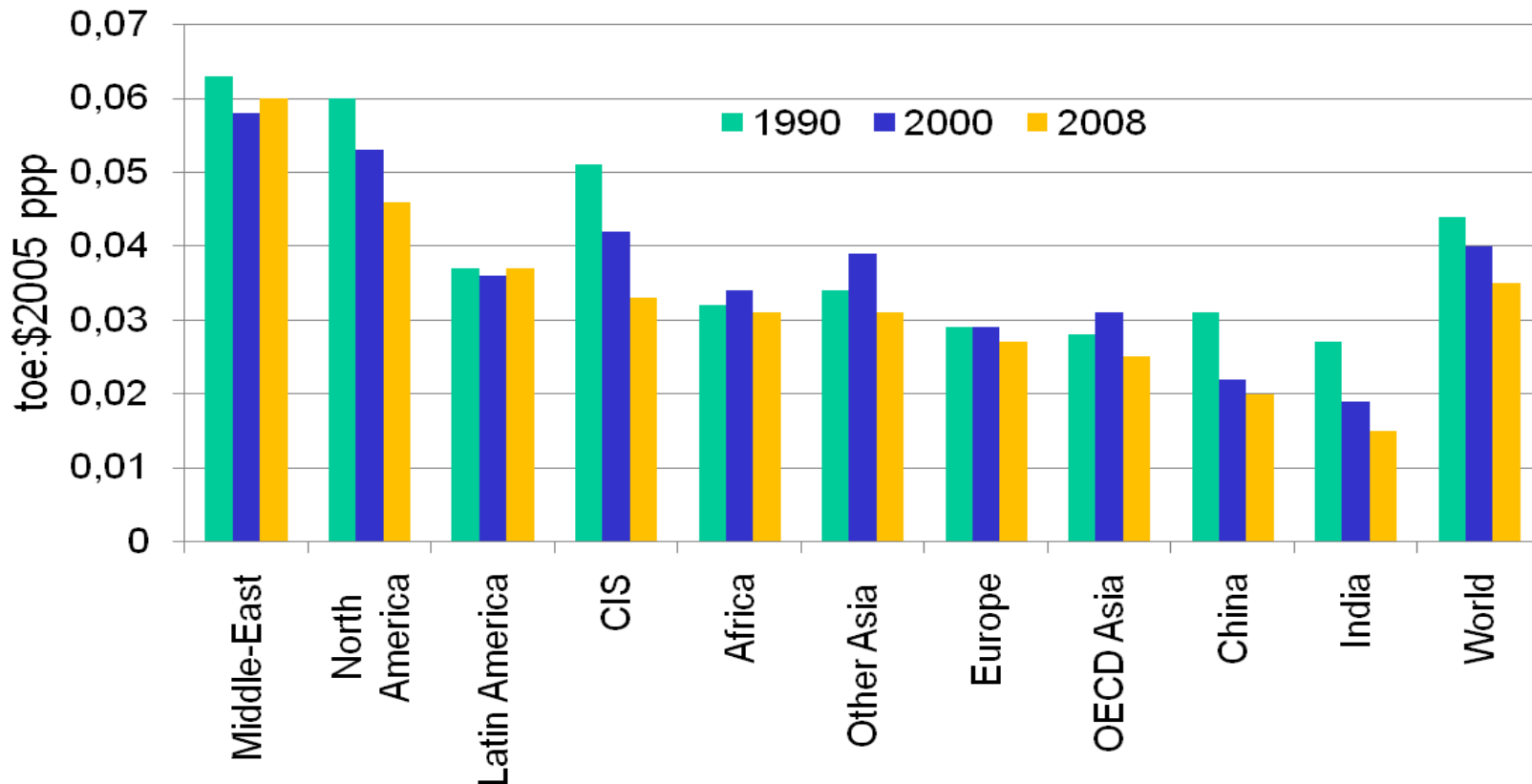
The energy performance of cement production is linked to the share of clinker produced in the country in relation to cement production: the lower this ratio the lower the specific consumption is. Distance to the red line (best practice) indicates the potential of energy savings.



The energy intensity of transport measures the relation between transport energy use and the GDP.

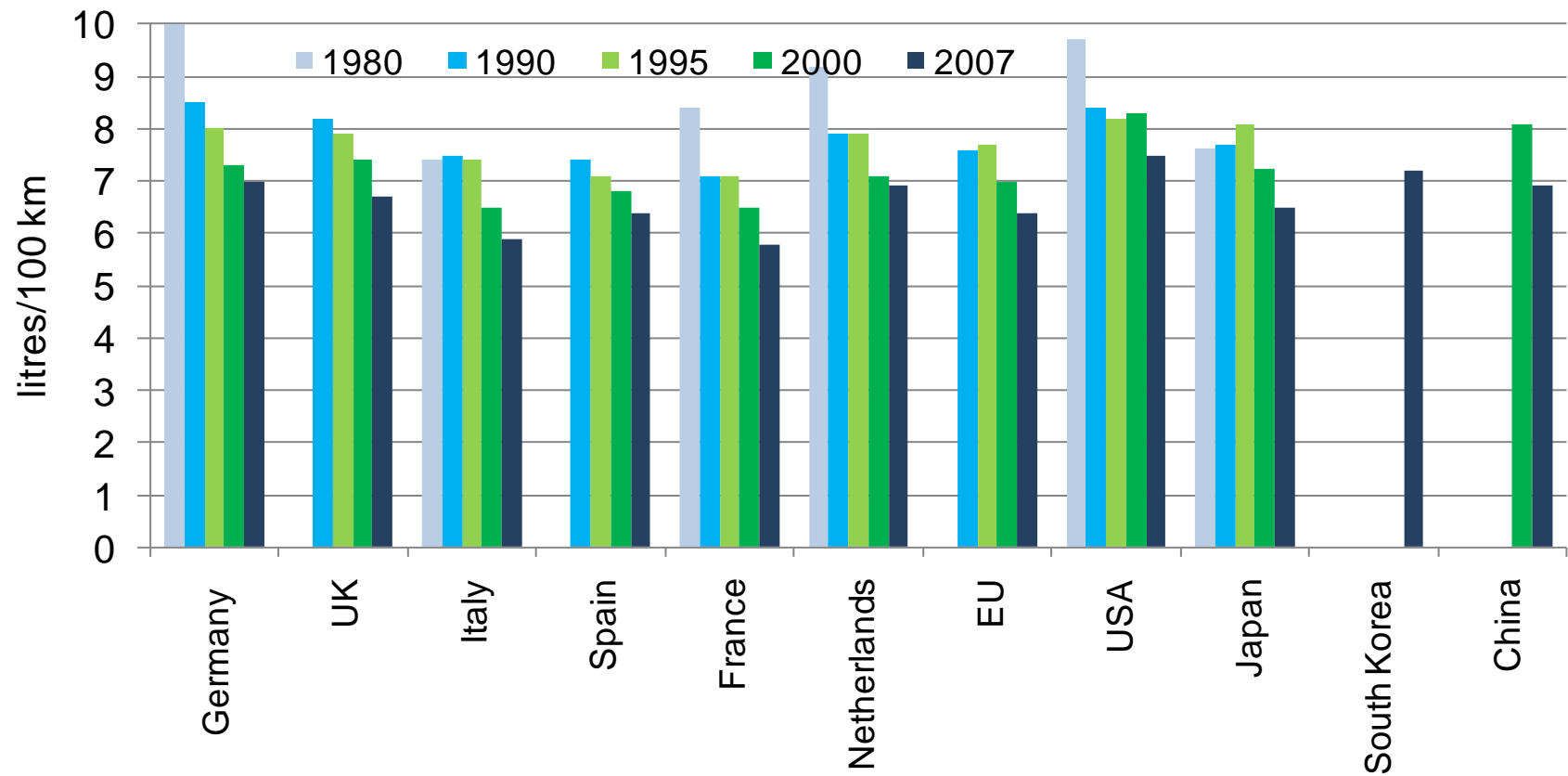
Regular decrease at world level and in most regions, which means that energy consumption is growing slower than the GDP,. This is a result among other factors of energy efficiency improvement in the sector.

Energy intensity of transport



In EU and Japan, the specific consumption of new cars has decreased regularly since 1995 (ACEA agreement for EU and top-runner programme in Japan); little reduction in the US.

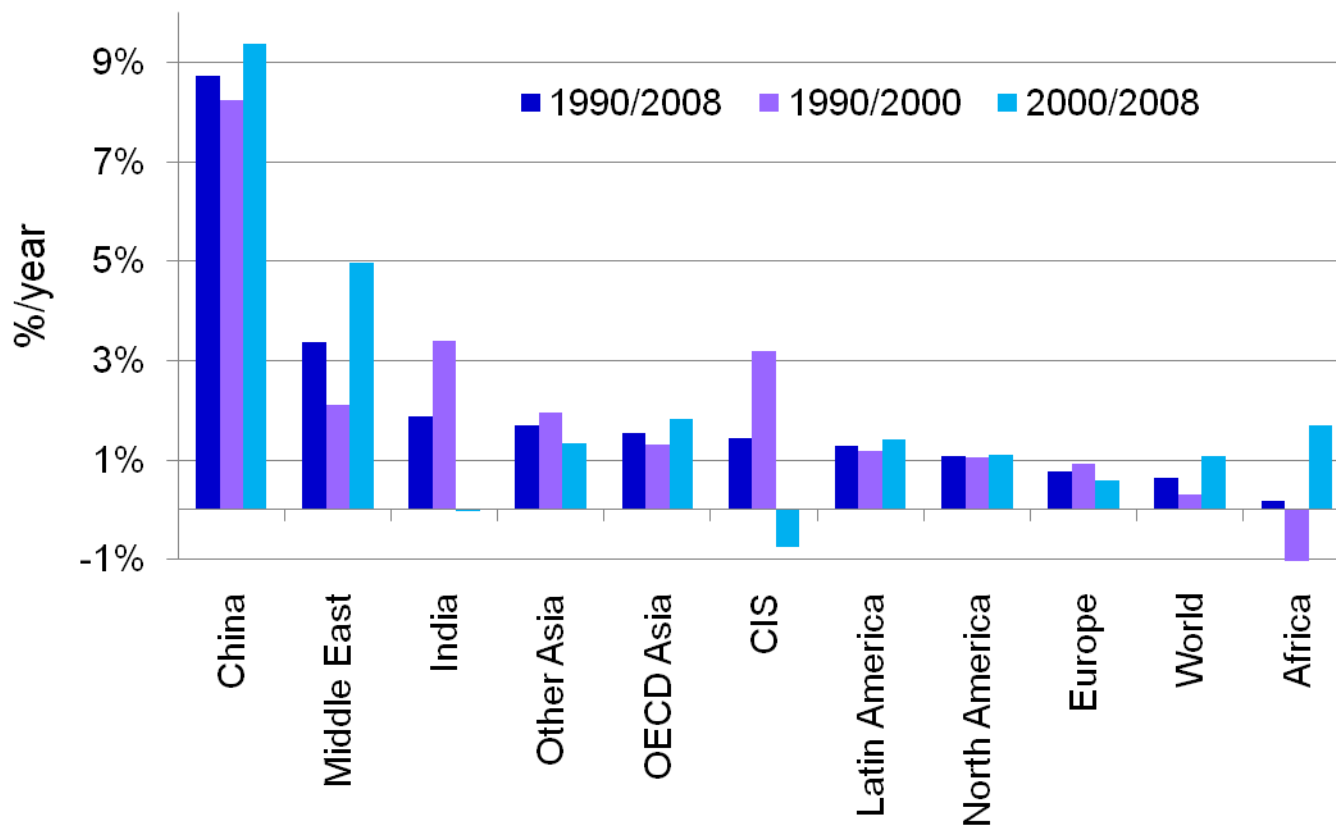
Specific consumption of new cars



Japan, China : only gasoline

In the residential sector, no real slow down in the average electricity consumption per electrified household (heating excluded in OECD countries) except in India), although the existence of strong policies

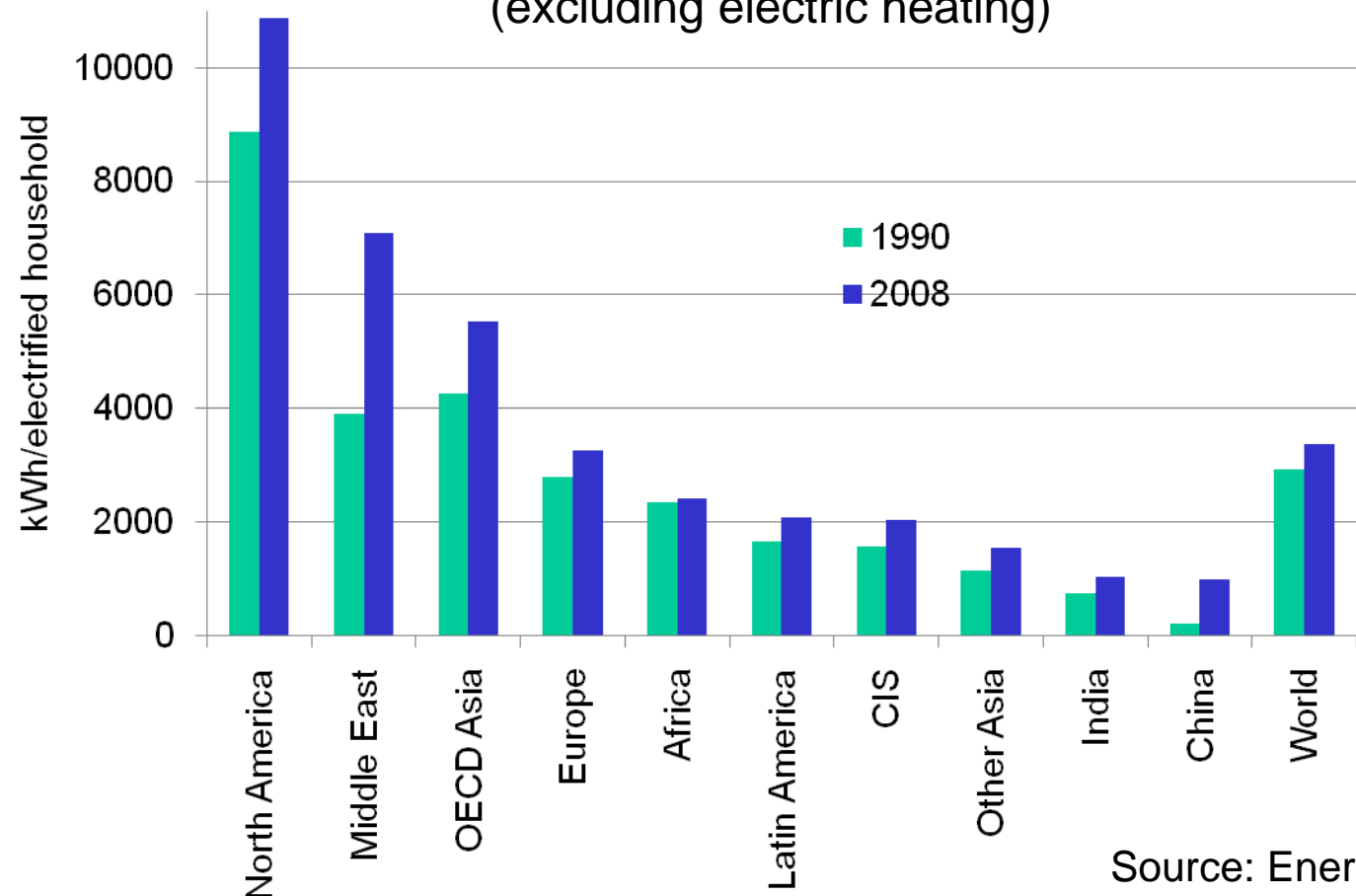
Variation of the average electricity consumption per electrified household



- Increase equipment ownership has offset the impact of the penetration of more efficient appliances.
- Moderate progression below 1%/year in Europe and North America
- Very sustained growth in China despite the policies

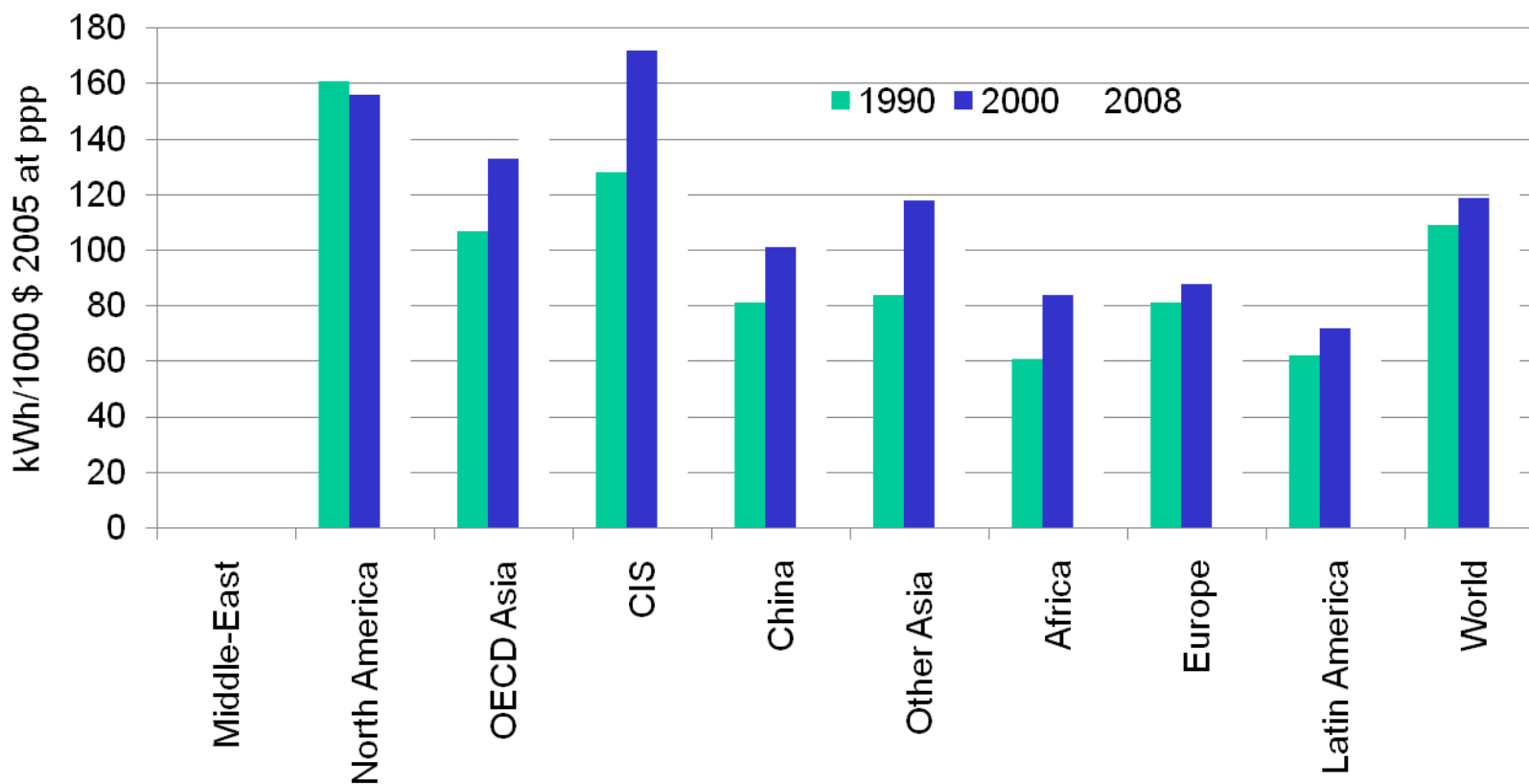
Very large discrepancies among regions in the electricity consumption of the residential sector per electrified household ,with 3500 kWh/ electrified household for world average, 11000 kWh for North America, 7000 in The Middle East
 Lower consumption for India and China (around 1000 kWh)

Electricity consumption of households per electrified household
 (excluding electric heating)



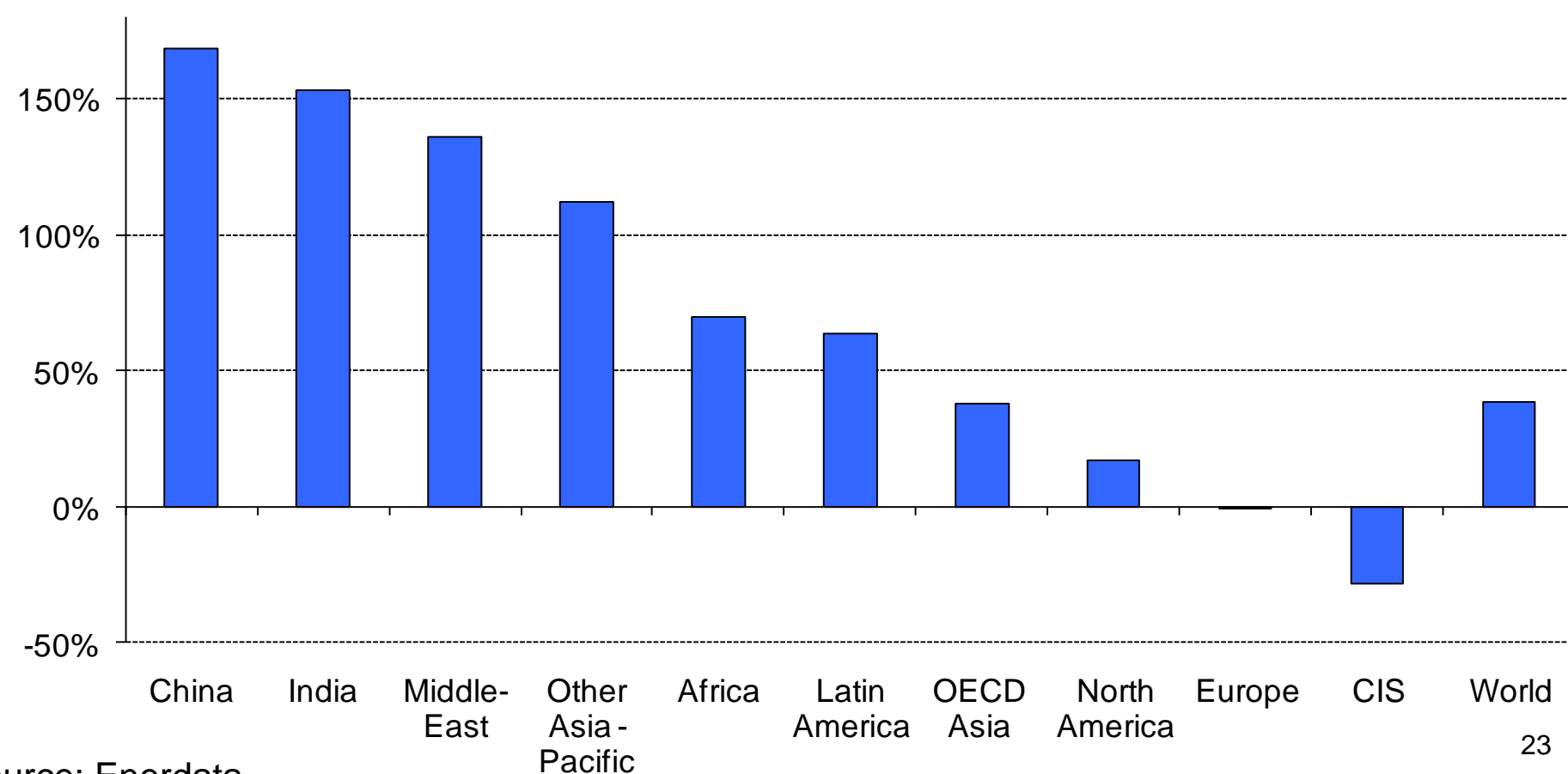
Rapid progression of electricity consumption in the service sector in almost regions with the diffusion of air conditioning and office appliances; slower progression in industrialised countries since 2000

Electricity consumption per unit of value added in the service sector

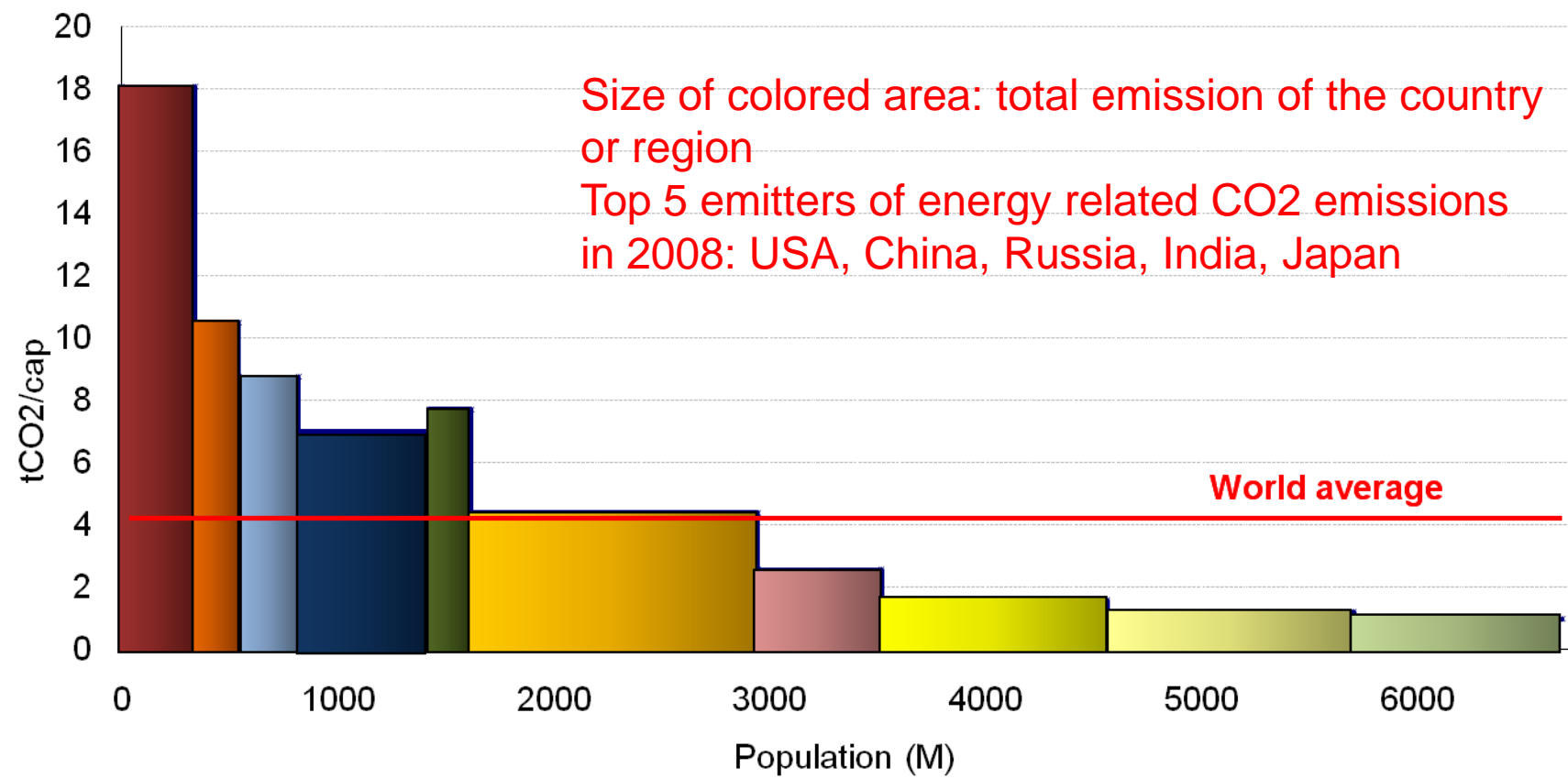


40% increase at world level of CO2 energy-related emissions since 1990
 (two third of which since 2000)
 Rapid progression in non OECD Asia in particular China and India
 Emissions in Europe back to 1990 level
 Reduction in CIS but progression since mid 90's

Variation of CO2 emissions from fuel combustion (1990-2008)

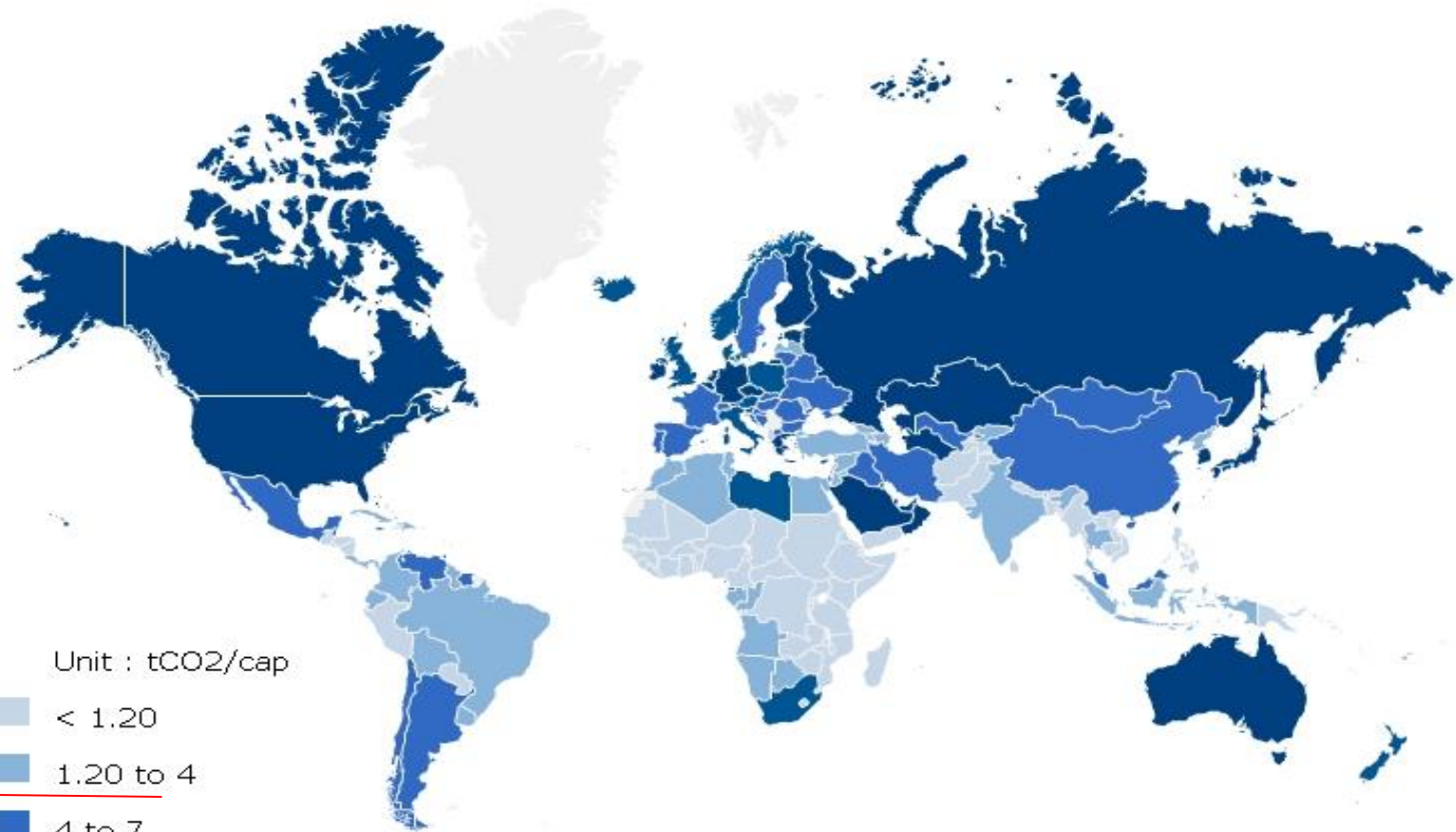


Very diverse levels of energy- related CO2 emissions per capita: a factor 20 between North America and the less developed regions



- North America
- OECD Asia
- CIS
- Europe
- Middle East
- China
- Latin America
- Other Asia
- India
- Africa

CO2 emissions per capita (2008)



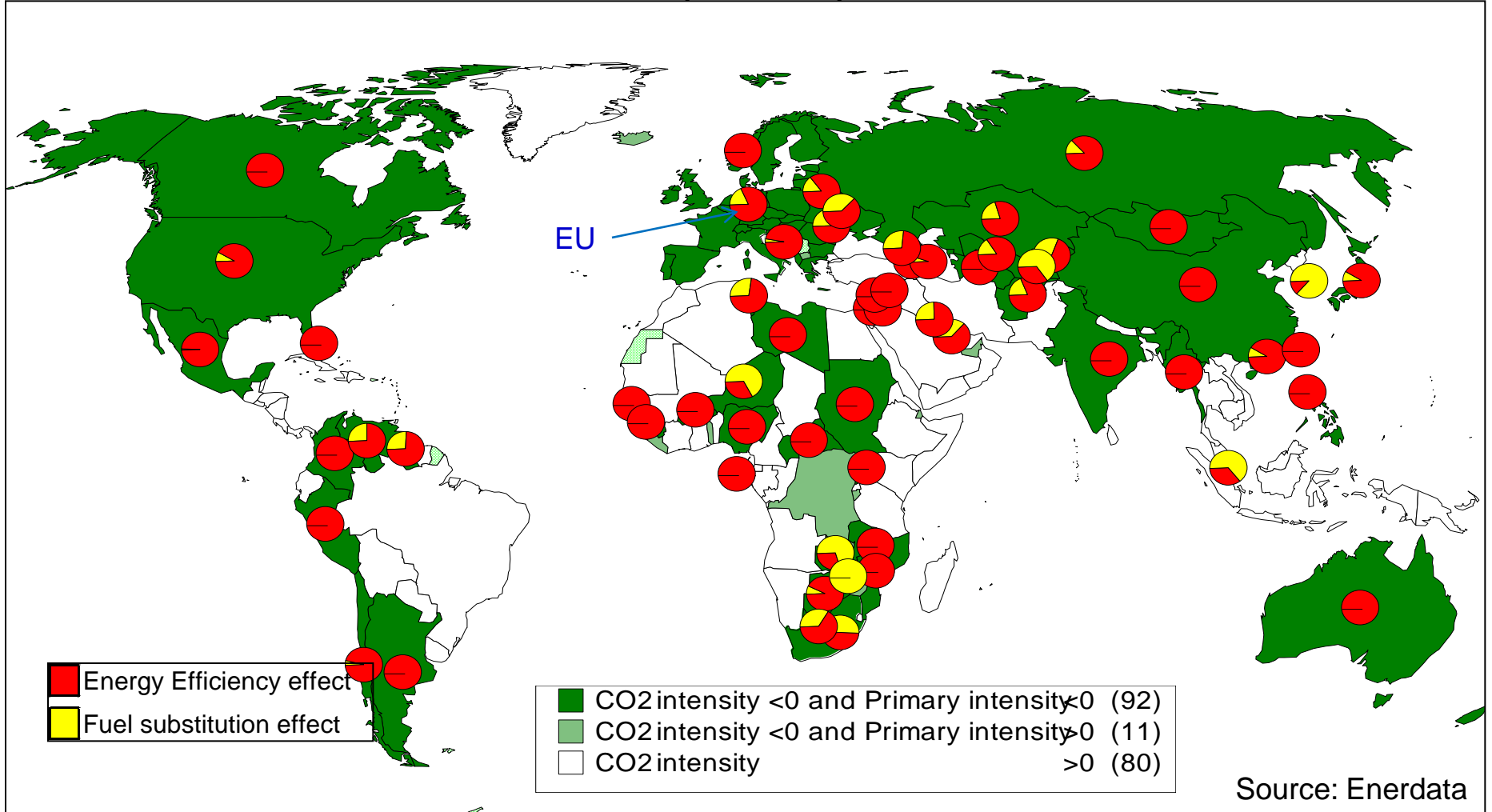
Unit : tCO2/cap



World
average

Most of the reduction in CO2 intensity driven by energy intensity (i.e. mostly energy efficiency) (e.g. 3/4 at EU level) and not fuel shift ;
Fuel substitution had an impact in a few countries (dominant yellow part) (e.g. Korea with 75% of the reduction).
Fuel substitutions often offset part of the energy intensity reduction (e.g. North Africa and world level)

Variation of CO2 intensity: impact of energy efficiency and fuel substitutions (1990-2008)



Conclusions

- It is not easy to see from the indicators the impact of policies, except in transport
- Most of the indicators, even if they are imperfect can help comparing the different performance of countries and regions and identify the best practice (top –ten, world best practice)
- Convergence of performance can be seen in the industry and transport sector

Thank you

For more information:

b.lapillonne@enerdata.fr

- For energy efficiency indicators :

- country tables:

- http://www.worldenergy.org/work_programme/technical_programme/technical_committees/energy_efficiency_policies_and_indicators/default.asp

- mapping by indicator: <http://wec-indicators.enerdata.eu/>

- For energy efficiency indicators in the EU: www.odyssee-indicators.org

Annex: data sources and definition of regions for WEC energy efficiency indicators

- Data coming from Enerdata databases combining data from various international (IEA, OLADE, APERC, World Bank , IMF, IRF, IISI...) and national sources.

- Indicators by country for all WEC member countries and for the world in 10 main regions/ countries:
 - Europe
 - CIS (Russia,Ukraine...)
 - North America: USA, Canada
 - Latin America (including Mexico)
 - Asia OECD (and Pacific): Japan, Korea, Australia, New Zealand
 - China
 - India
 - Other Asian countries (South East Asia,...)
 - Africa
 - Middle East