

Greenhouse gas efficiency in the industry

The European Union and the rest of the world

TNO | Knowledge for business



Jeroen Kuenen & Peter Bosch

This presentation reflects the views of the consultants and not the position of the European Commission

Outline

- Background
- Introduction to greenhouse gas efficiency concepts
- General methodology and data availability
- Results per industry branch
- Main conclusions



Background

- Revision of ETS Directive
- Possible reallocation of industries to non-EU countries could lead to “carbon leakage”
 - Loss of market share to less carbon efficient installations outside EU, thus leading to overall higher greenhouse gas emissions
- This study: Gather, assess and compare available data on greenhouse gas efficiency of industrial installations covered by the ETS in the EU and other industrialized and developing countries
 - Current differences between installations in EU and non-EU countries
 - Differences when Best Available Technologies (BAT) would be applied



Industries and gases

- Iron and steel industry
 - Non ferrous metal industry
 - Production of Aluminium, Copper, Lead, Zinc
 - Mineral industry
 - Production of Cement, Lime, Glass
 - Chemical industry
 - Production of Sulphuric acid, Ammonia, etc.
 - Paper and pulp industry
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- Focus on CO₂ in this study
 - CH₄ and N₂O important for some specific processes in the (chemical) industry
 - PFCs in the aluminium industry

Countries considered

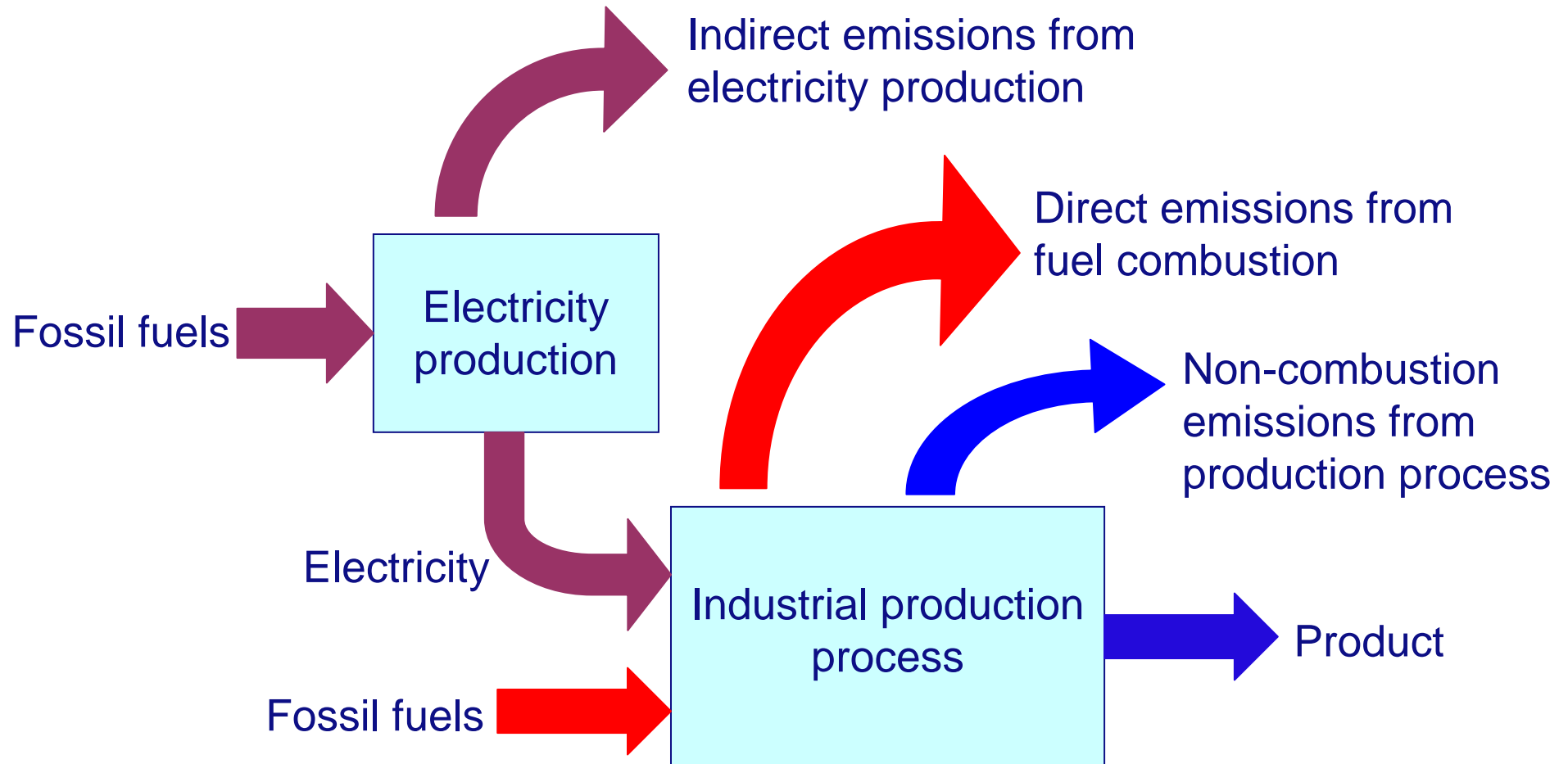
- European Union
- Other industrialized countries (non-EU) (7)
 - USA, Canada, Japan, Russia, Ukraine, Turkey, Switzerland
- Developing countries (8)
 - China, India, Brazil, South Africa, South Korea, Mexico, Indonesia, Thailand
- Selections based on
 - shares of industry in GDP (selection of “industrialised countries”)
 - initial screening of data availability



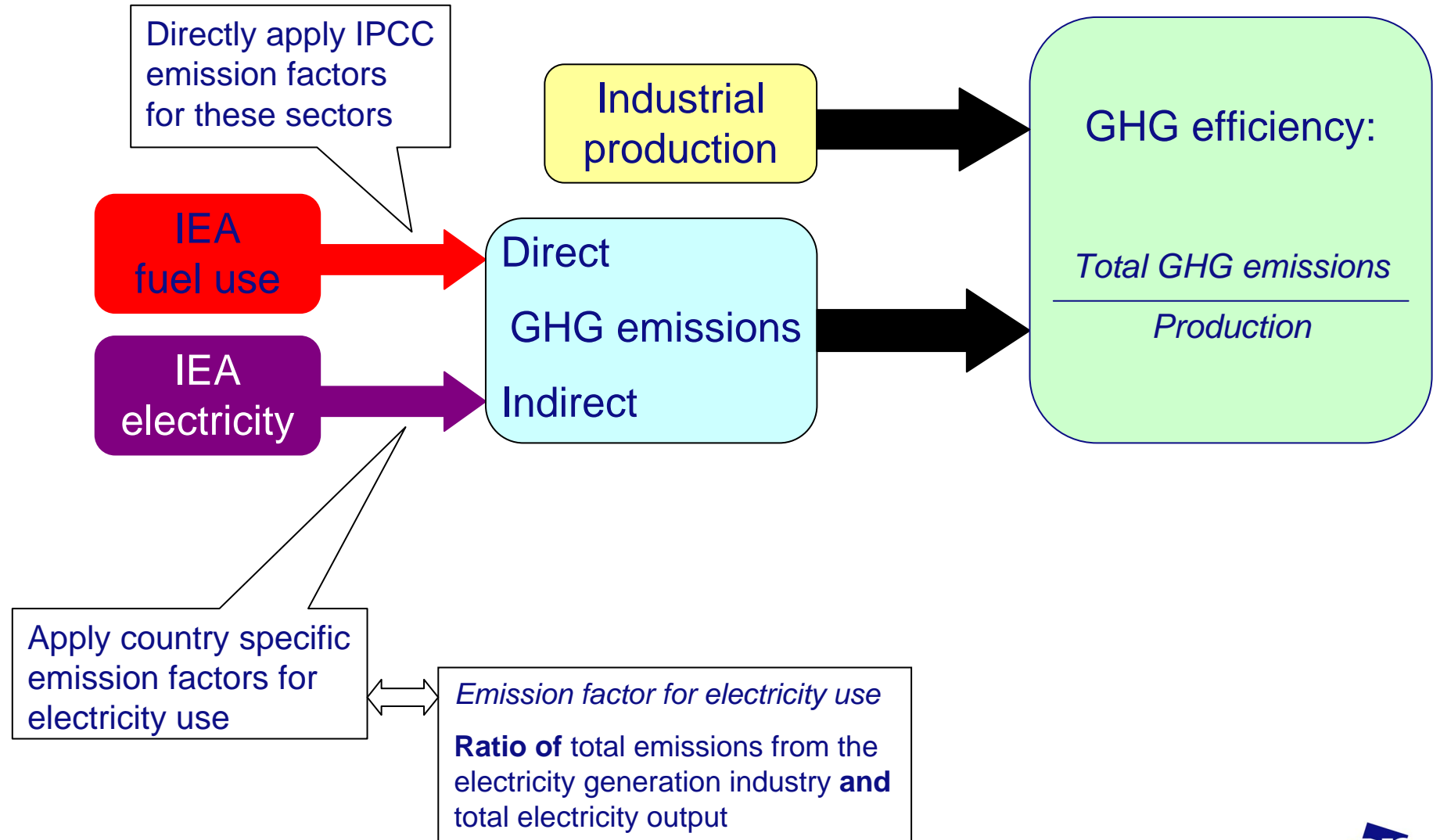
Data availability

- Initial screening shows poor data availability for most branches
 - Energy use: IEA statistics include fuel and electricity use for all countries & sectors, but only at an aggregated sector level
 - Production data (total product produced per country/annum): for some industries available, but for others not
 - Statistical reporting has problems, e.g. the use of CHP plants in the pulp and paper industry, which is not reflected in the statistics
- For a reliable comparison between countries, more detailed data are needed regarding
 - Production
 - Energy consumption (both fossil fuels and electricity) at a more detailed level than available from the Energy Statistics
- This study can therefore not provide reliable conclusions regarding exact amounts of carbon leakage, but can help to gain insight in the main factors determining greenhouse gas efficiencies

Greenhouse gas efficiencies



General methodology using IEA Statistics



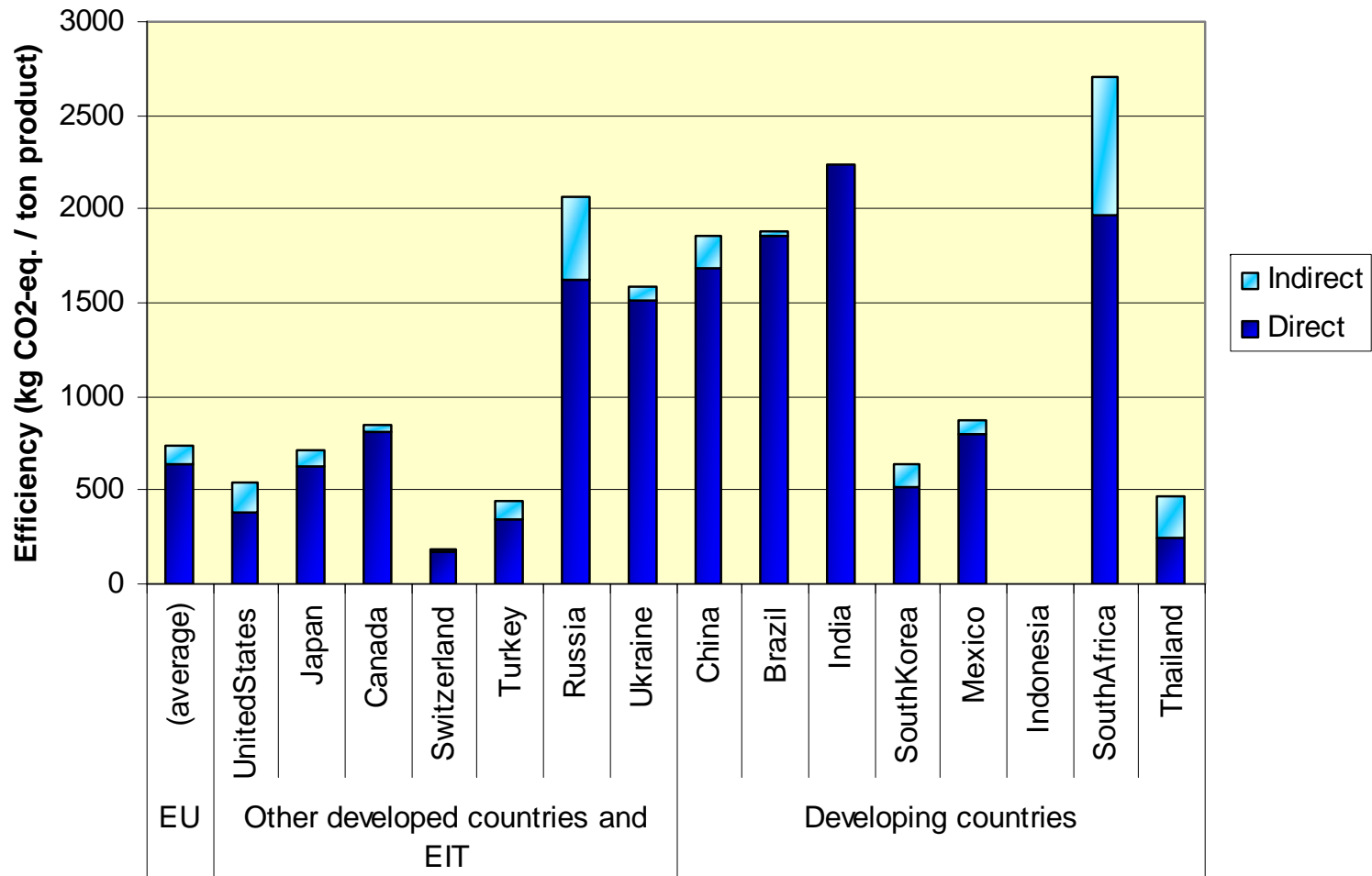
Data availability: statistical route

- Fossil fuel and electricity use: IEA major source, but limited detail

Industrial category	IEA category	ISIC
Iron and steel	IRONSTL	2731
Non-ferrous metals	NONFERR	2732
Chemicals and petrochemical	CHEMICAL	24
Pulp, paper and print	PAPERPRO	21 and 22
Non-metallic minerals	NONMET	26

- Emission factors for greenhouse gases: from IPCC 2006 Guidelines
- Industrial production data
 - available for some major sectors from international databases, e.g. iron and steel, cement, paper
 - very limited availability for most other sectors
- **Alternative route:** Specific energy requirements of process types, combined with typical fuels used and CO₂ emission factors, can be converted to CO₂ efficiencies
 - limited info on use of processes by country

Iron and Steel industry



Values are only useful for a relative country comparison; absolute values may differ considerably from reality due to lack of reliable data in this study

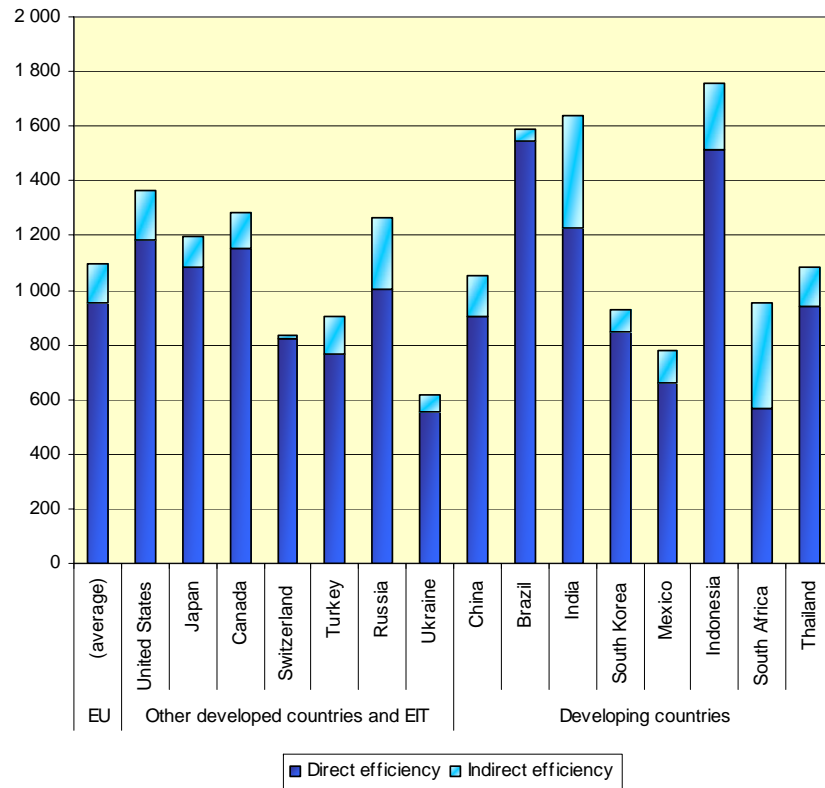
Pulp and paper industry

- General methodology using IEA statistics unreliable
 - Large extent of on-site CHP plants (not included in Energy Statistics)
 - Use of black liquor (from chemical pulping) to produce electricity
 - Heavily dependent on bio energy, with limited CO₂ reduction potential
- Use process specific data on energy efficiency
 - Fuel & electricity intensity for each specific process route
 - Data on the share of each process route in each country
 - GHG emission factors from IPCC
 - Data from IEA, BREF and FAOstat

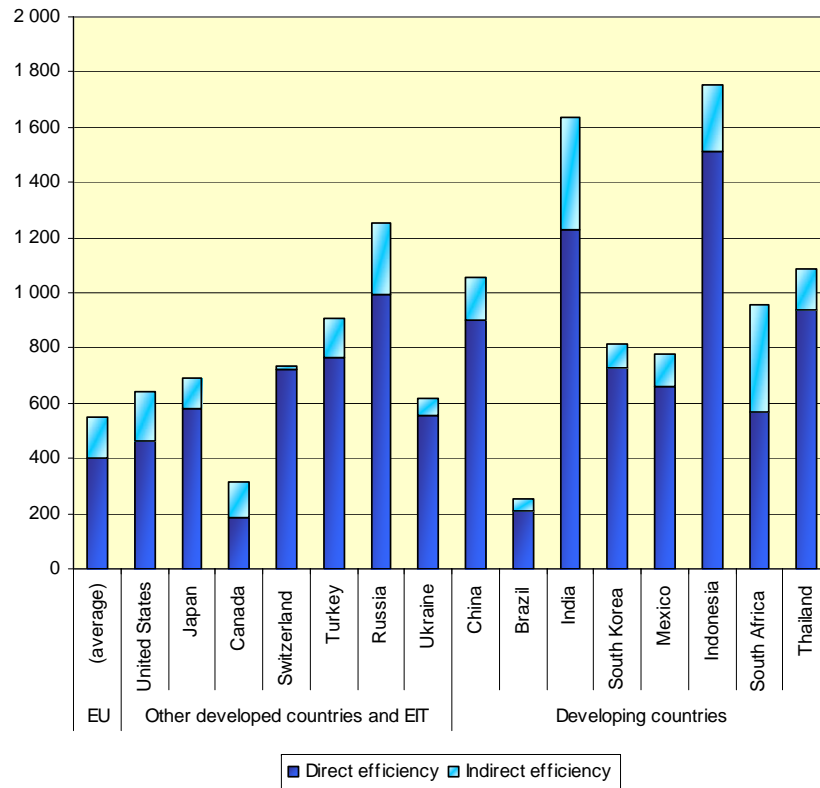


Pulp and paper industry

including biomass emissions



excluding biomass emissions

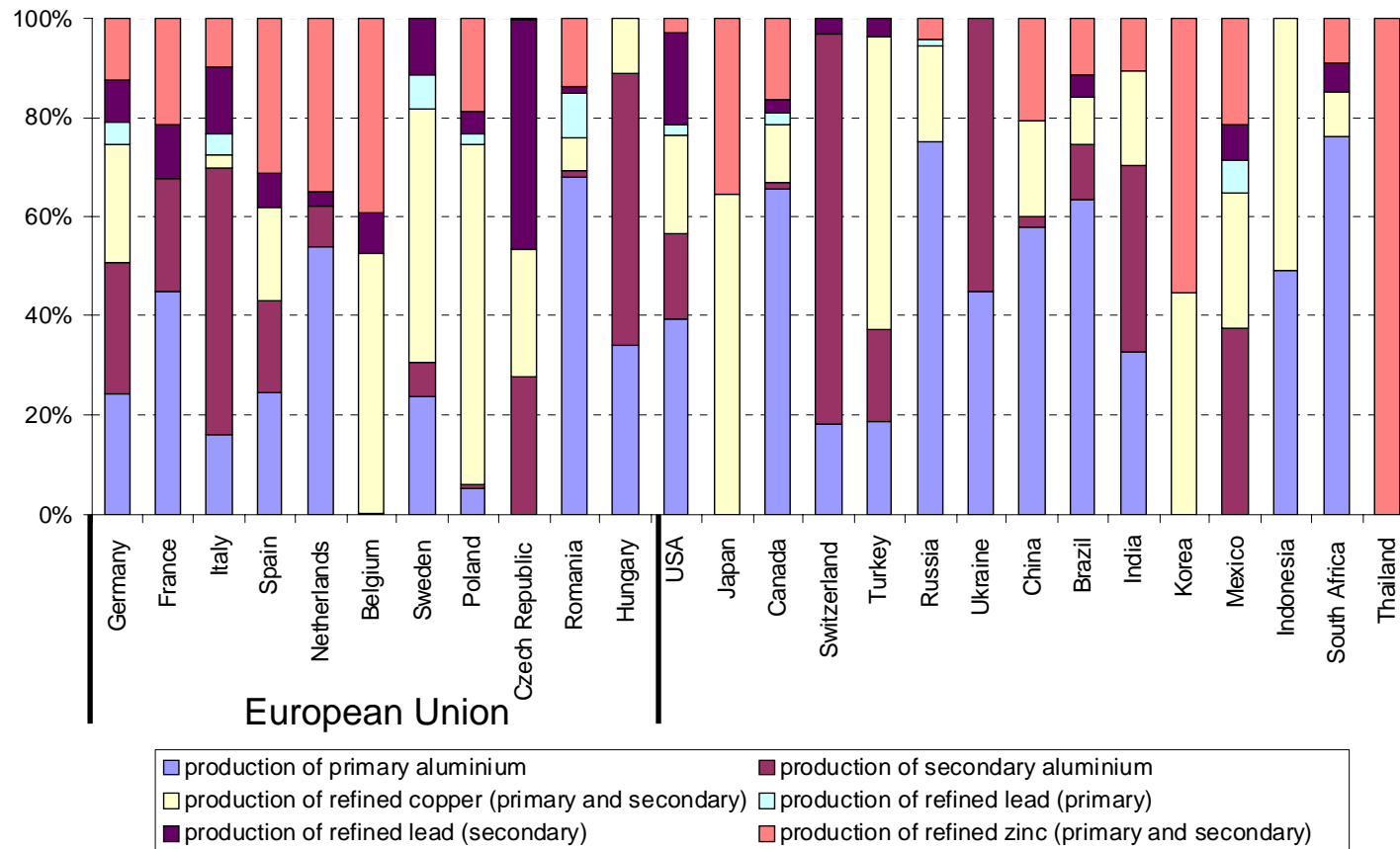


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Non ferrous metal industry

Similar situation for:
 - Mineral industry
 - Chemical industry

- Broad sector; major differences per country
- IEA energy data too aggregated and not usable

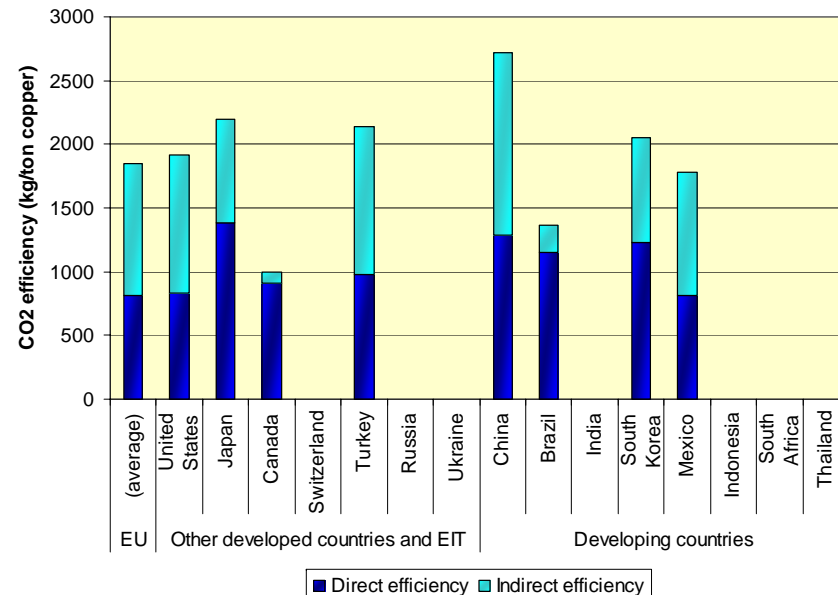


Subbranches non-ferrous metals

- Look at different kinds of non-ferrous metal production
- As for pulp and paper, use process specific intensities from literature
- Two important parameters that determine the CO₂ efficiency:
 - Fossil fuel use in production process and electricity generation processes
 - Type of production (primary, secondary)

- Example: copper, pyrometallurgical process

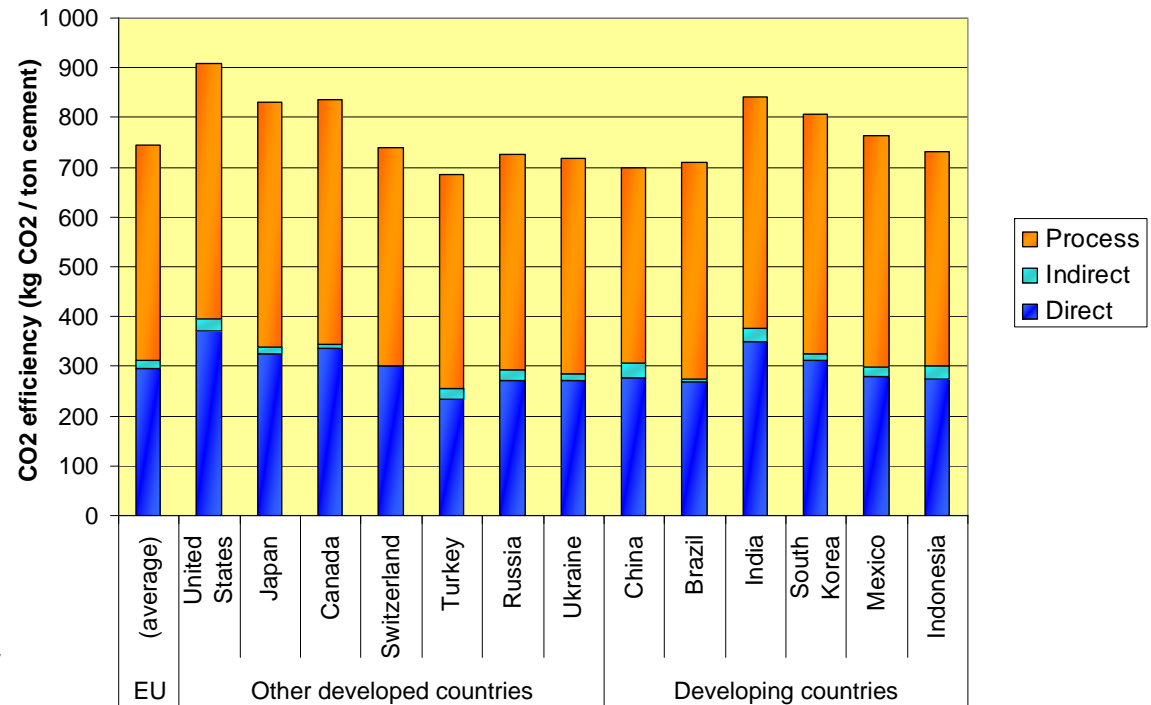
- Data not available for all countries
- Generally, coal based economies are higher
- Electricity use is very important parameter



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Mineral industry: Cement production

- Statistics available for cement production; for other sectors lacking
- **Cement:** China main producer (2005: 46% globally)
- Significant part of the CO₂ emissions are from calcination rather than from combustion
- Efficiencies calculated using specific process types and their typical fuel efficiencies



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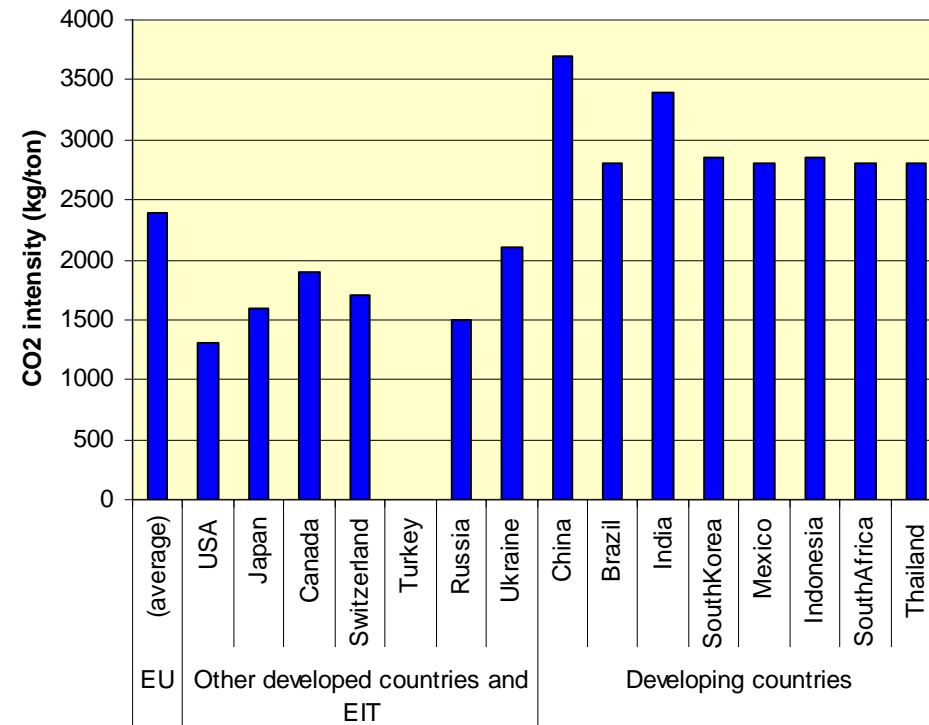
Chemical industry

- Very broad and diverse sector
- Limited availability of data; if available then with gaps
- Country comparisons as for other sectors not possible
 - Specific energy intensities for specific process routes available from literature
 - But share of each process route per country not available
- Try to collect other relevant information
 - Example: Ammonia production



Ammonia production

- Rough guess estimates of GHG efficiency possible by combining:
 - reported emissions and production data from UNFCCC (Annex I only)
 - continent specific energy requirements from literature
 - CO₂ emission factors from IPCC



Values are only useful for a relative country comparison; absolute values may differ considerably from reality due to lack of reliable data in this study

Overall conclusions

- Comparisons between countries often impossible due to lack of sufficient and reliable statistics
 - IEA Energy Statistics only at aggregated level
 - Problems with statistical reporting, e.g. the use of combined heat and power plants (CHP) in pulp and paper industry
 - Unavailability of statistics at a detailed level for many branches
- For a reliable comparison between countries, more detailed data are needed regarding
 - Production
 - Energy consumption (both fossil fuels and electricity)



Preliminary conclusions

- Efficiencies derived in this study are only useful for a relative comparison between countries
 - Absolute values may differ considerably from reality due to unreliable and insufficient data used in this study
- Greenhouse gas efficiency depends heavily on
 - Type of industry
 - Energy source in country of origin (EU) and destination
 - Electricity generation source in country of origin (EU) and destination
 - Specific production process
- Higher CO₂ intensities are generally found in coal-based economies such as China
- The potential differences in greenhouse gas efficiencies between countries is very different between industrial sectors

Thank you for your attention !!!

