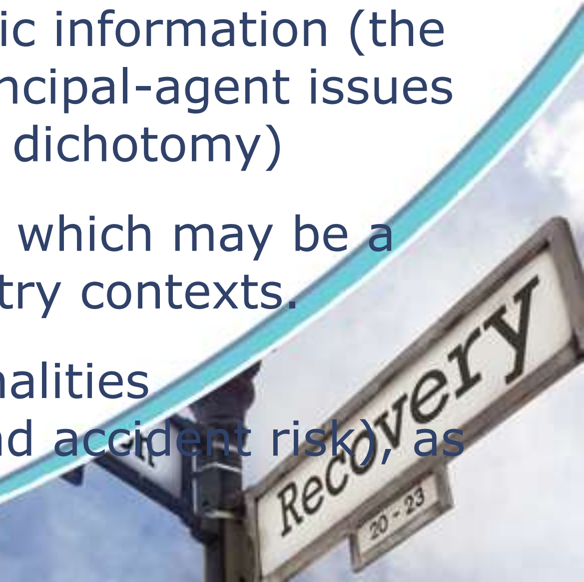
Calculating Energy Efficiency
Data Sources and Main Challenges

Jakub Vít

Confederation of Industry and Transport

Energy Efficiency Gap

- market failures, such as lack of information or misplaced incentives
  - research and development (R&D) and learning-by-doing spillovers; inefficient product quality and differentiation due to market power; and inefficient introduction of new products due to consumer taste spillovers (for example, consumers becoming comfortable with a new technology)
  - lack of information on the part of consumers (learning-by-using or so-called experience goods; energy prices; energy consumption of products; and available substitutes); asymmetric information (the “lemons problem”); and split incentives and principal-agent issues (such as the frequently-discussed renter/owner dichotomy)
  - capital market failures and liquidity constraints, which may be a particularly significant issue in developing-country contexts.
  - energy market failures, including various externalities (environmental, energy security, congestion, and accident risk), as well as average-cost pricing of electricity

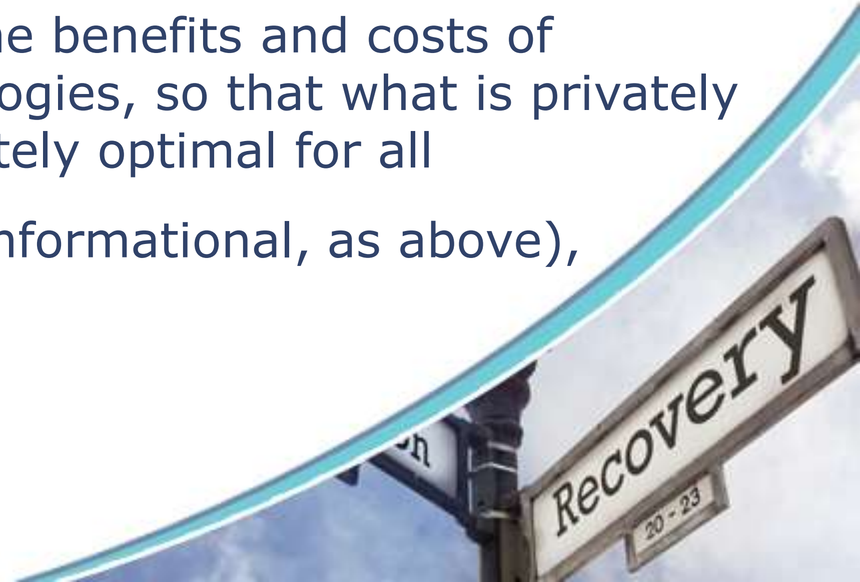


Energy Efficiency Gap II

- behavioral effects, such as inattentiveness to future energy savings when purchasing energy-consuming product
  - inattentiveness and salience issues (although inattention can be rational and efficient under some circumstances);
  - myopia (that is, short-sightedness);
  - prospect theory (and reference point issues);
  - bounded rationality and heuristic decision-making; and
  - systematically biased beliefs (regarding, for example, future energy prices and the development of new technologies).

Energy Efficiency Gap III

- modeling flaws, such as assumptions that understate the costs or overstate the benefits of energy efficiency
  - possibility of unobserved or understated adoption costs, including unaccounted for product characteristics
  - overstated benefits of adoption, due to inferior project execution relative to assumptions, and/or poor policy design.
  - incorrect discount rate may be employed in an analysis, when the correct consumer and firm discount rates should vary
  - heterogeneity across end users in the benefits and costs of employing energy-efficiency technologies, so that what is privately optimal on average will not be privately optimal for all
  - possibility of uncertainty (real, not informational, as above), irreversibility, and option value.

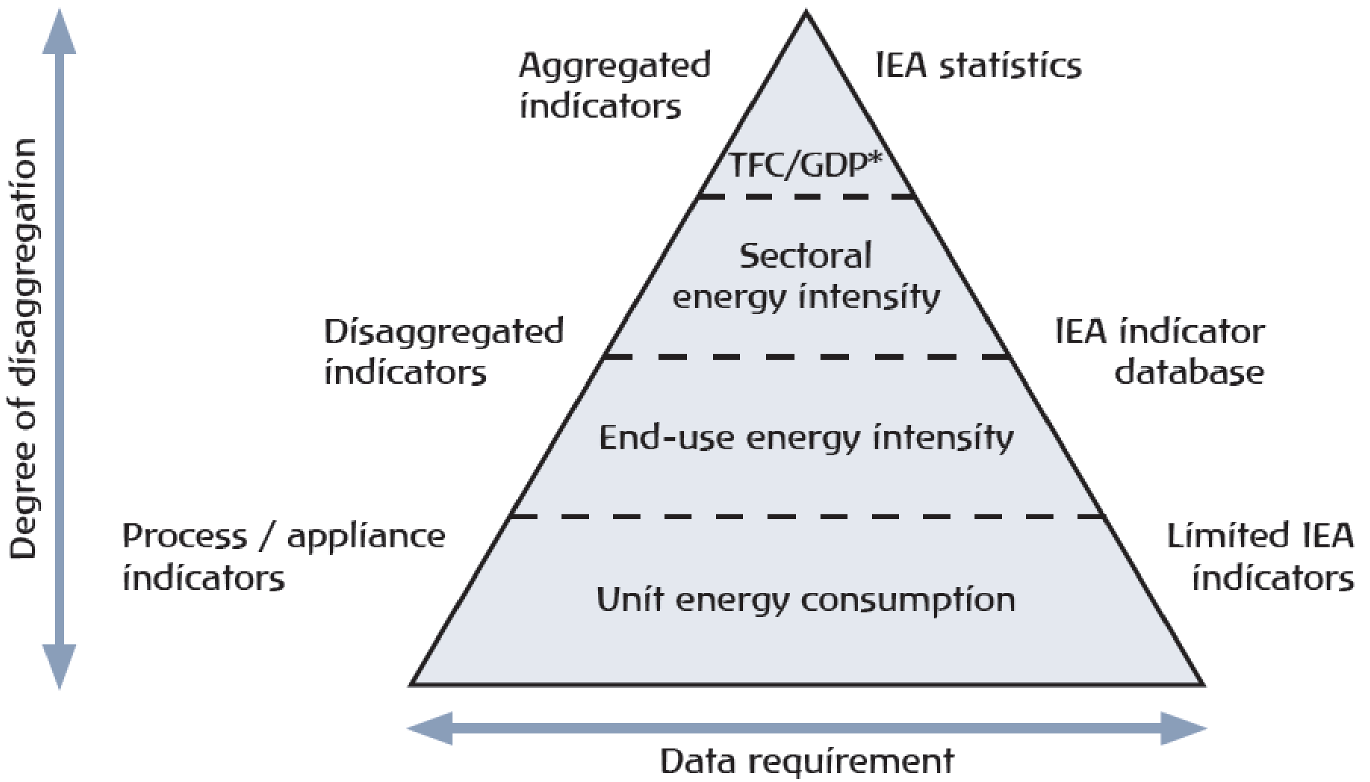


PRIMES

- a general purpose model; conceived for forecasting, scenario construction and policy impact analysis
  - standard energy policy issues: security of supply, strategy, costs etc
  - environmental issues
  - pricing policy, taxation, standards on technologies
  - new technologies and renewable sources
  - energy efficiency in the demand-side
  - alternative fuels
  - energy trade and EU energy provision
  - conversion decentralisation, electricity market liberalisation
  - policy issues regarding electricity generation, gas distribution and refineries
- Only some indicators regarding specific energy consumption are calculated in for calibration based on data bases MURE, IKARUS, ODYSSE and national sources

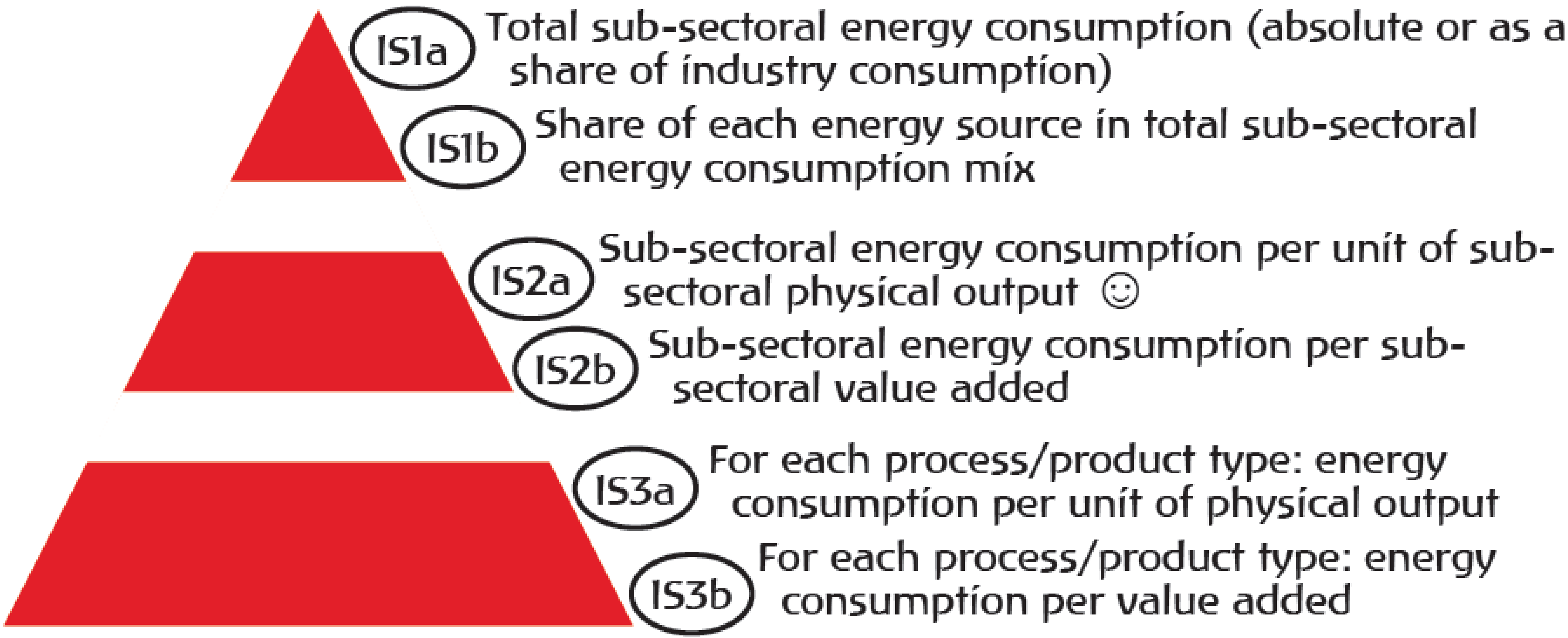
- **Total final consumption**
  - **Residential**
    - Space heating
    - Space cooling
    - Water heating
    - Lighting
    - Cooking
    - Appliances
    - Other energy use
  - **Services**
    - Space heating
    - Space cooling
    - Water heating
    - Lighting
    - Other equipment
    - Other energy use
  - **Industry**
    - Iron and steel
    - Chemical and petrochemical
    - Non-ferrous metals
    - Non-metallic minerals
    - Transport equipment
    - Food and tobacco
    - Wood and wood products
    - Paper, pulp & print
    - Textile and leather
    - Not elsewhere specified
  - **Transport**
    - **Passenger**
      - Road:
        - Passenger light-duty vehicles
        - Powered 2- and 3-wheelers
        - Buses
      - Rail:
        - Passenger trains
      - Air:
        - Passenger airplanes
      - Water:
        - Passenger ships
    - **Freight**
      - Road:
        - Freight light-duty vehicles
        - Heavy duty vehicles
      - Rail:
        - Freight trains
      - Air:
        - Freight airplanes
      - Water:
        - Freight ships
  - **Other**
    - Mining and quarrying
    - Construction
    - Water supply/waste management
    - Agriculture/ forestry
    - Fishing
    - Pipeline transport
    - Non-specific other sectors
    - Non-energy use

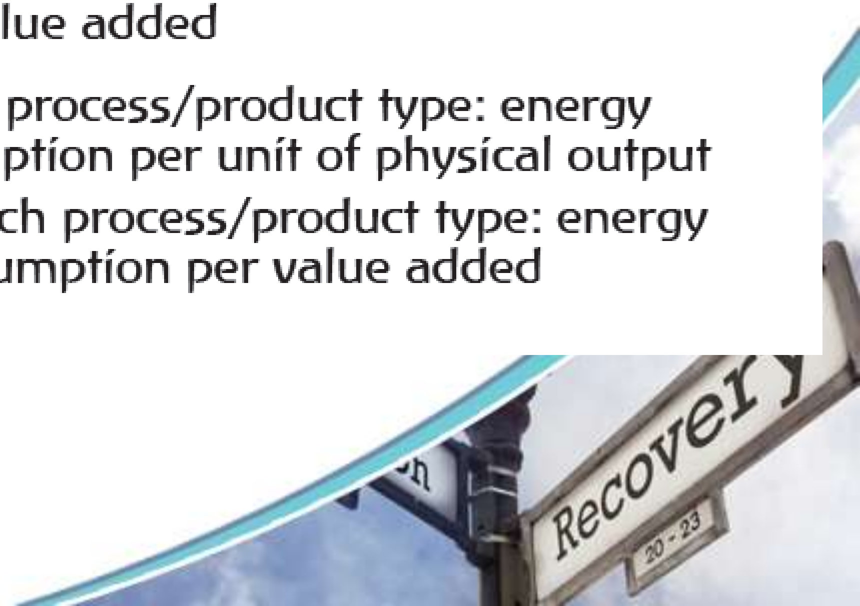
Preferential Approach



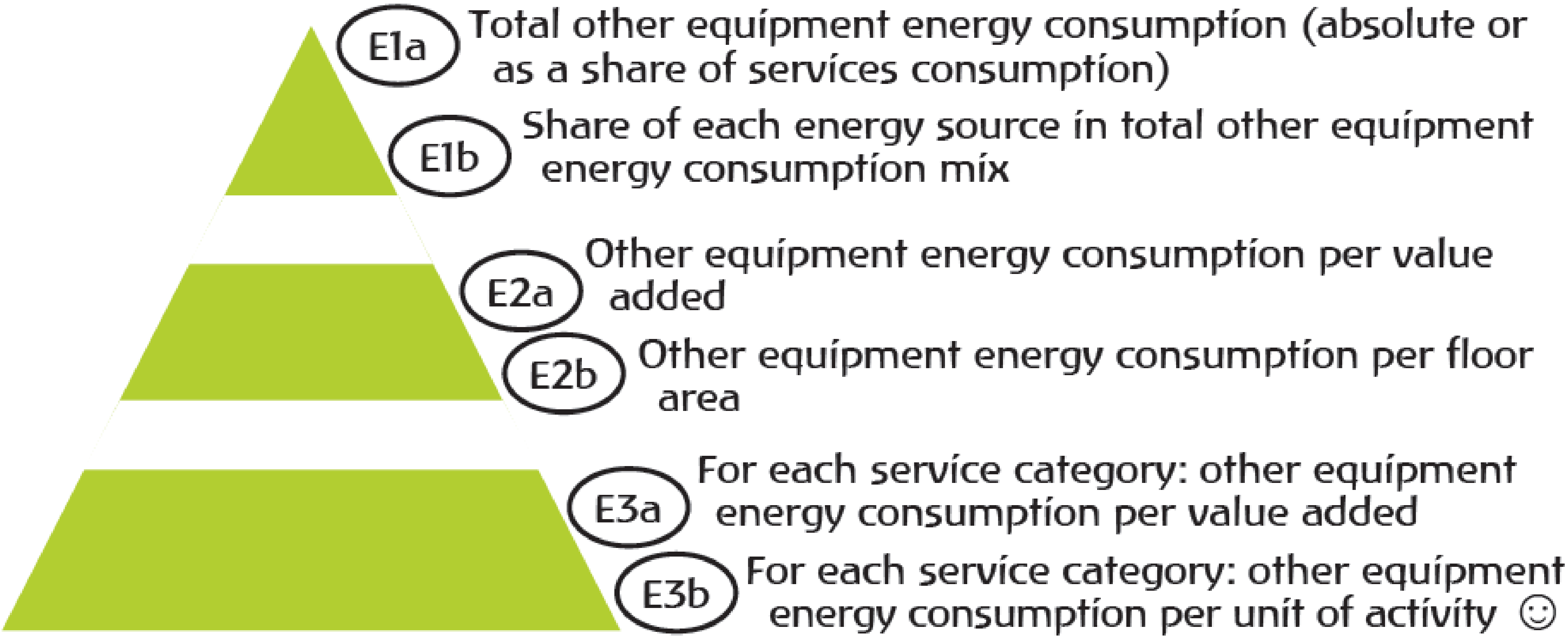
* Gross Domestic Product

Industry Efficiency Indicator Data

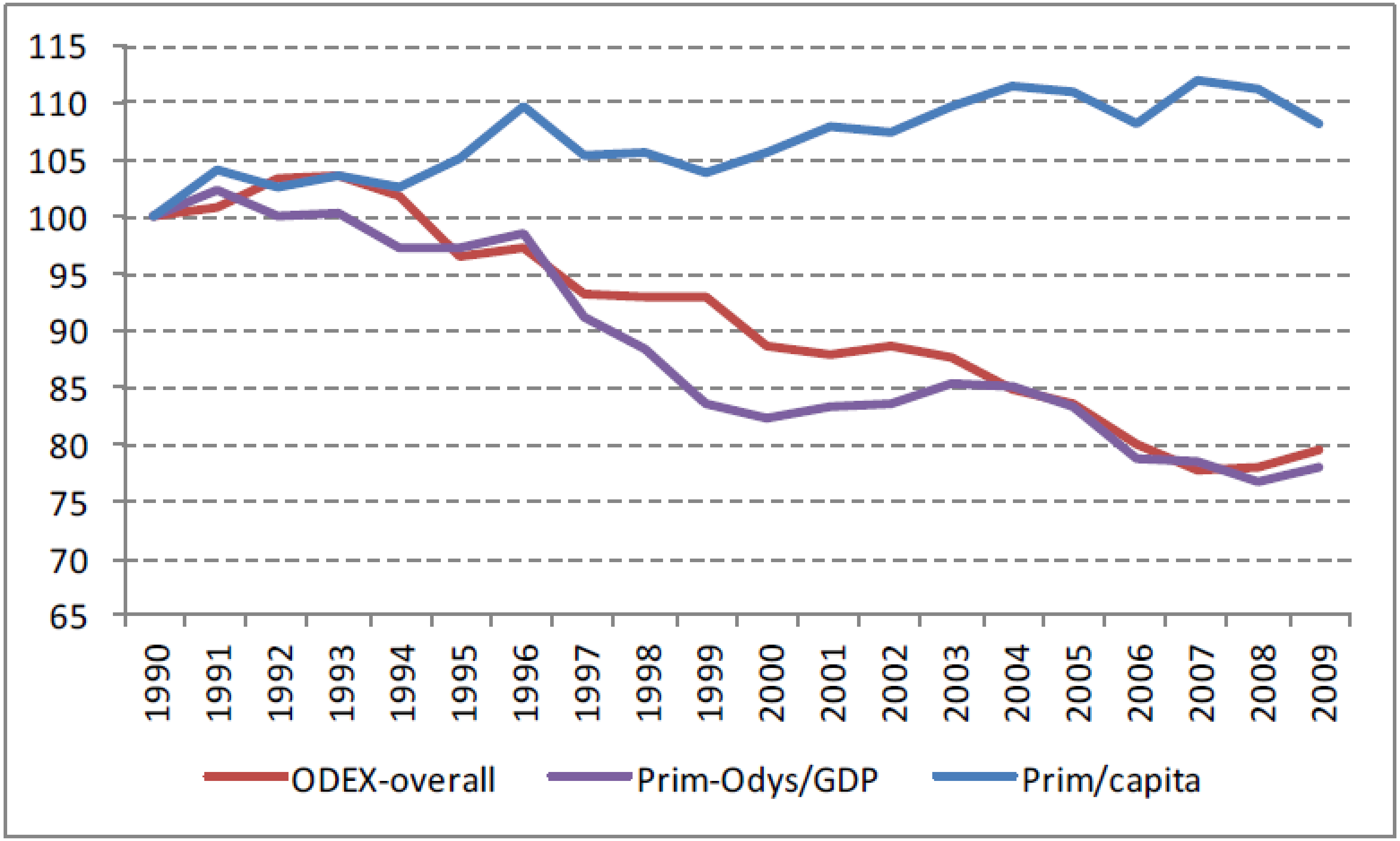




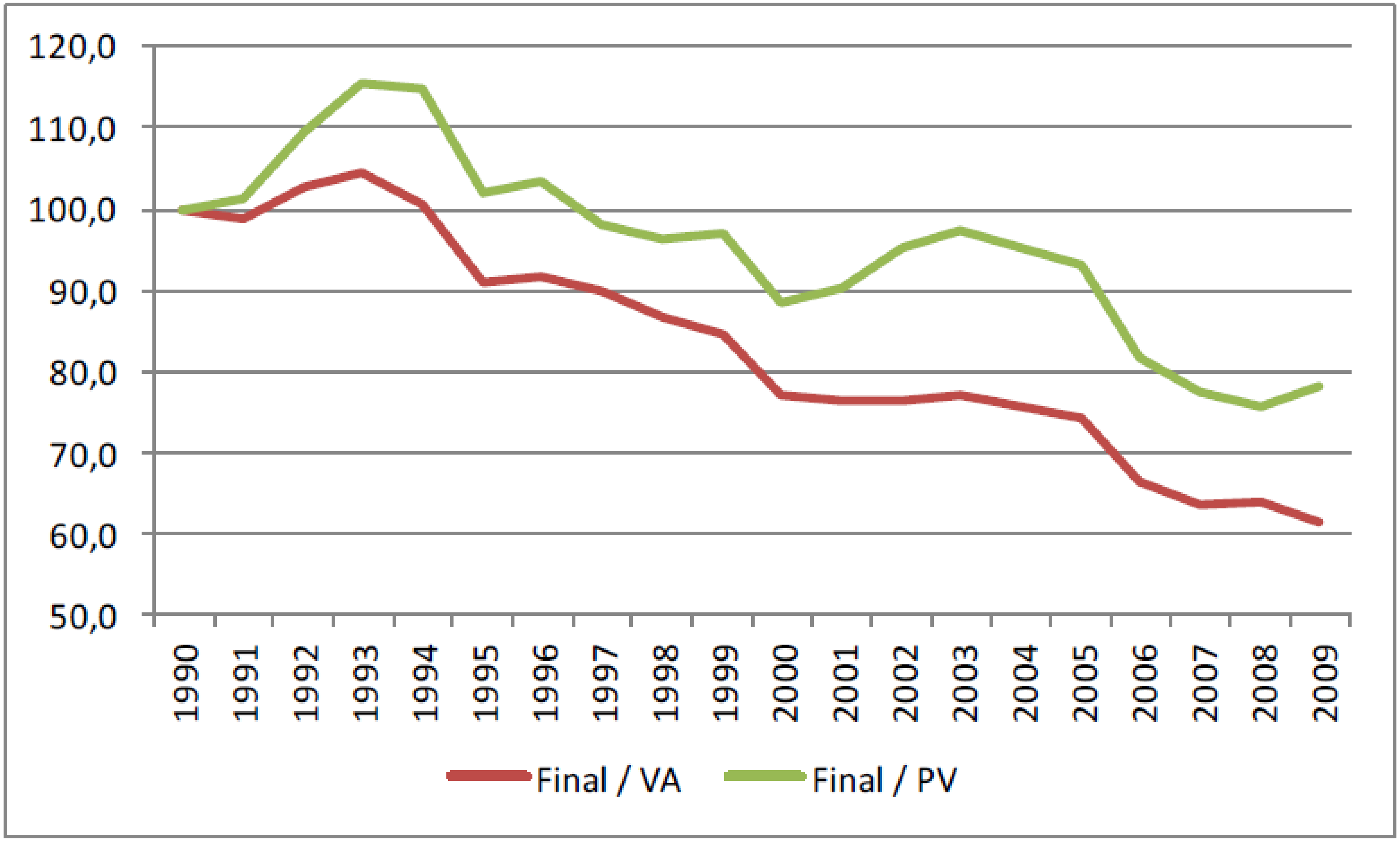
Services Efficiency Indicator Data



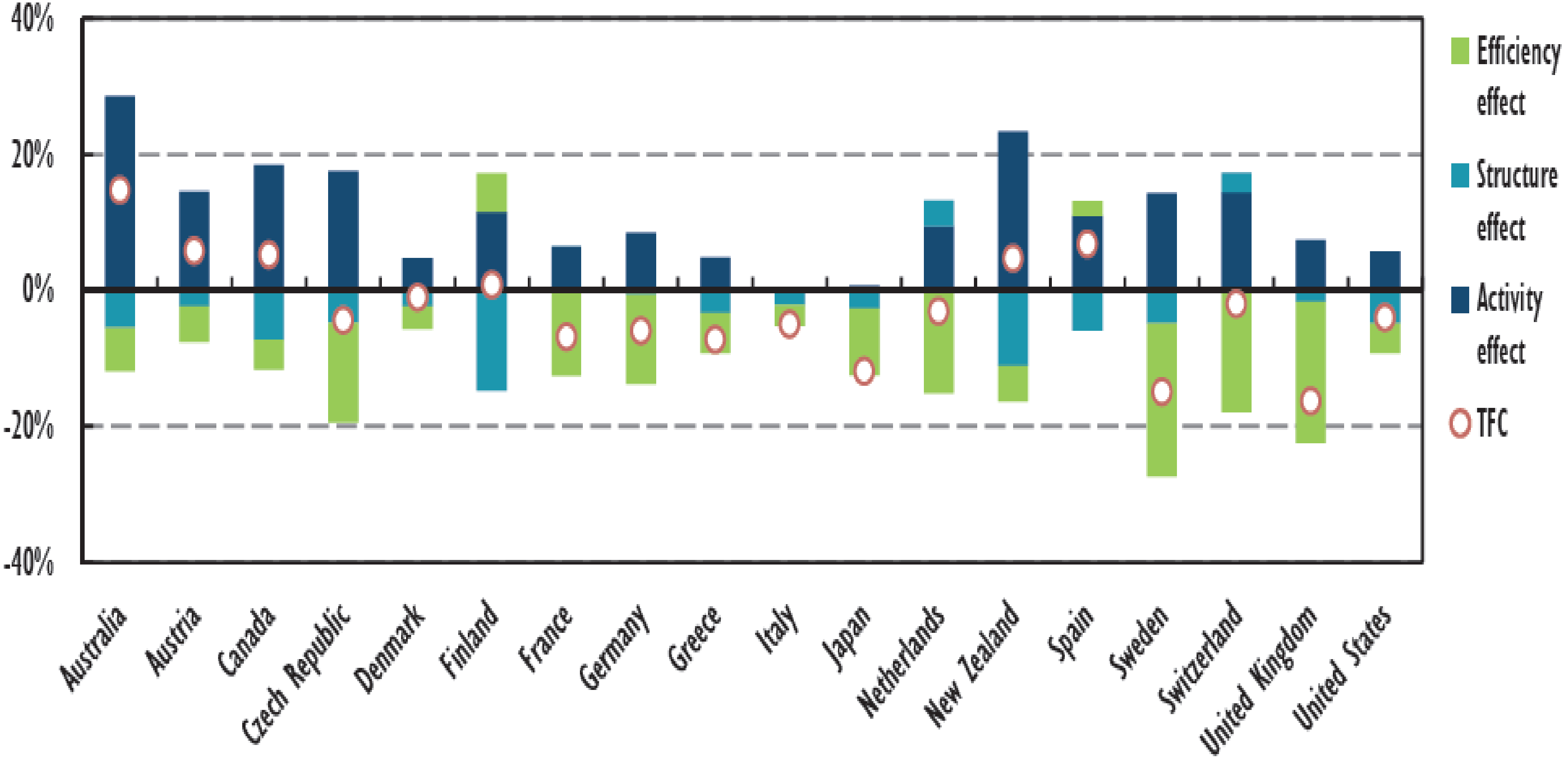
Comparison of trends (by indexation) for savings and intensities at national level



Comparison of trends (by indexation) for industrial intensity at national level

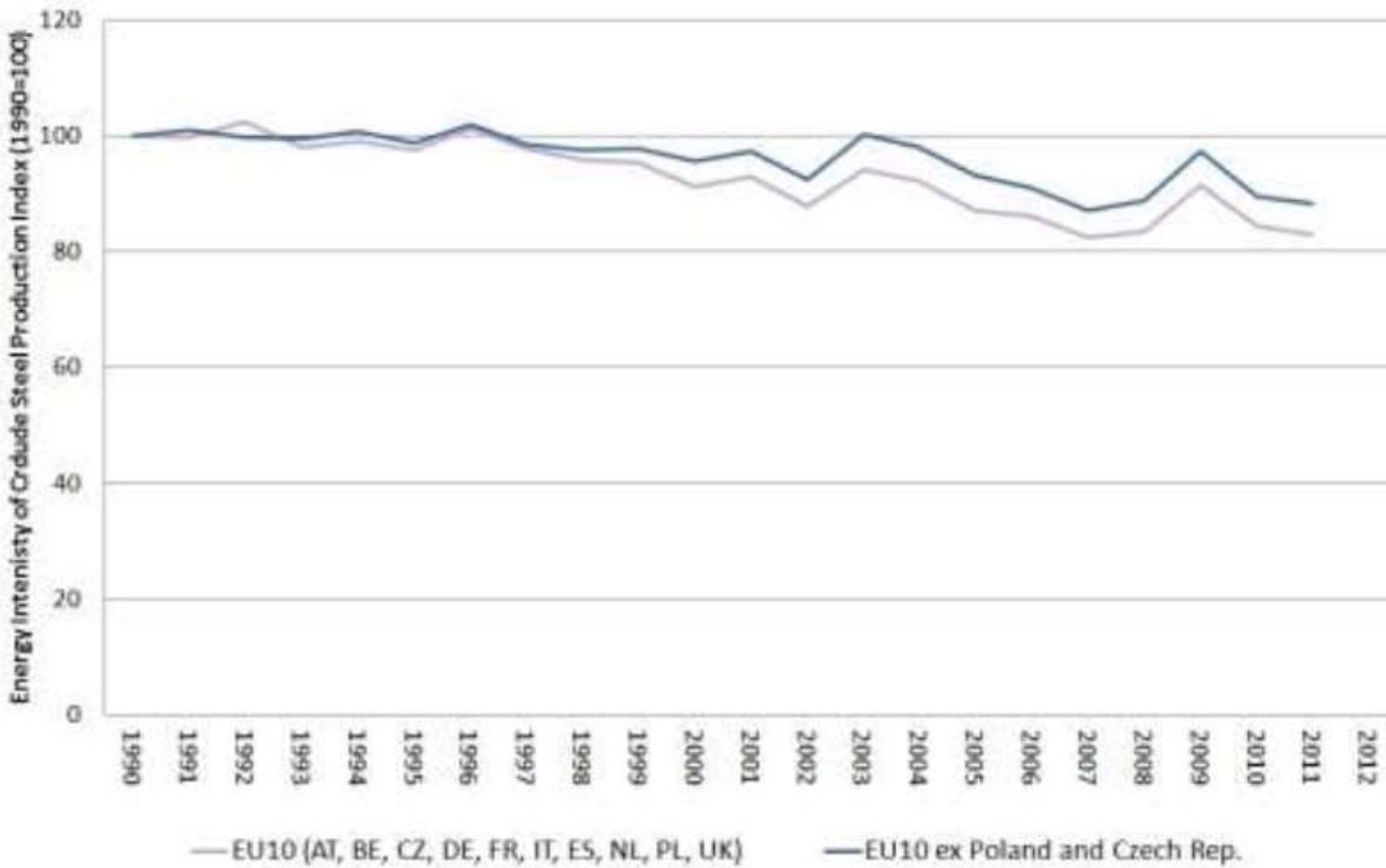


Decomposition of TFC between 2001 and 2011 (relative to 2001 levels)



Source: **IEA/Enerdata**

CEE Steel Sector Intensity



Source: Odyssee-mure database. Energy intensity adjusted for share of BF/BOF and respective EAF process

Primary Energy /Conversion/ Factor (PEF)

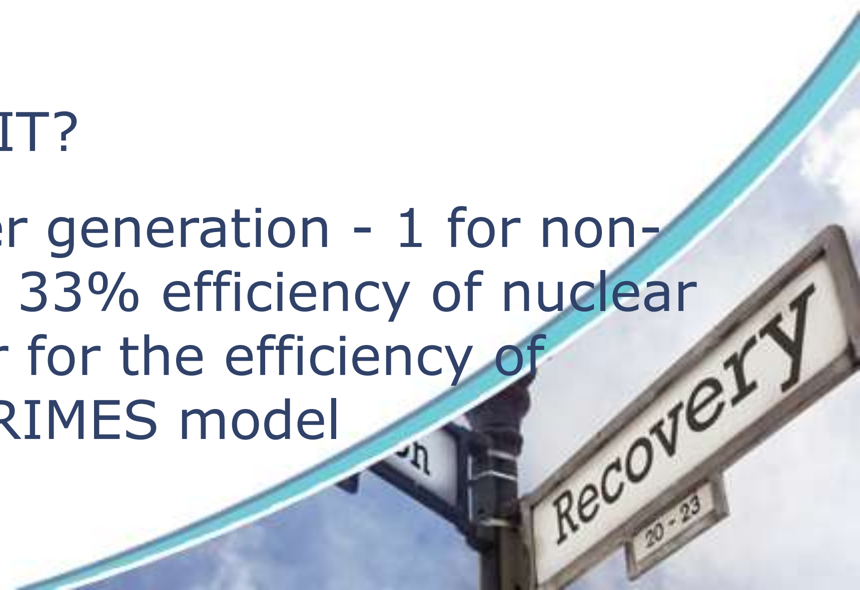
- used to transform electricity consumption into primary energy consumption
- a default coefficient of 2.5 in Annex IV of the Directive 2012/27/EU on energy efficiency (the EED) may be applied by Member States when transforming electricity savings into primary energy savings
- used by several implementing regulations under the Ecodesign and Energy Labelling Directives
- relevant in the context of the establishment of a common EU voluntary certification scheme for non-residential building under the Directive 2010/31/EU (energy performance of buildings)

PEF – open issues

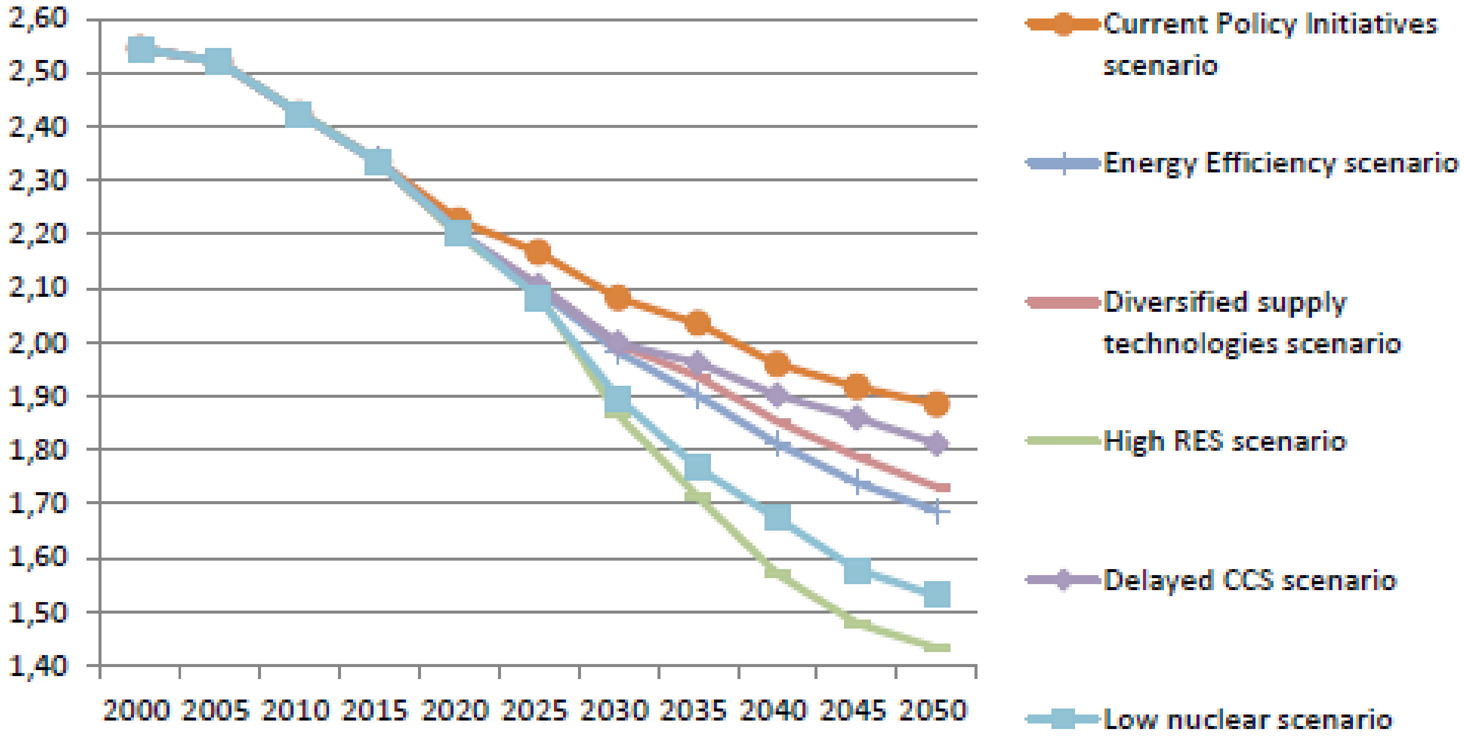
- necessity of using a PEF?
- its value?
- on today's electricity production efficiency or on future developments of the European electricity mix?
- PEF to be time-variant, reflecting the fact that there are times with abundant electricity, and effectively zero or negative electricity prices?

WHY IS IT IMPORTANT TO MENTION IT?

Arbitrary decision on factors for power generation - 1 for non-thermal renewables, 3 for the default 33% efficiency of nuclear power plants, and a conversion factor for the efficiency of remaining thermal plants based on PRIMES model



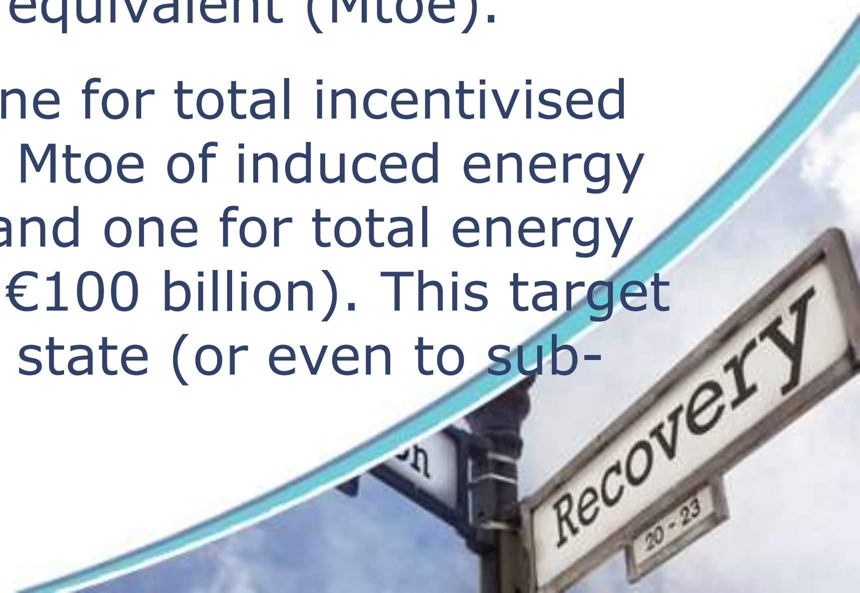
Conversion Coefficients in the 2050 Energy Roadmap



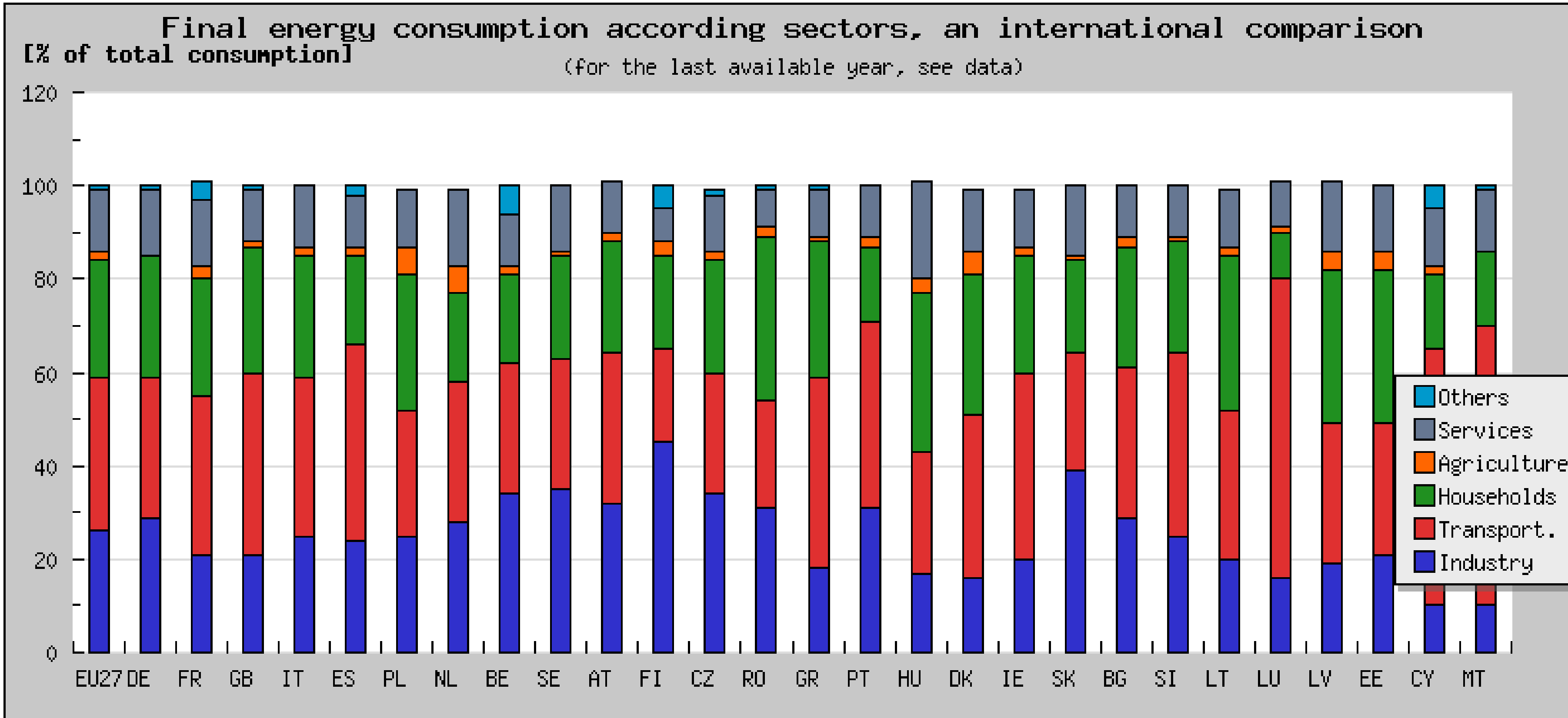
Assumptions: factor 1 for non-thermal renewables, 3 for the default 33% thermal efficiency of nuclear power plants, and a conversion factor for the efficiency of remaining thermal plants based on PRIMES model, as appears in the annex of the 2050 Energy Roadmap

Bottom-Up Approach to the EU 2030 Target

- individual market failures should be addressed by the most efficient measures at the right level of government
- based on the ex-post evaluation of each individual energy efficiency policy, the incentivized demand reduction and the corresponding policy cost should be reported. For example, the energy-efficiency loans in Germany in 2011 had an estimated cost of about €1 billion and encouraged annual savings of 0.1 million tonnes of oil equivalent (Mtoe).
- the success by two benchmarks: one for total incentivised energy savings (eg more than 400 Mtoe of induced energy savings between 2020 and 2030) and one for total energy efficiency policy cost (eg less than €100 billion). This target might be broken down by member state (or even to sub-national level).



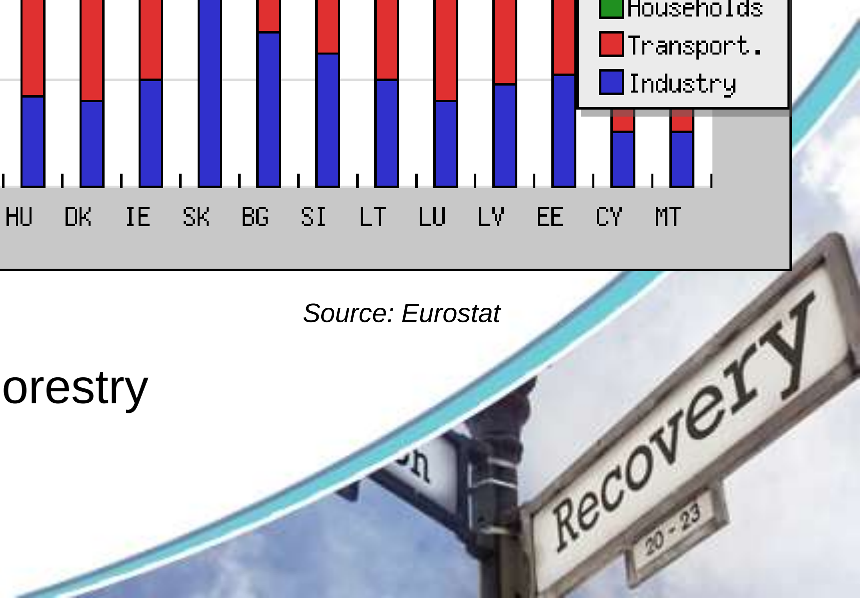
EU Comparison FEC by Sectors



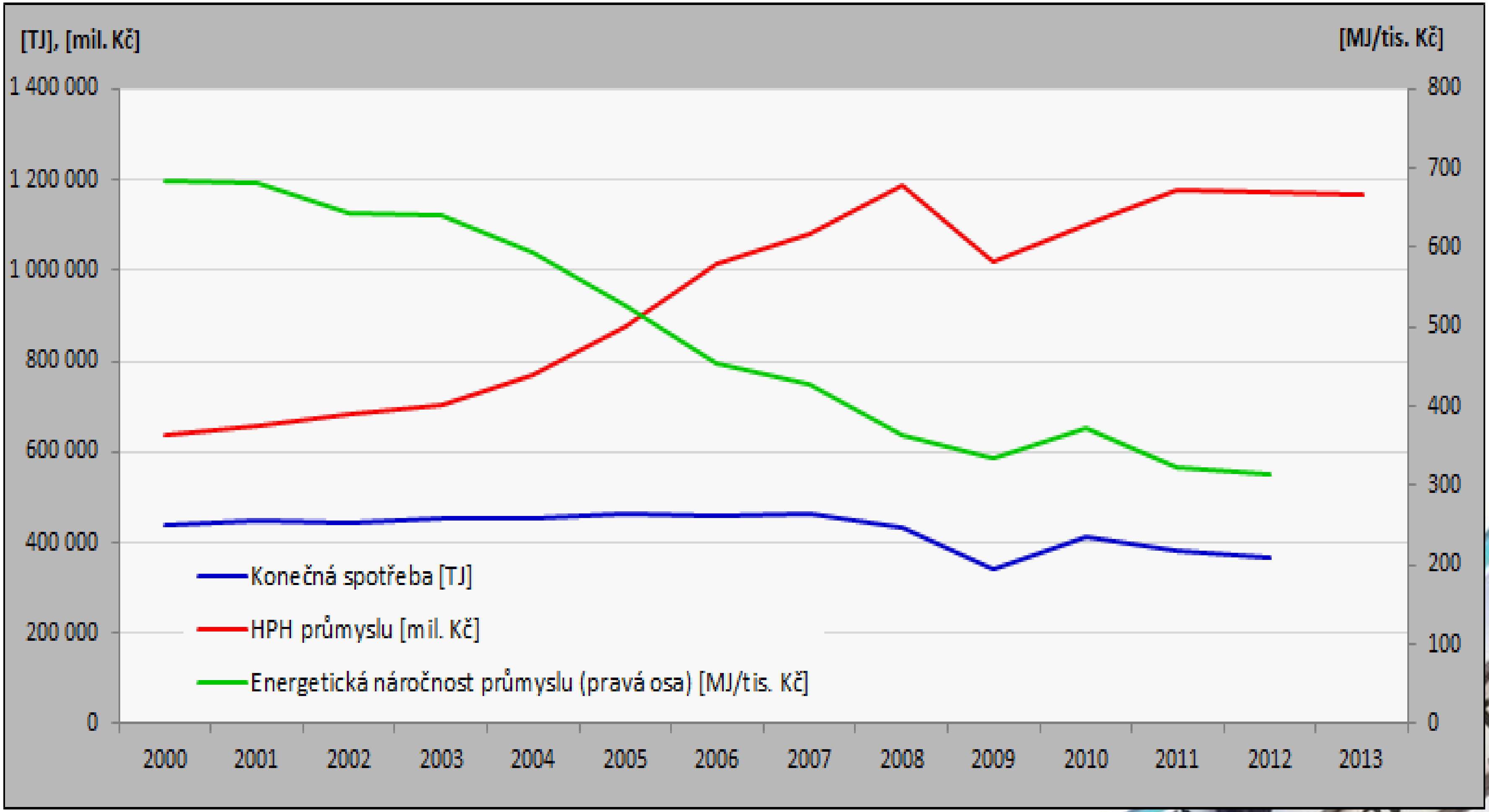
Source: Eurostat

Industry
Transport
Households

Agriculture and Forestry
Services
Others

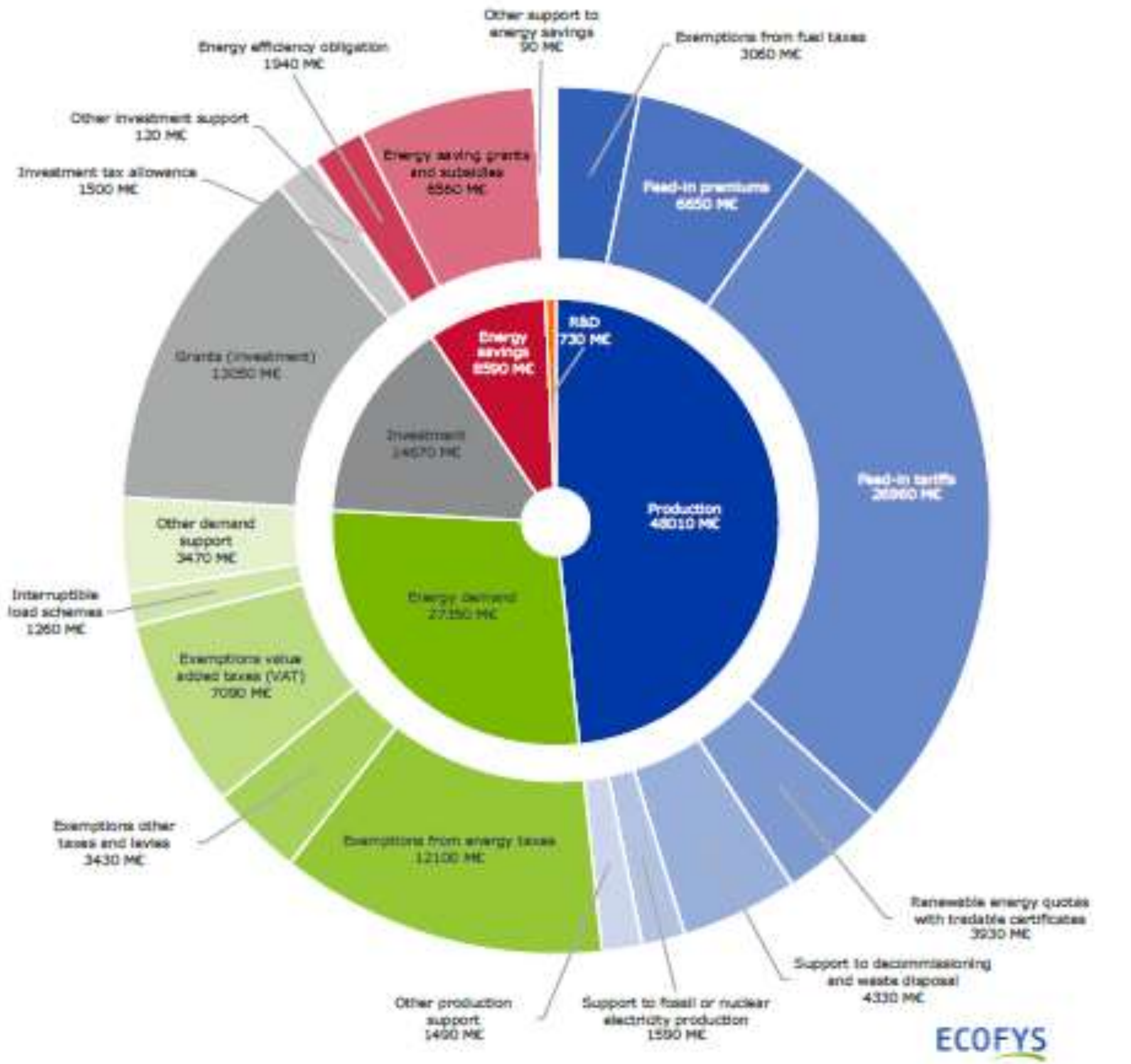


Energy Intensity of CZ Industry (MJ/th CZK)

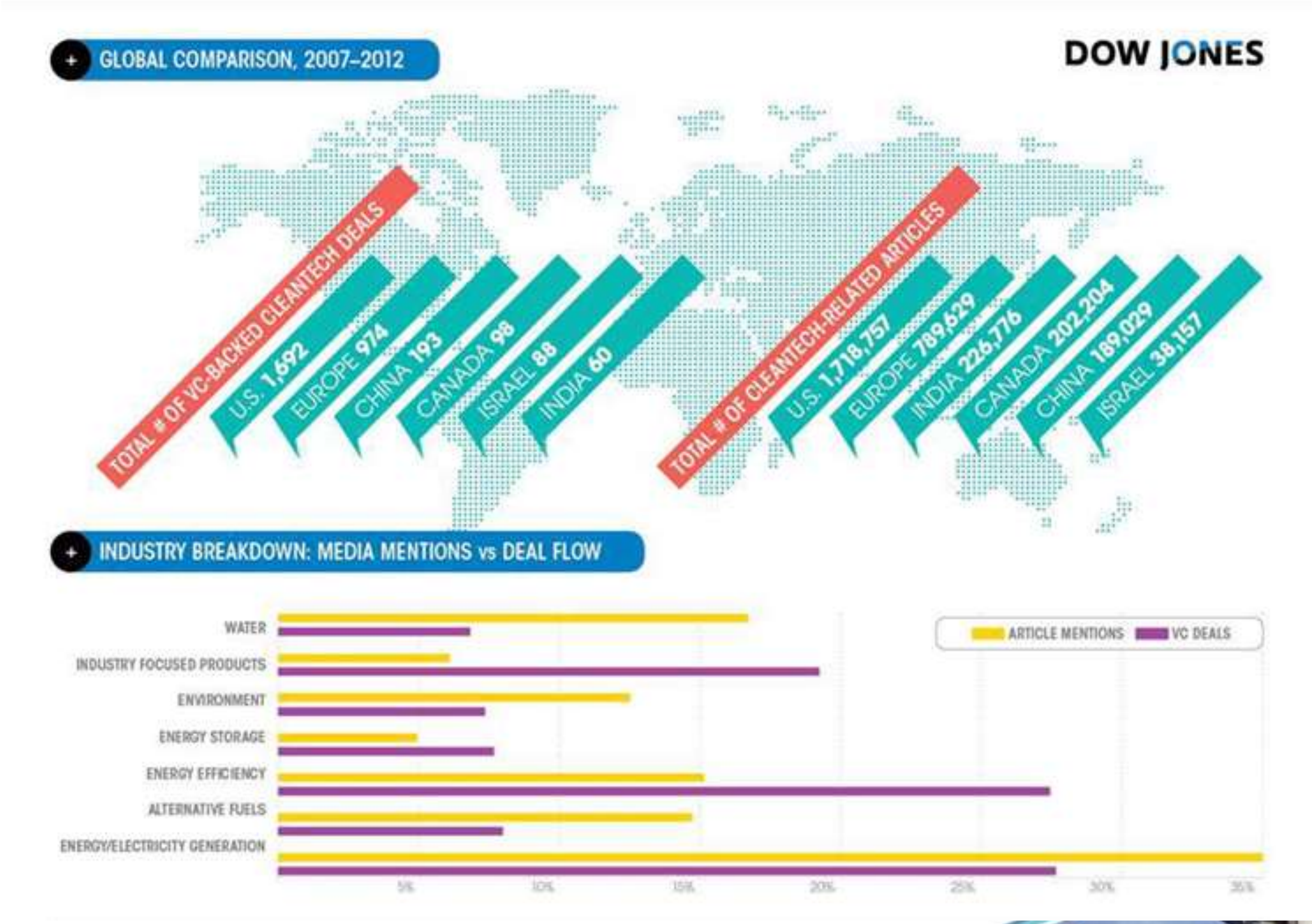


Source: Czech Statistical Bureau

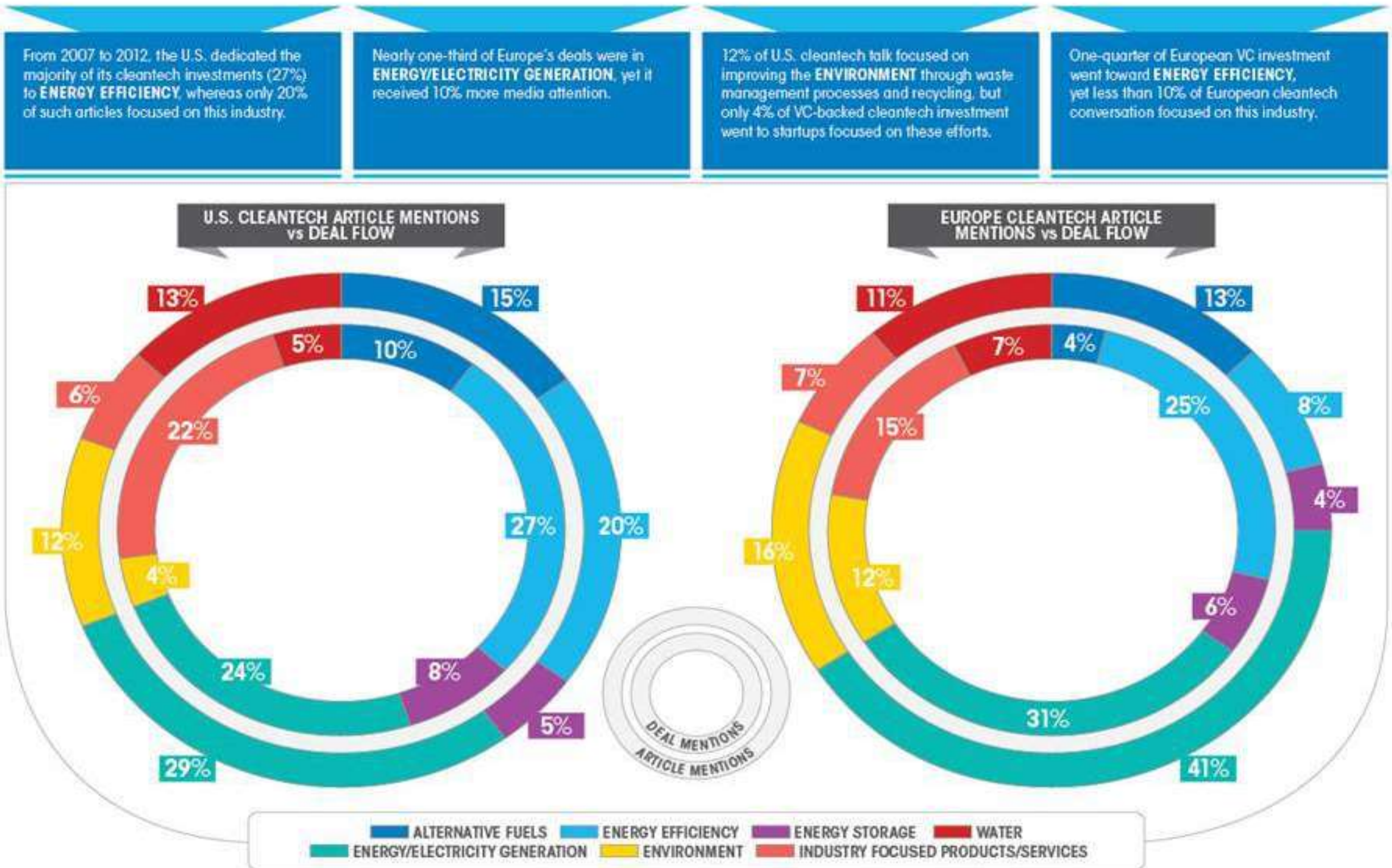
Way Too Many Subsidies on EU Energy Market (2012)



Clean Technology Dissected



Picture vs. Reality – Leading Regions



"For a successful technology, reality must take precedence over public relations, for Nature cannot be fooled."

Richard Feynman

Thank you for attention

Jakub Vít
Confederation of Industry and Transport of the
Czech Republic

jvit@spcr.cz