Energy indicators and greenhouse gas emissions

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Presentation overview

Energy indicators currently in use

Focus on the GHG indicators

Focus on the energy efficiency indicators

Energy indicators currently in use

What is an indicator?

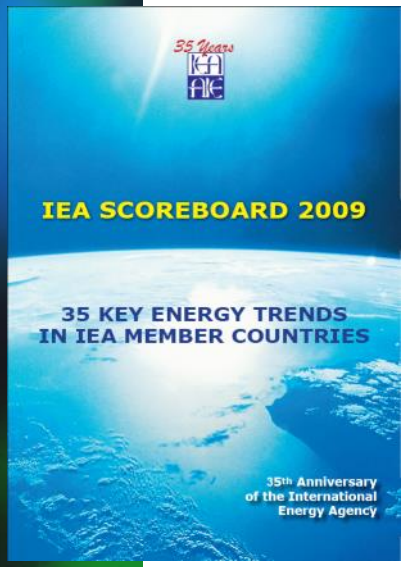
An indicator is a synthesis of information

- **«an indicator is a number or ratio (a value on a scale of measurement) derived from a series of observed facts»**
- **Indicators are based on statistics, but go beyond:**
  - **« *The indicators are not merely data; rather, they extend beyond basic statistics to provide a deeper understanding of the main issues and to highlight important relations that are not evident using basic statistics. They are essential tools for communicating energy issues to policymakers and to the public, and for promoting institutional dialogue. Each set of indicators expresses aspects or consequences of the production and use of energy. Taken together, the indicators give a clear picture of the whole system, including interlinkages and trade-offs as well as the longer-term implications of current decisions and behaviour. Changes in the indicator values over time mark progress or lack of progress towards sustainable development*» (IAEA).**

Different sets of energy indicators are in use

- Sustainable Development Goals Indicators (see day 1)
- Green Economy indicators (later on by Leonardo)
- Energy Efficiency Indicators
- Greenhouse Gas Emissions Indicators

Types of indicators



- Chapter 1 | The IEA in the World
- Chapter 2 | Energy Diversification
- Chapter 3 | Energy Security
- Chapter 4 | Non-Fossil Fuels
- Chapter 5 | Energy Intensity and Efficiency
- Chapter 6 | Energy and the Environment
- Chapter 7 | Energy Prices and Taxes
- Chapter 8 | Research, Development and Demonstration

Types of indicators (examples)

- **Chapter 2 | Energy Diversification**
  - In energy production
  - In supply and consumption of individual fuels
  - In sector consumption
- **Chapter 3 | Energy Security**
  - Net imports
- **Chapter 4 | Non-Fossil Fuels**
  - Shares in TPES
- **Chapter 5 | Energy Intensity and Efficiency**
- **Chapter 6 | Energy and the Environment**
- **Chapter 7 | Energy Prices and Taxes**
- **Chapter 8 | Research, Development and Demonstration**

Focus on GHG emissions

International Context

- **Milestones in international climate change agreements**
  - **1988: Intergovernmental Panel on Climate Change (IPCC) established.**
  - **1992: United Nations Framework Convention on Climate Change (UNFCCC) negotiated at the Earth Summit Conference, Rio de Janeiro.**
    Aim: "to avoid dangerous human interference with the climate system".
  - **1997: Kyoto Protocol negotiated.**
  - **2008-2012: First commitment period, 38 developed countries agreed to reduce anthropogenic greenhouse gas emissions by about 5% compared to 1990.**
  - **2013-2020: Second commitment period, with revised targets and country membership.**

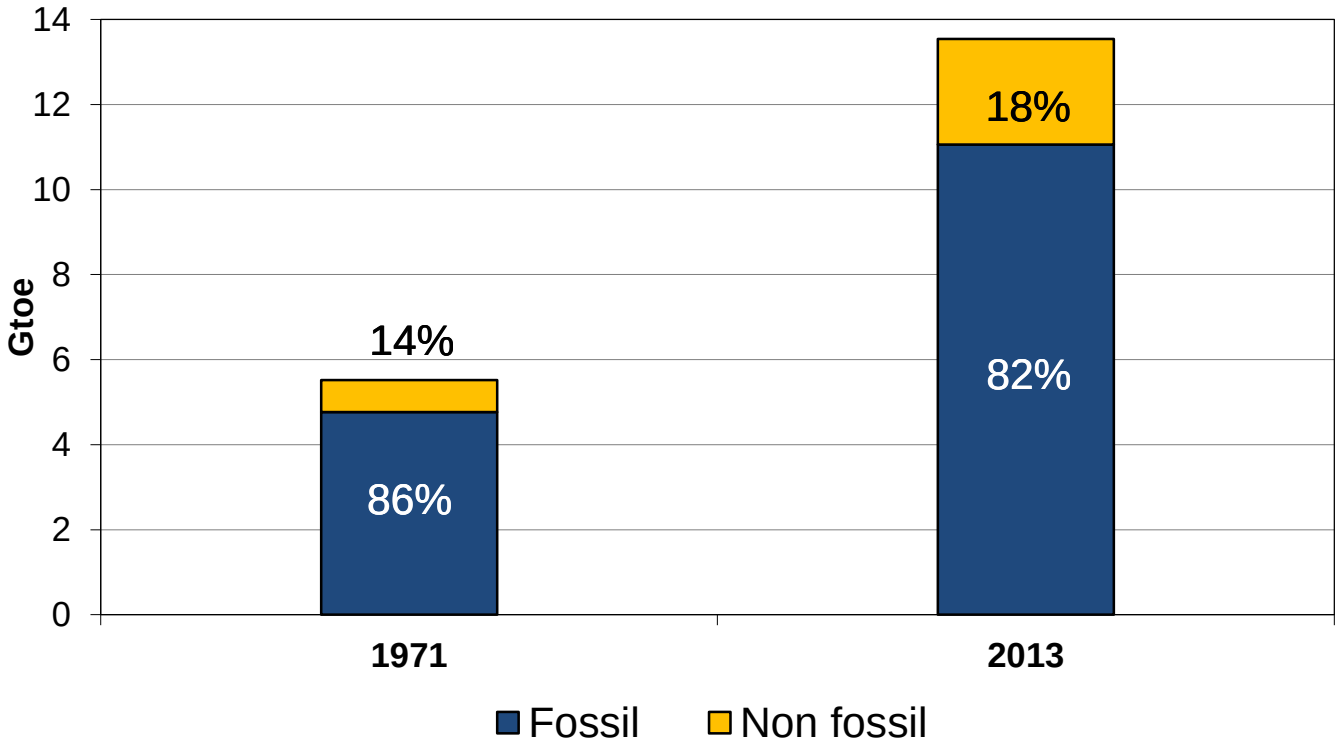
Recent Developments

- **Ongoing:** Since 1995, the parties to the Convention have met once a year at the Conference of the Parties (COP) to discuss progress.

- **2015:** At COP21 in Paris, countries approved a new global climate change agreement.

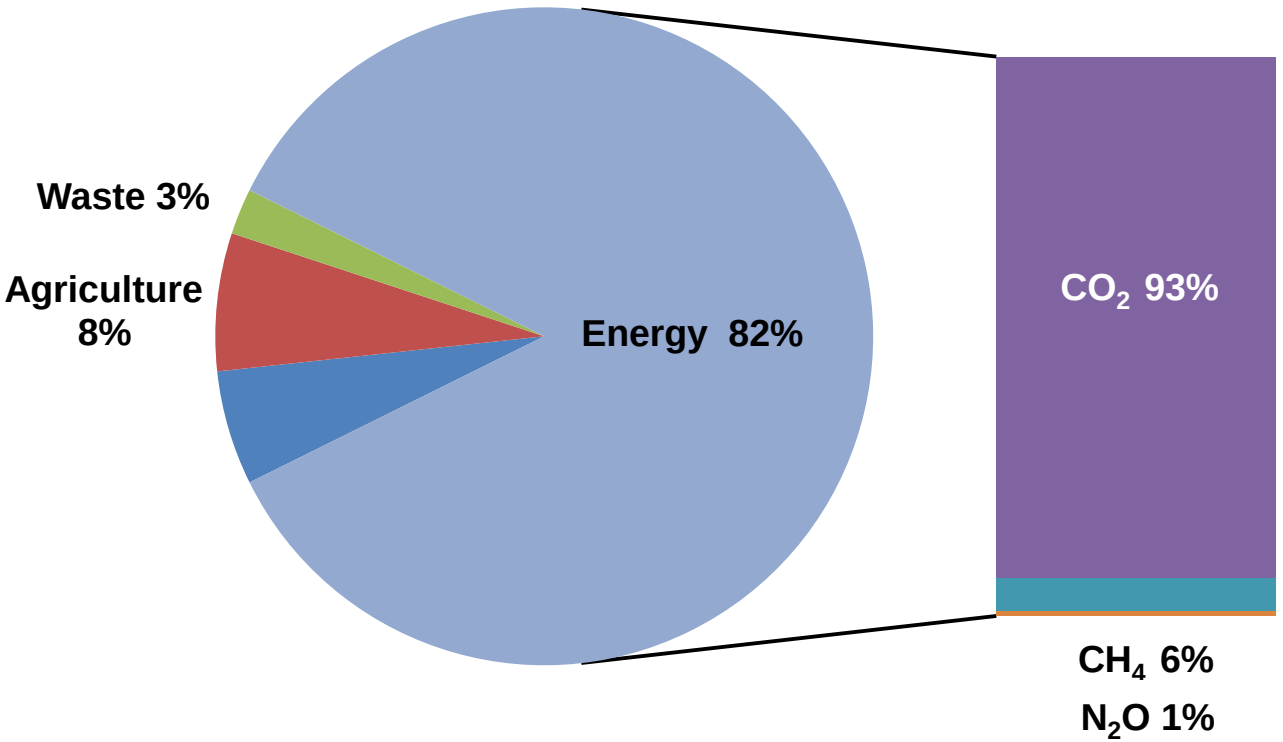
  - Aim is to limit the global average temperate increase to well below 2ºC, with efforts to limit it to 1.5ºC.
  - Initial targets for each country (2020-2025) were submitted by the countries themselves. These are known as Nationally Determined Commitments (NDCs).
  - Global progress towards goal be formally reviewed in 2023 and every five years thereafter.

World primary energy supply



Despite growth in renewable energy, fossil fuels still satisfy most of the world's energy supply.

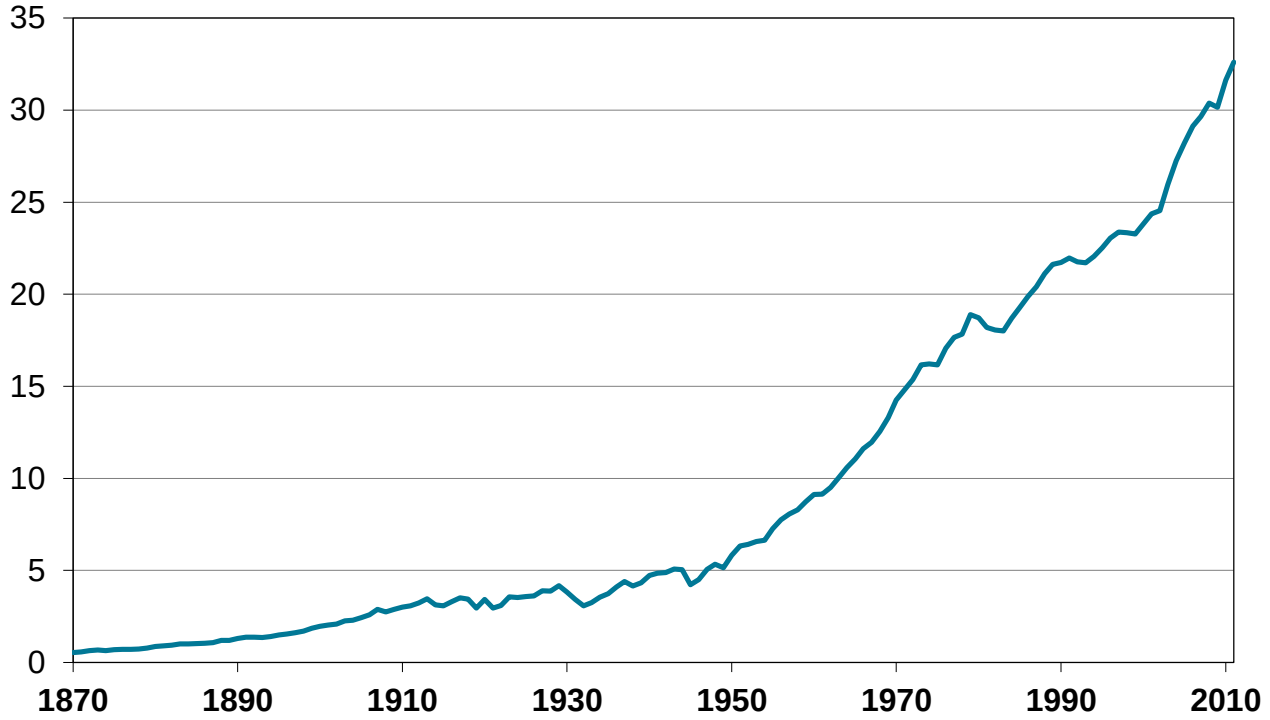
Share of energy in GHG emissions



Source: UNFCCC - based on Annex I countries for 2012

Energy sector emissions, which are predominantly CO_2, account for the largest share of global greenhouse gas (GHG) emissions.

Trend in CO_2 emissions from fossil fuel combustion



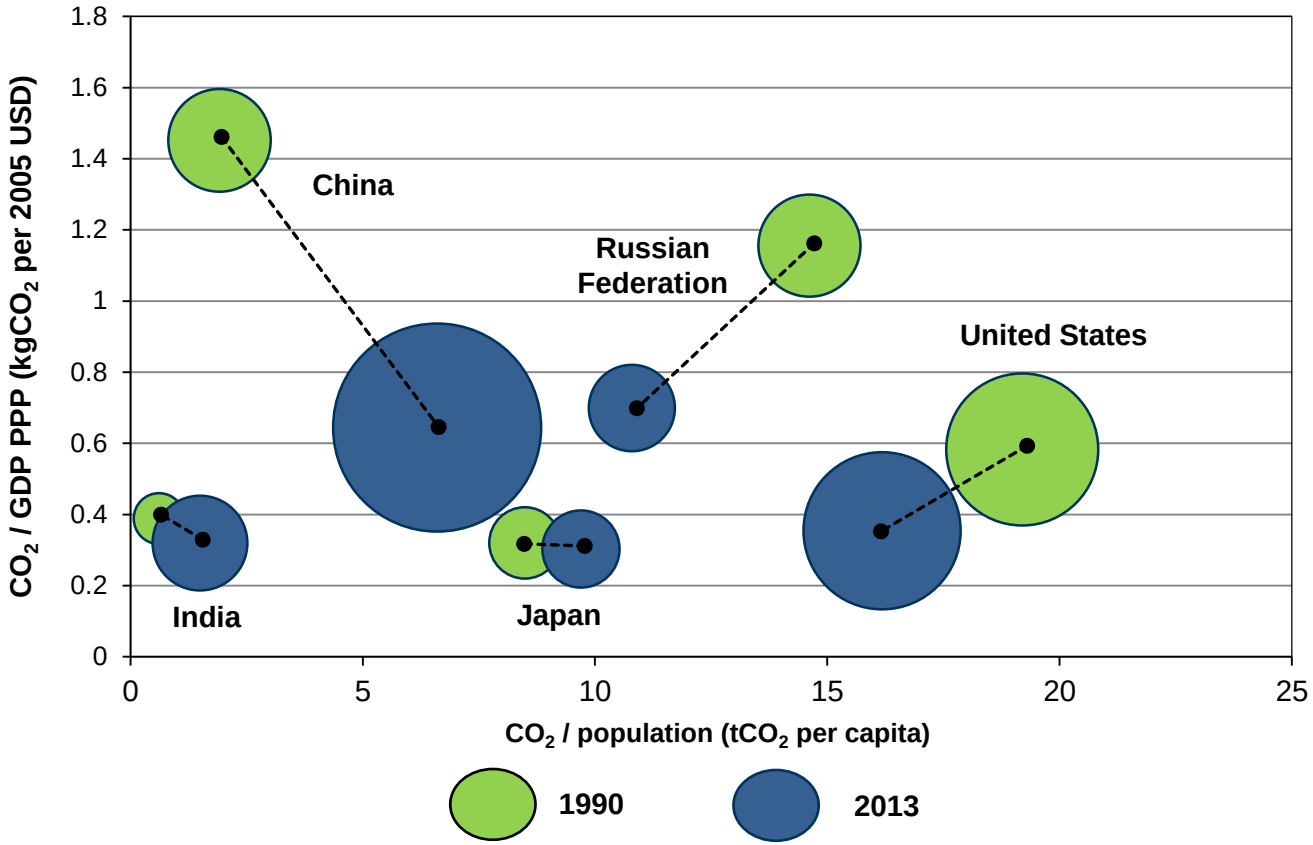
Source: Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, US

Since 1870, CO_2 emissions from fuel combustion have risen exponentially.

CO_2 intensity indicators

- Emissions estimates can be combined with energy data and other socio- economic figures to produce useful indicators such as:
  - CO_2 / population
  - CO_2 / GDP
  - CO_2 / TPES
  - CO_2 / kWh

CO_2 intensities of a few countries



CO_2 indicators can be used to compare emissions across countries with differing economic circumstances.

IPCC methodologies: overview

- Allow a complete inventory of emissions across countries to be calculated in a consistent, accurate, comparable and transparent manner.
- Two sets of Guidelines were published:
- Revised 1996 IPCC Guidelines
- 2006 IPCC Guidelines
- The first commitment period of the Kyoto Protocol (2008-2012) was based on the Revised 1996 IPCC Guidelines. Therefore, IEA CO_2 estimates for this period were also calculated using the Revised 1996 IPCC Guidelines.
  In 2015, the IEA, and Annex-I countries reporting to the UNFCCC began calculating emissions using the 2006 IPCC Guidelines.

IPCC methodologies: basic computation

- **Basic computation for CO_2 emissions:**
  - **CO_2 emissions = Fuel quantity x product-specific emission factor**
  - **Sum across all products**

Can be done from two independent sets of data:

Supply of fuels to the country **Reference Approach**	**Consumption** by end-use sectors **Sectoral Approach**

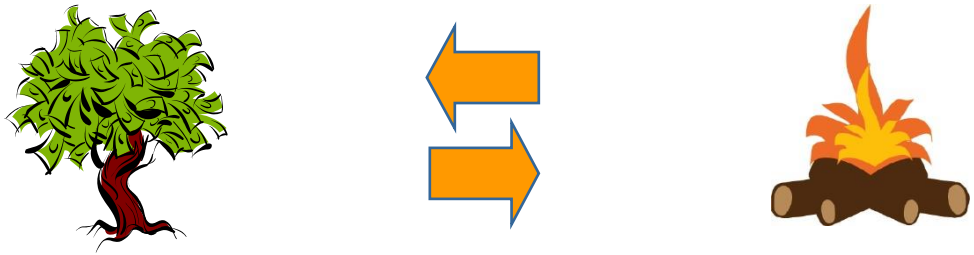
IPCC methodologies: what is not included?

***IPCC Guidelines*: Biomass is not included in national totals for CO_2 emissions from fuel combustion.**

Biomass contains carbon, absorbed from the air by plants through photosynthesis.

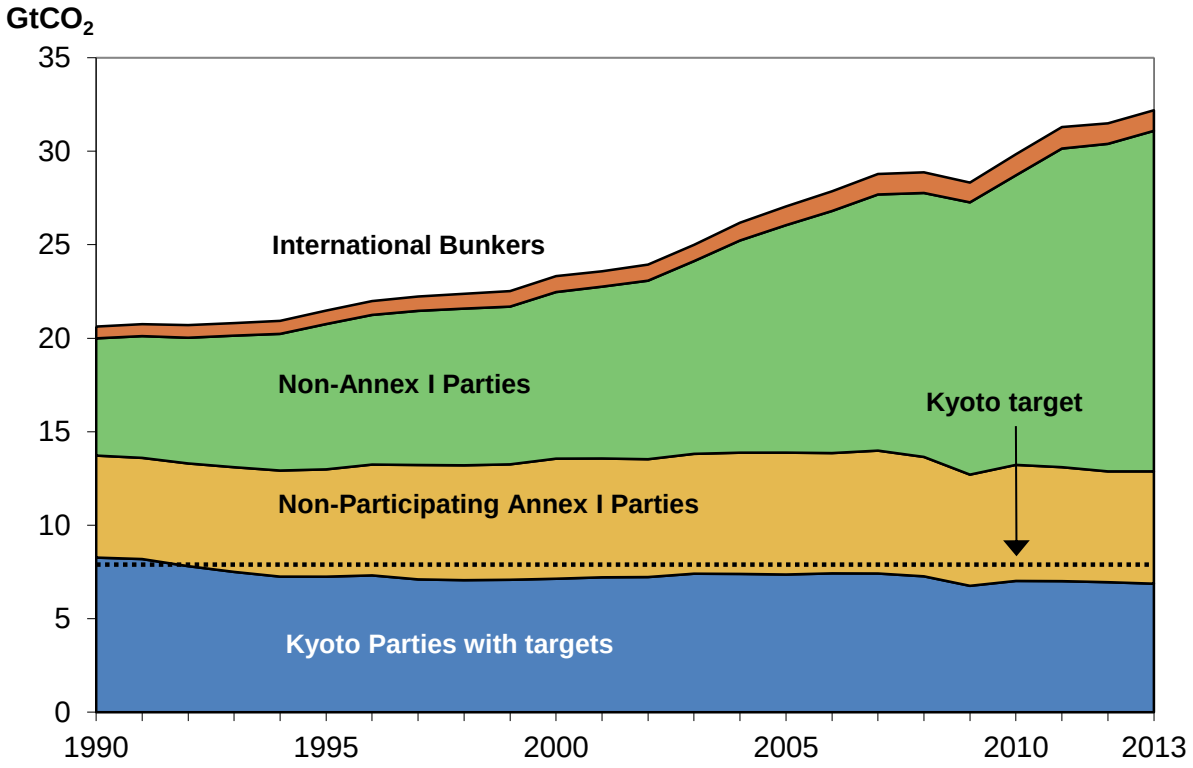
If biomass is used sustainably, no additional CO_2 is considered to be emitted into the atmosphere.

However, if there is a change in the biomass stocks, then the CO_2 is accounted for in *Agriculture, Forestry and Other Land Use (AFOLU).*



IPCC methodologies: what is not included?

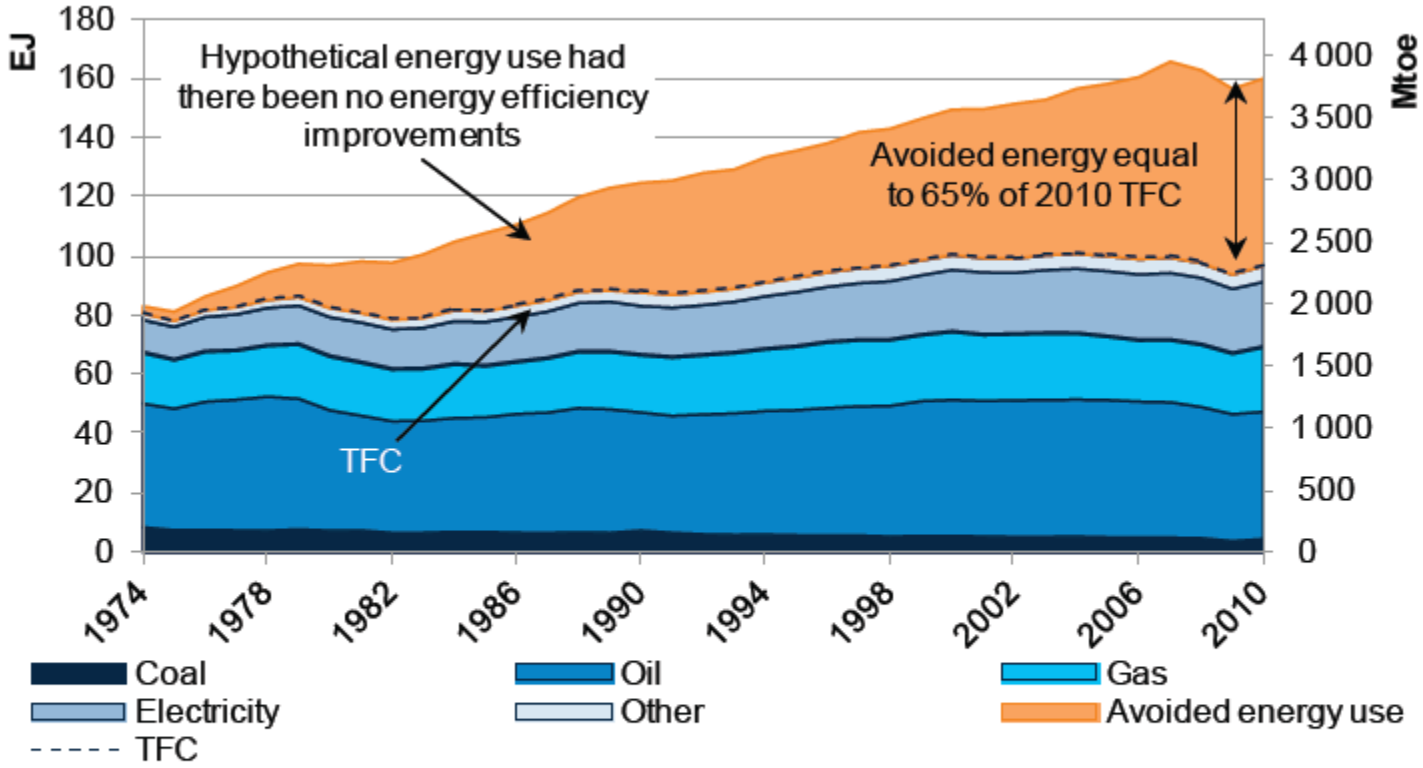
IPCC Guidelines: international aviation and international marine bunkers are **not included** in national totals.



Focus on energy efficiency indicators

The huge potential of energy efficiency…

Figure ES.2 The "first fuel": avoided energy use from energy efficiency in 11 IEA member countries



Notes: TFC = total final consumption. The 11 countries are Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States, those for which sufficient data is available to undertake analysis. "Other" includes biofuels plus heat from geothermal, solar, co-generation and district heating. Co-generation refers to the combined production of heat and power.

Source: IEA indicators database.

IEA Energy Efficiency Market Report 2013

Developing energy efficiency data and indicators

Energy efficiency means consuming less to provide the same service (eg low energy lightbulbs) -

1. **First: what do energy balances tell us?**

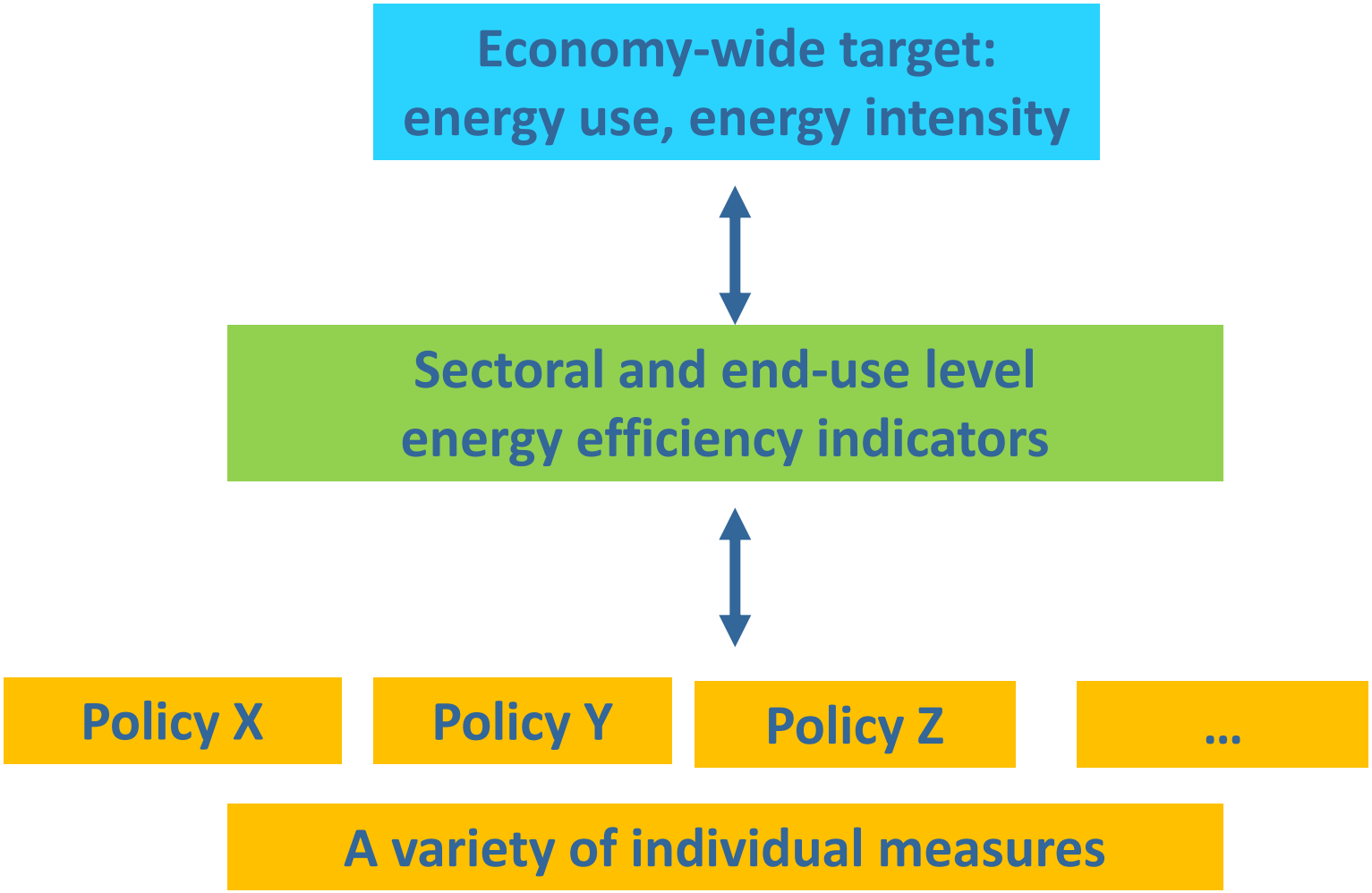
2. **What indicators can be developed based on existing data?**

3. **What further indicators would be meaningful for which new data collection is needed?**

Why are energy balances important in the context of energy efficiency?

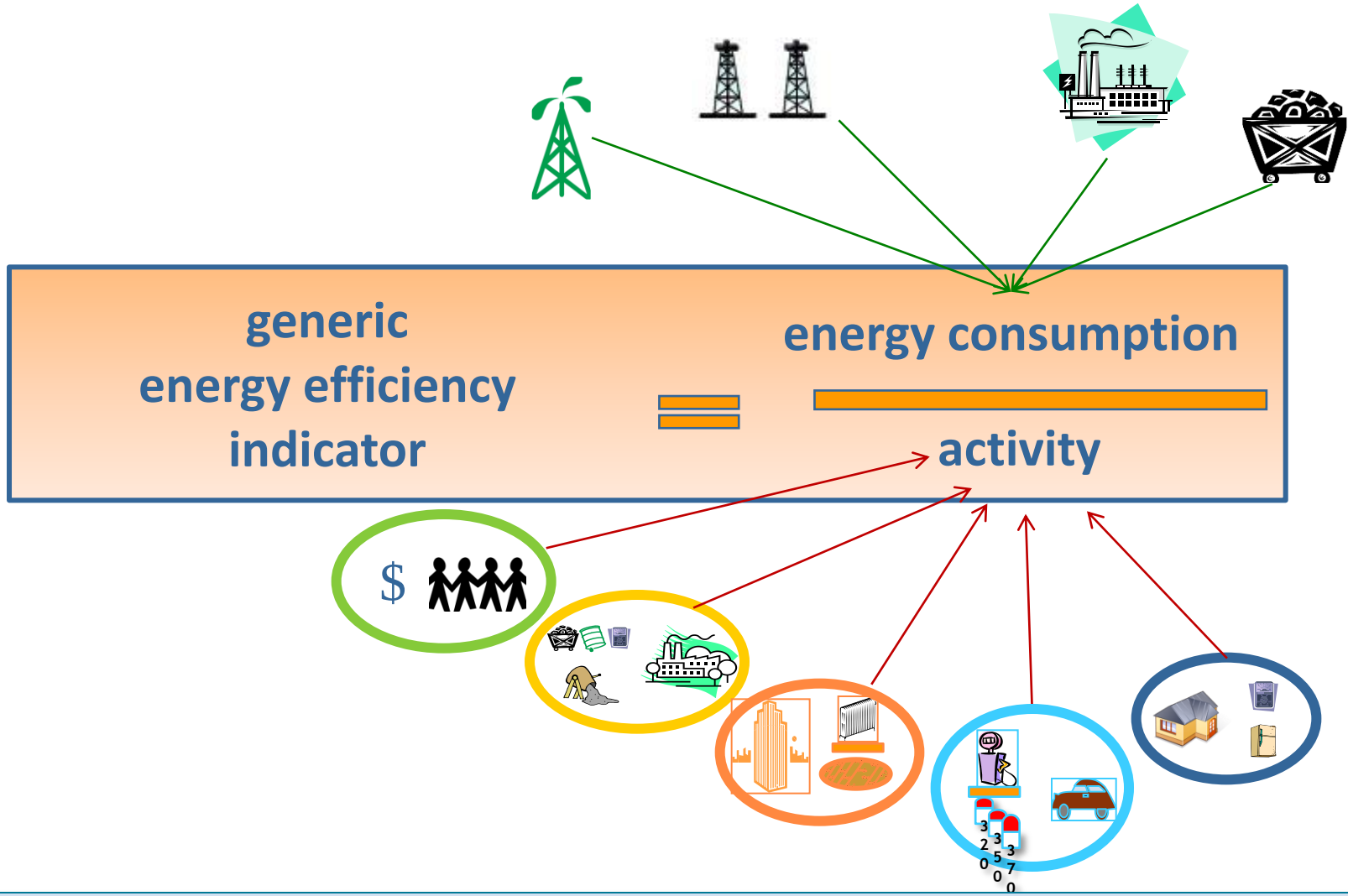
- To understand overall energy supply and use at the country level
- To assess the relative importance of the residential sector within the energy demand
- To understand the relative importance of the different energy sources
- To develop sectoral-level indicators (with headline activity data such as population)
- To understand transformation losses (electricity)

Efficiency indicators: understanding impacts of portfolio of measures on economy-wide trends



Indicators complement monitoring of individual policies

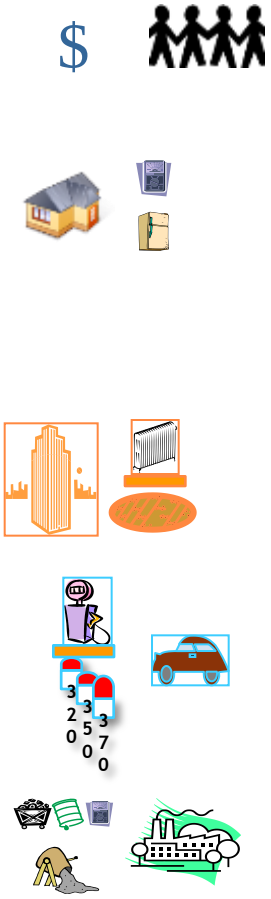
How to define energy efficiency indicators?



Linking energy use and service produced (activity)

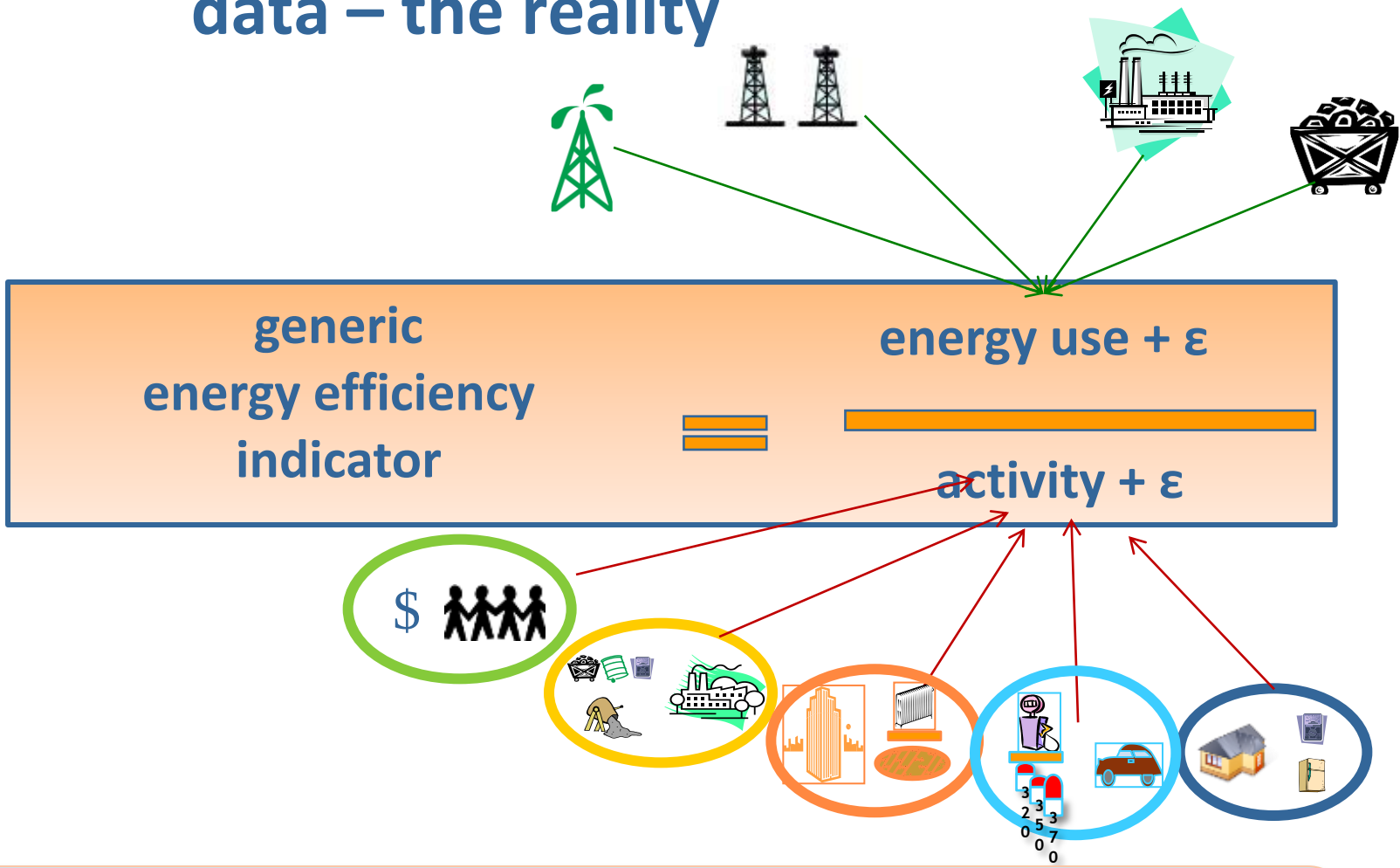
“Activities” vary across sectors

Sector	Activity
Overall	GDP Population
Residential	Population Number of dwellings Floor area Number of appliances …
Services (ideally by category)	Value added Number of employees Floor area
Transport	Passenger-kilometer Tonne-kilometer
Industry (by subsector)	Value added Physical production process-level production



Need to consider what data are available!

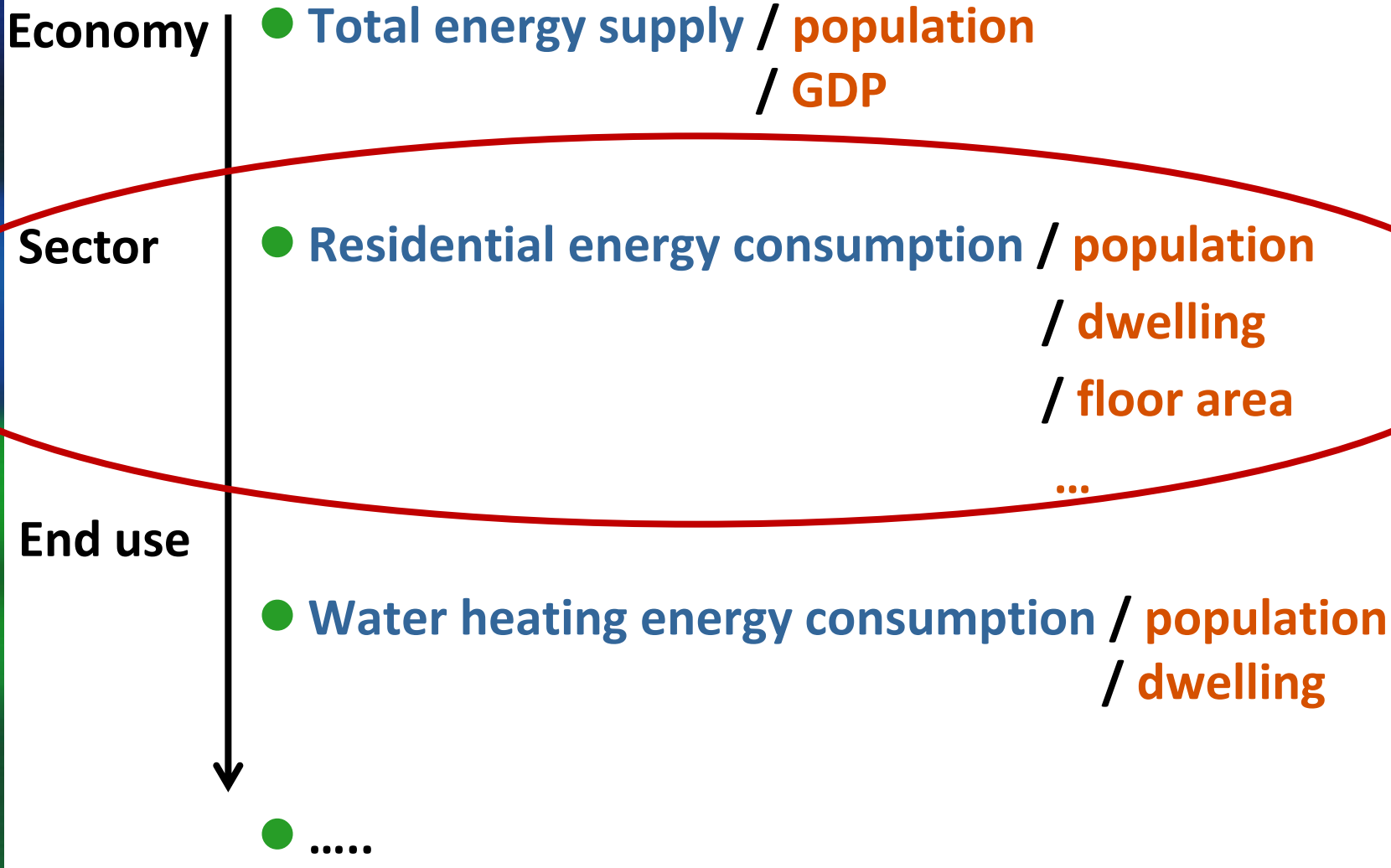
Indicators link activity and energy data – the reality



Need to understand the accuracy of both the energy and activity data – are error terms greater than change

Think about data in indicators

Developing sectoral-level indicators



Coupling sectoral energy data with relevant "activity" data

A selection of possible sectoral-level indicators for residential

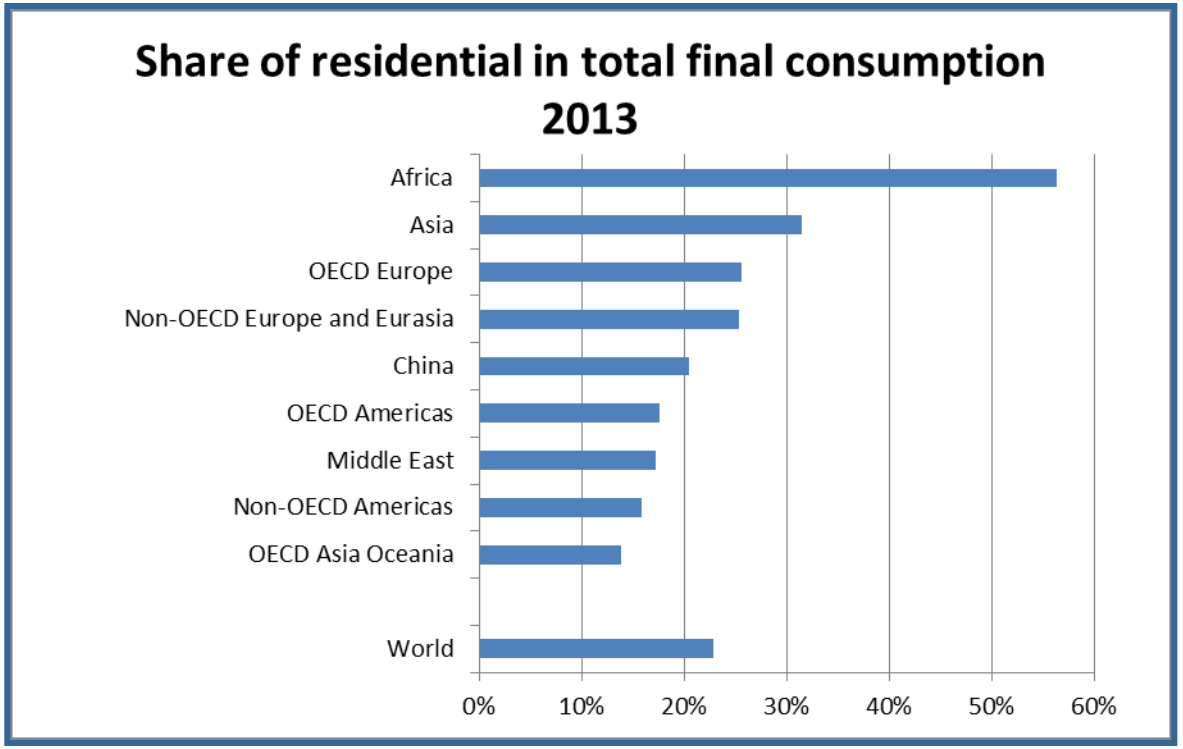
- Residential share in total final consumption
- Share of each energy source in residential consumption

- Residential consumption per capita
- Residential consumption per dwelling

- Residential consumption per capita by source
- Residential consumption per dwelling by source (electricity; solid biofuels; kerosene; etc)

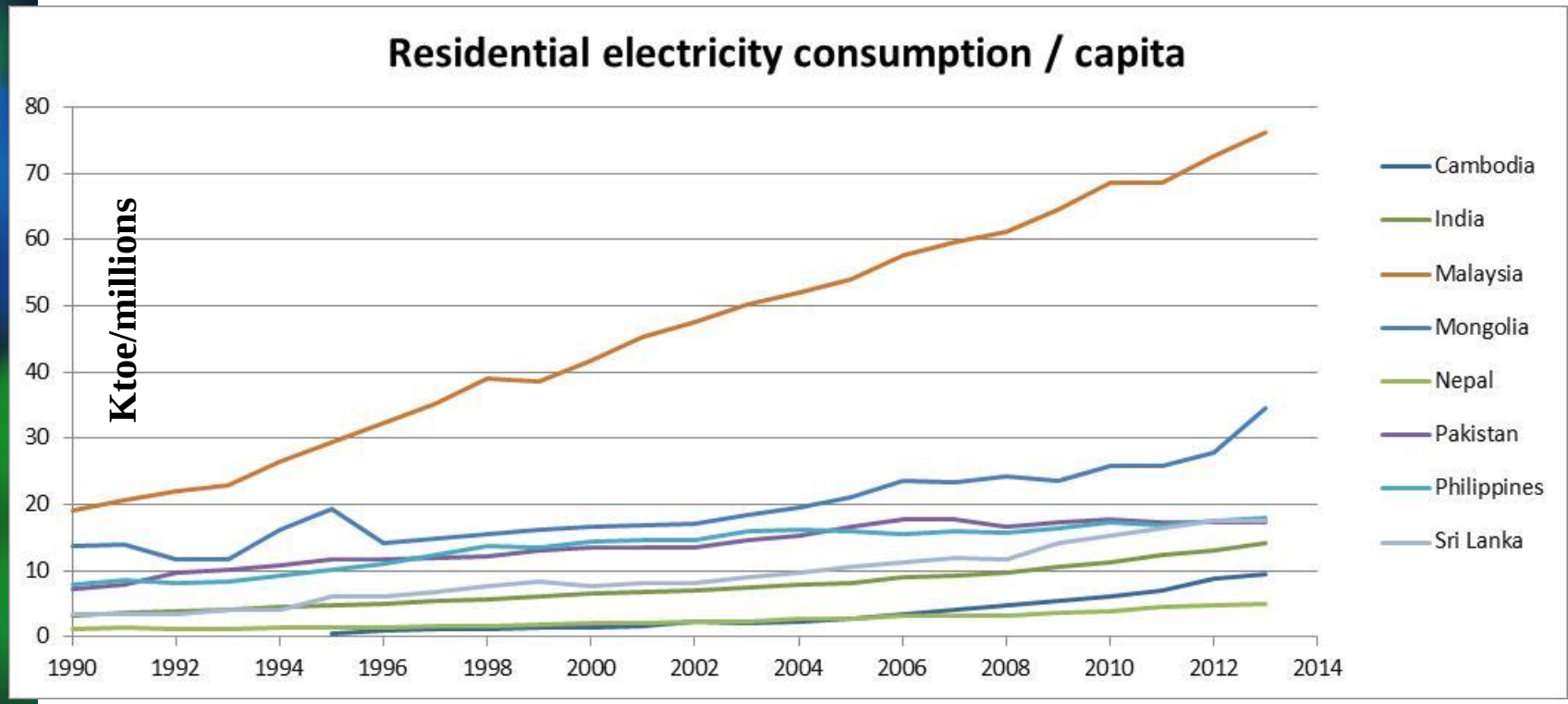
A set of sectoral indicators will provide a useful picture of national trends

Examples: Residential share in total final consumption



Source: IEA, World Energy Balances, 2015

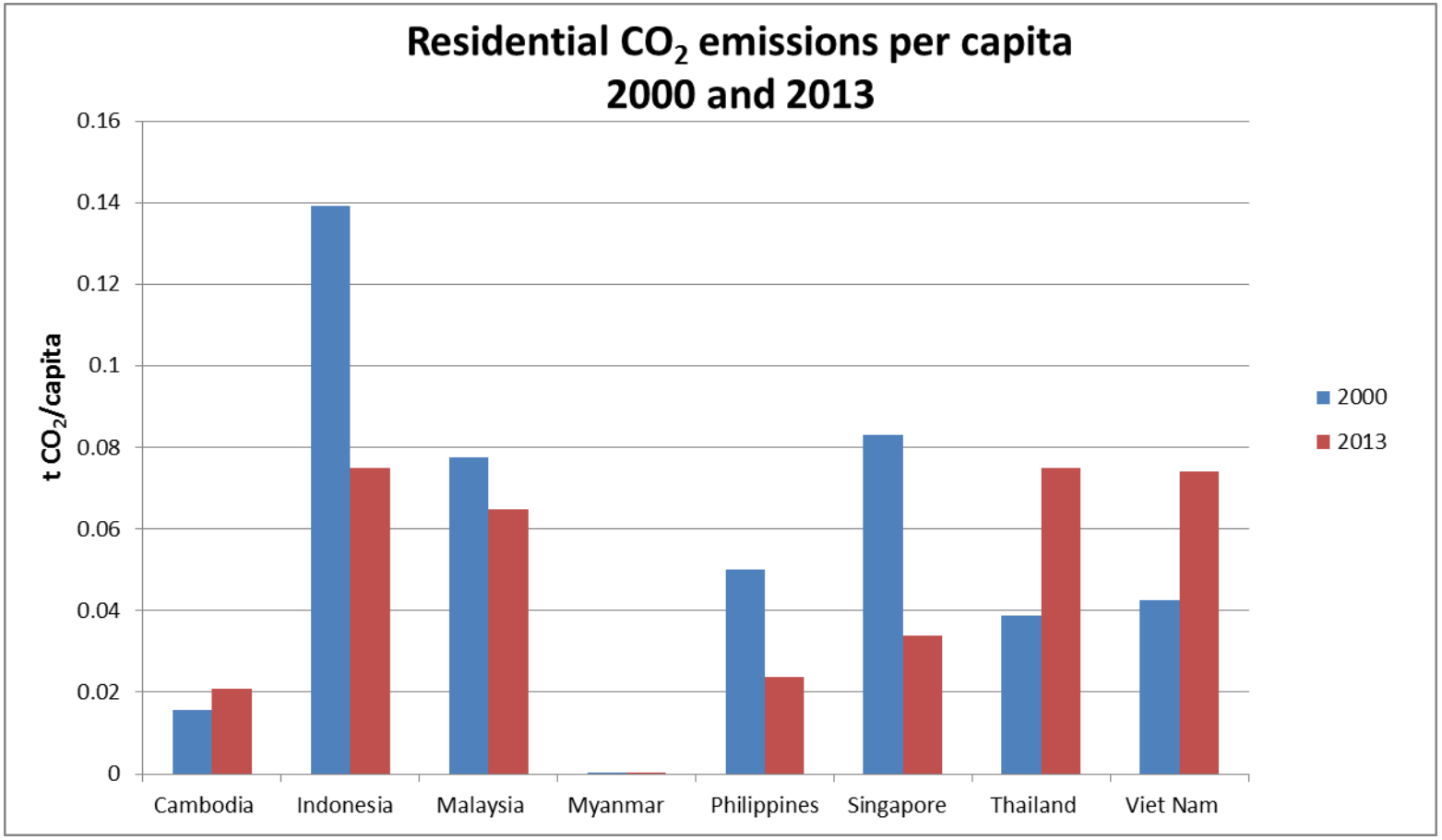
Example: Residential consumption per capita by source - electricity



Source: IEA, World Energy Balances, 2015

…Indicators are also a tool to check data quality and time series consistency

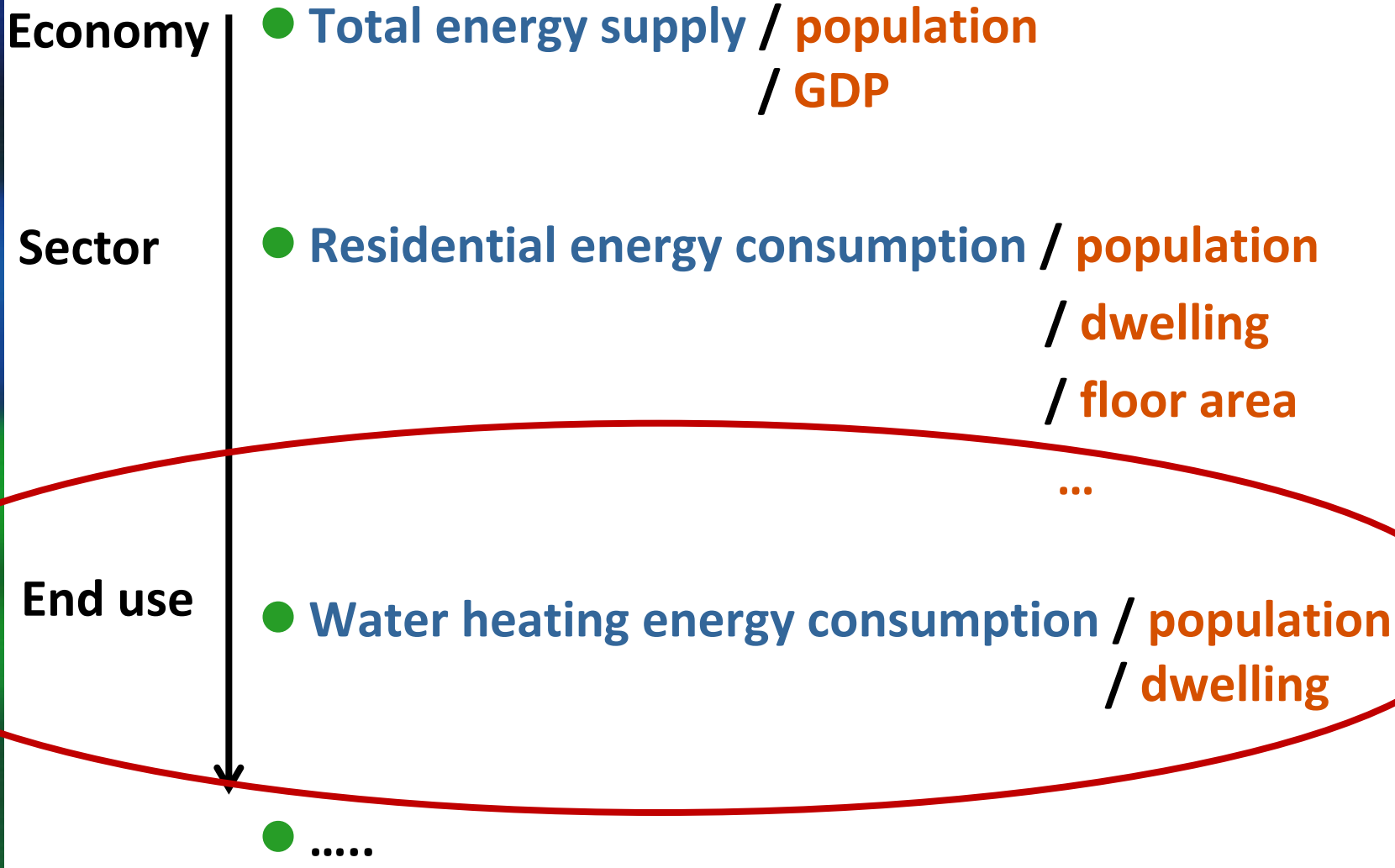
All sectoral-level energy indicators may easily be translated into CO_2-emissions indicators



Source: IEA, CO2 emissions from fuel combustion, 2015

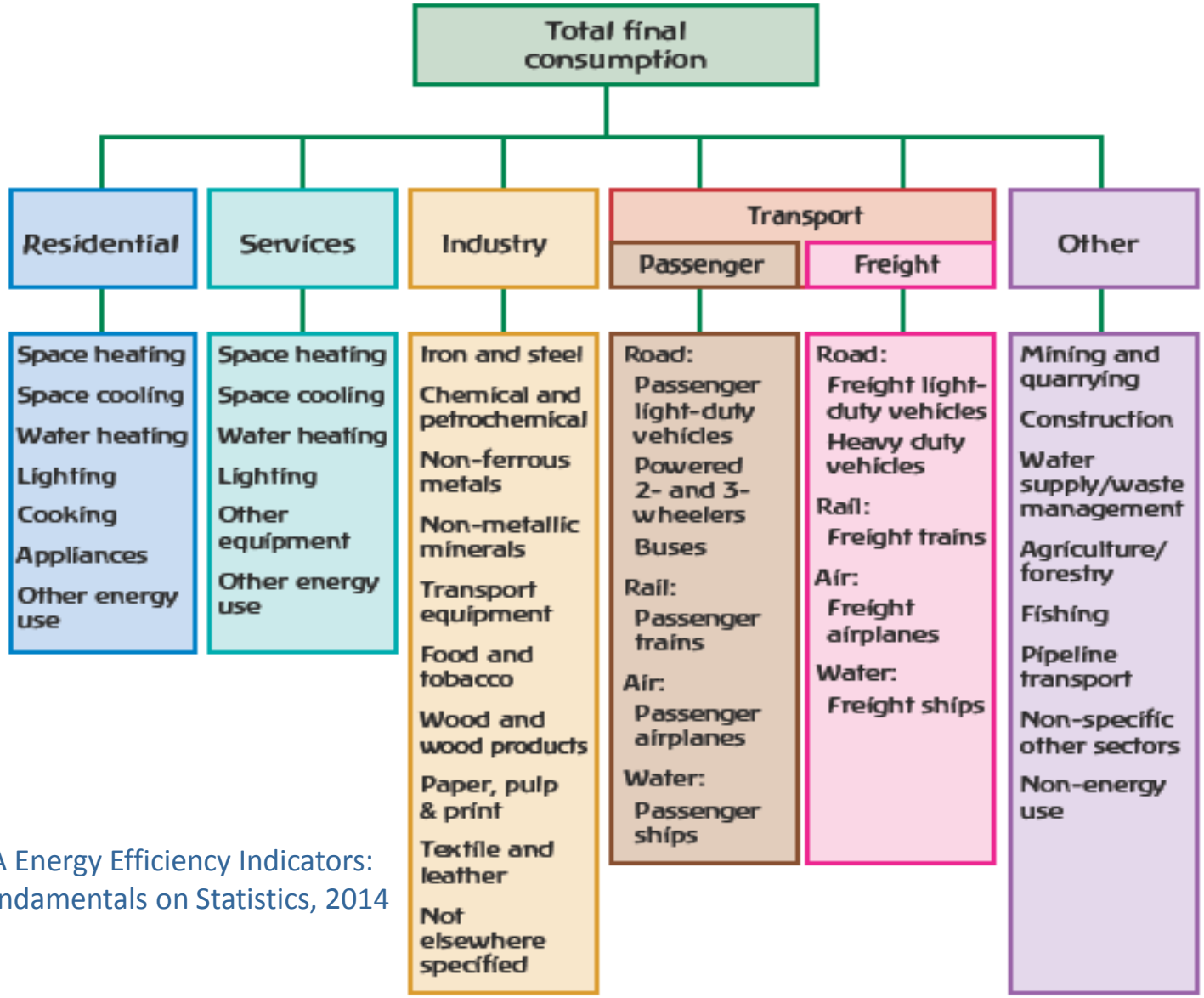
Based on energy balances and IPCC Guidelines on GHG emissions estimations for national inventories

From sectoral to end-use level indicators



Energy data more disaggregated than in energy balance

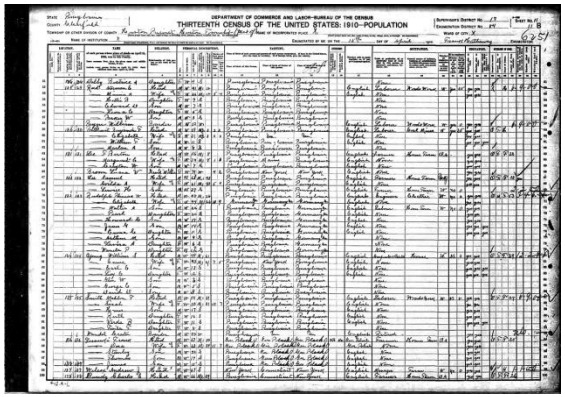
What are the most important end-uses



IEA Energy Efficiency Indicators: Fundamentals on Statistics, 2014

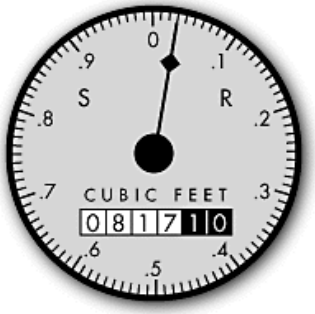
Data collection at the core of developing indicators

- Administrative sources

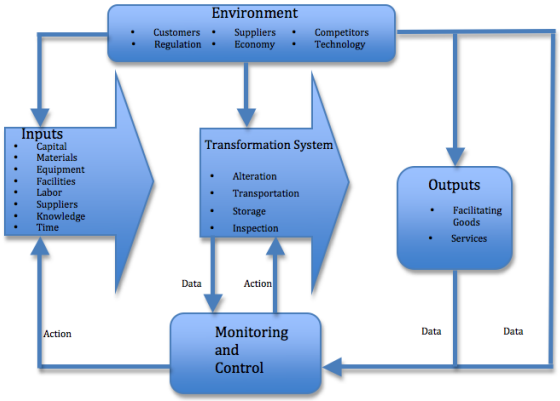


- Surveys

- Metering and measuring



- Modelling



Optimising use of "Administrative sources"

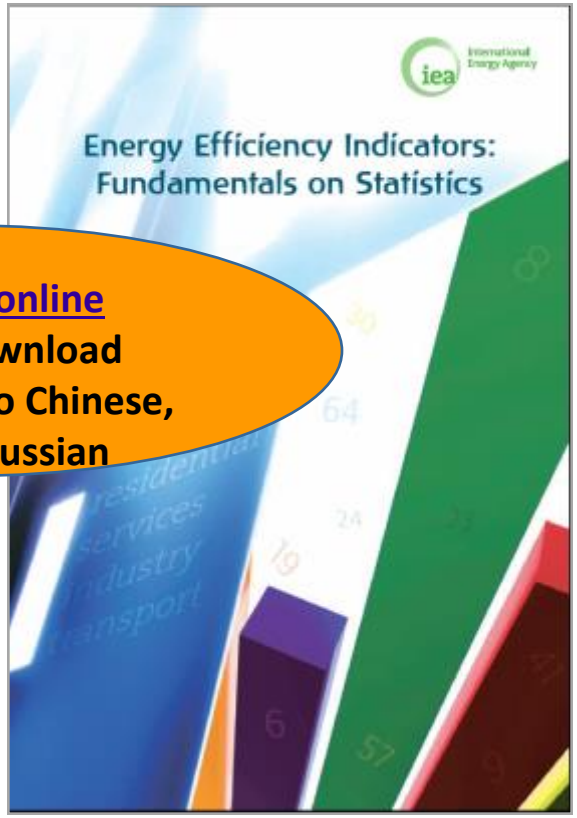
Table 4.2 • Summary of the main data needed for residential indicators and examples of possible sources and methodologies

Data	Source	Methodology
Energy data		
Total residential consumption	National energy balance	Administrative sources Modelling
Energy consumption by source	National energy balance Utilities	Administrative sources Modelling
Activity data		
Floor area	National statistics offices Real estate Regional governments Taxation registers	Administrative sources Surveys
Number of dwellings	Land registry National statistics offices	Administrative sources Surveys
Heating equipment	Building registers Manufacturers/Vendors Subsidy registers	Administrative sources
Number of appliances	Manufacturers National statistics offices	Administrative sources Surveys

IEA Energy Efficiency Indicators: Fundamentals on Statistics, 2014

Key activity data to couple with energy data may be easily available at national level

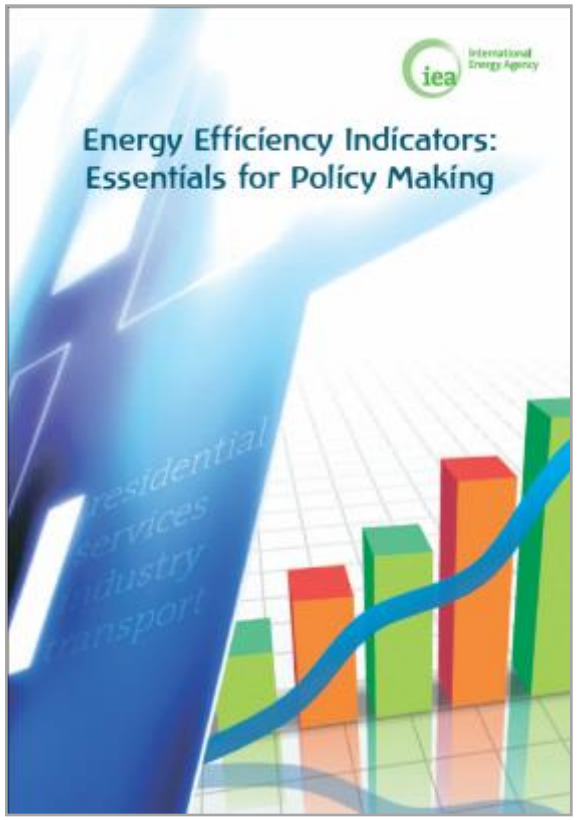
Helping countries with methodologies: two manuals on energy efficiency indicators



Available online
for free download
Translated into Chinese,
Spanish, Russian

http://bit.ly/eei-statistics

Fundamentals on statistics: what data for what indicators, and how to collect them?

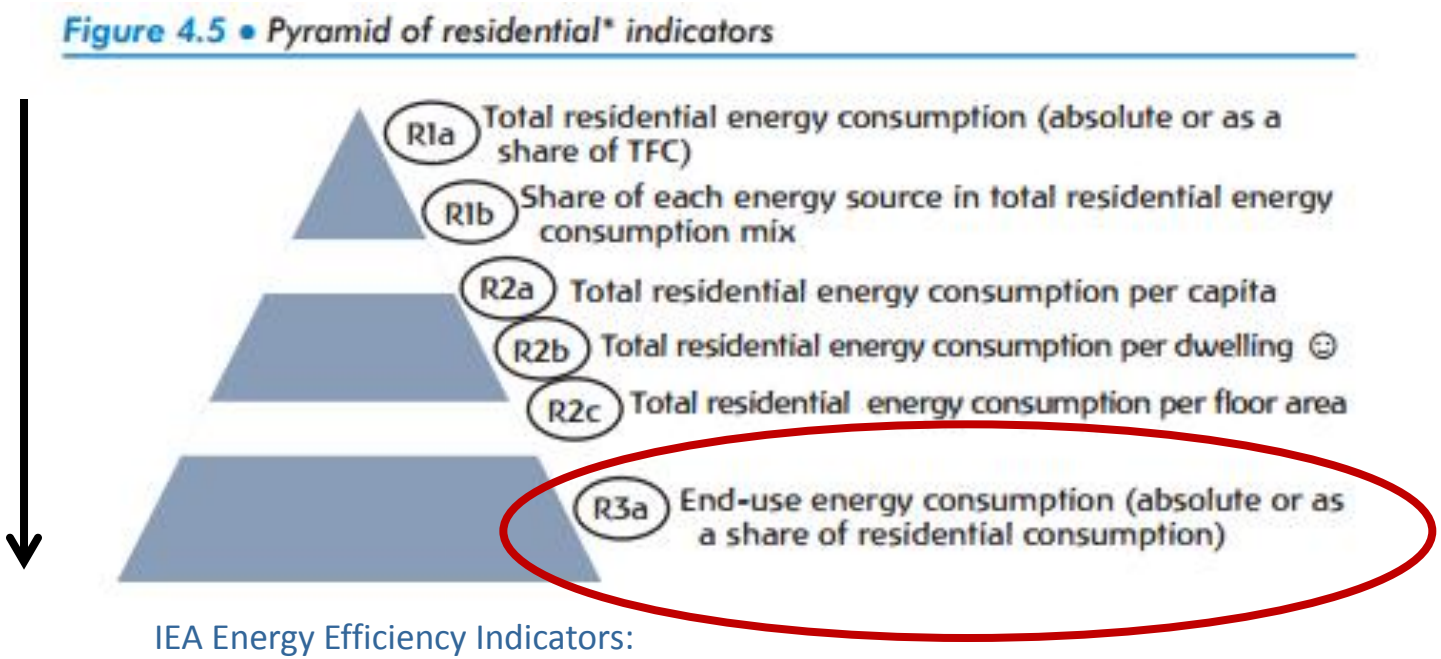


http://bit.ly/eei-policy

Essentials for policy makers: how to develop and interpret energy efficiency indicators?

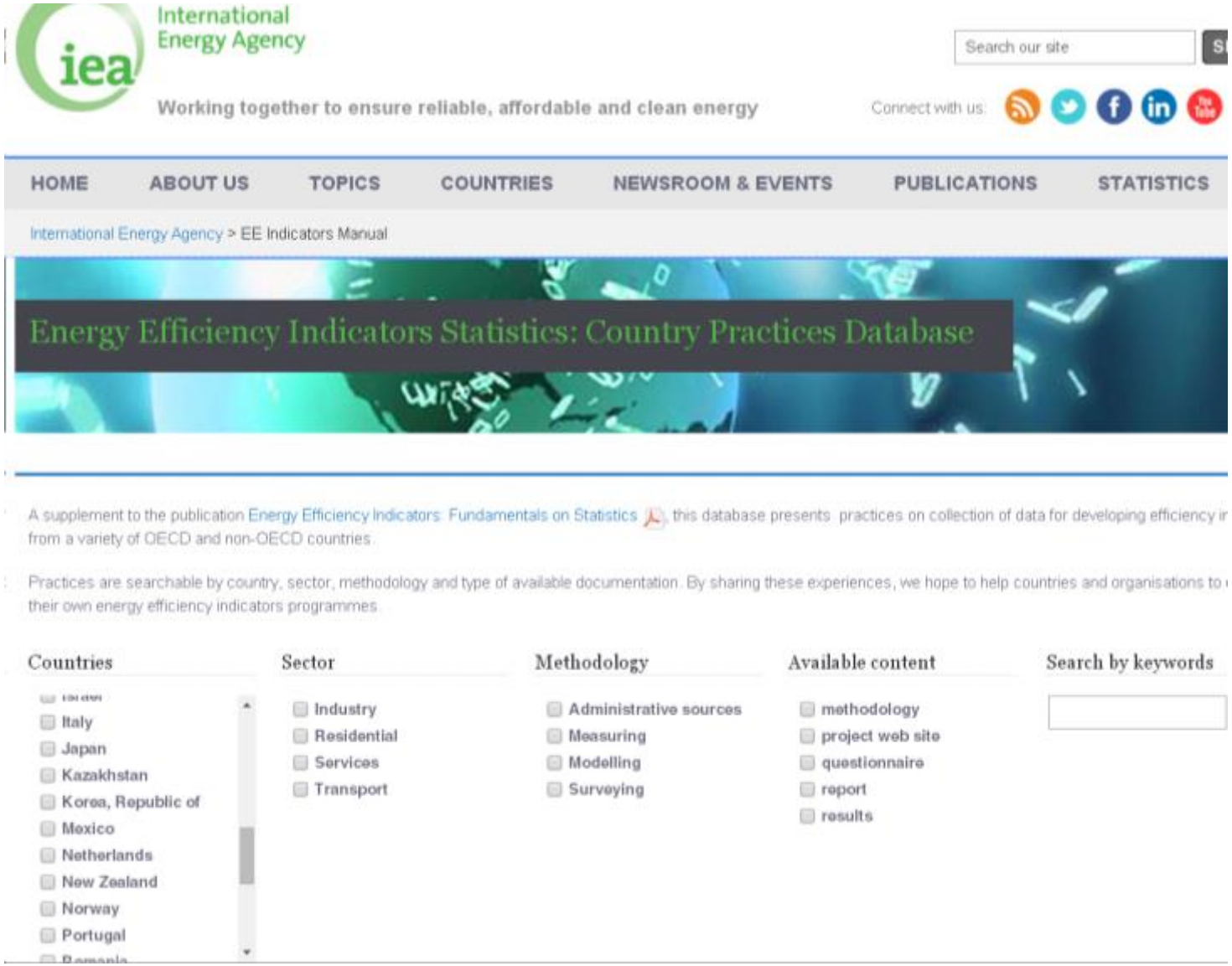
Please let us know if you would like to receive copies of these manuals

The need to prioritise end uses to be monitored as data requirements increase



IEA Energy Efficiency Indicators: Fundamentals on Statistics, 2014

IEA database of country methods to collect EE data



http://www.iea.org/eeindicatorsmanual/

Key steps to monitor energy efficiency

- Strengthen the national energy balances to develop sectoral-level indicators
- Understand what priority end uses drive residential energy consumption and what energy sources are used for each
- How can end use data be collected?
- Identify and map existing “ activity” data sources and plan data collection in priority areas to develop end-use indicators

Thank you

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