Why data matters for energy efficiency policies

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IEA Energy Data Centre

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IEA

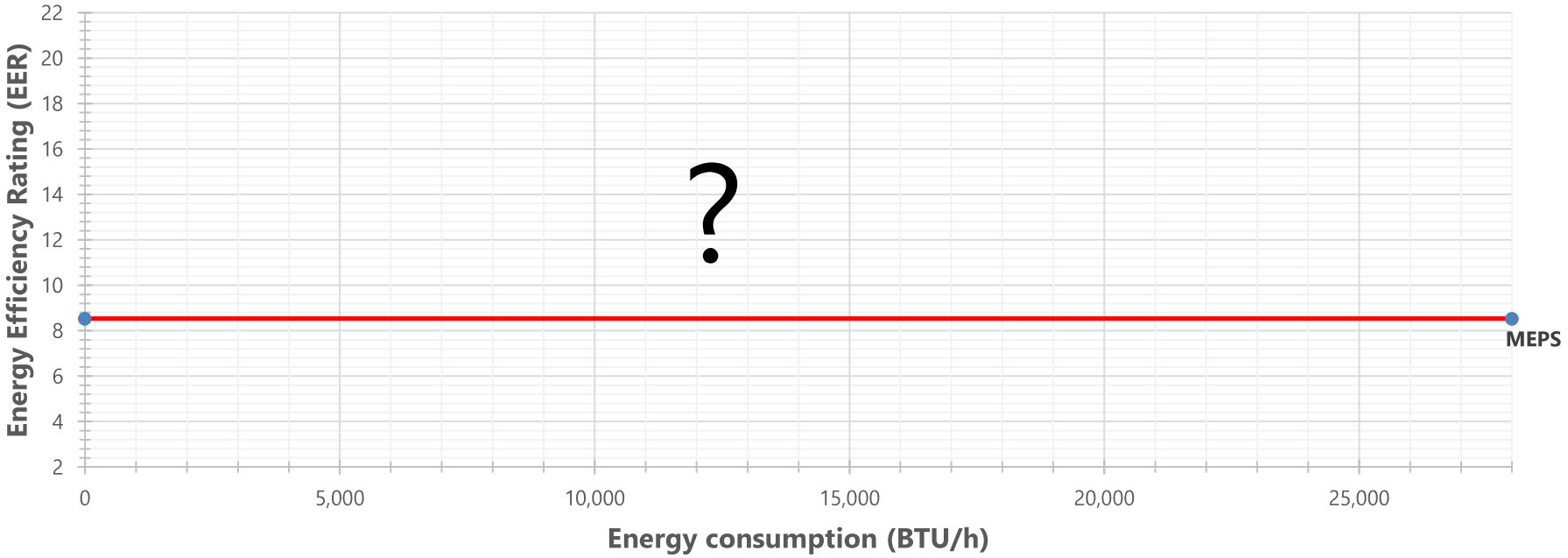
Data and indicators are essential at all stages of the policy cycle

- Inform design based on current state and ambition
- Adapt policy during its implementation
- Understand policy performance
- Evaluate what happened and why

Each individual measure requires appropriate data to be effective

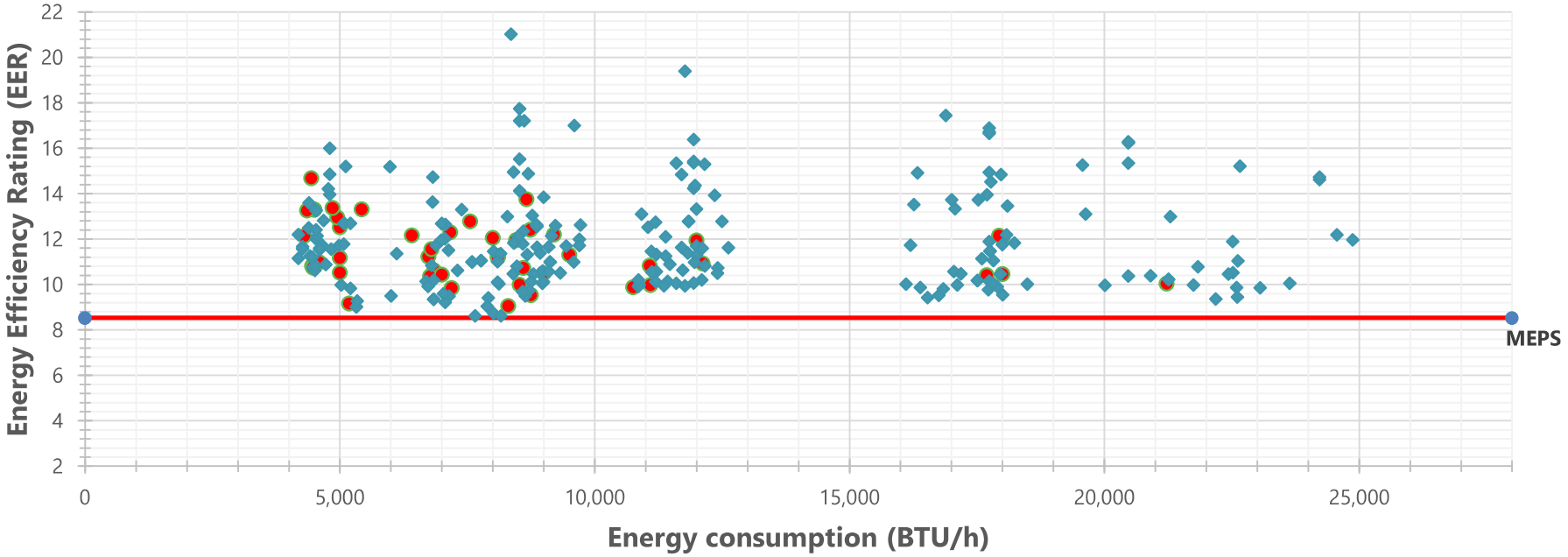
Why does effective policy design require appropriate data?

Case study: defining MEPS in the absence of national market data



Policy design without appropriate data may not be optimal

Efficiency rating of selected air conditioners in national/regional market – data collected after MEPS



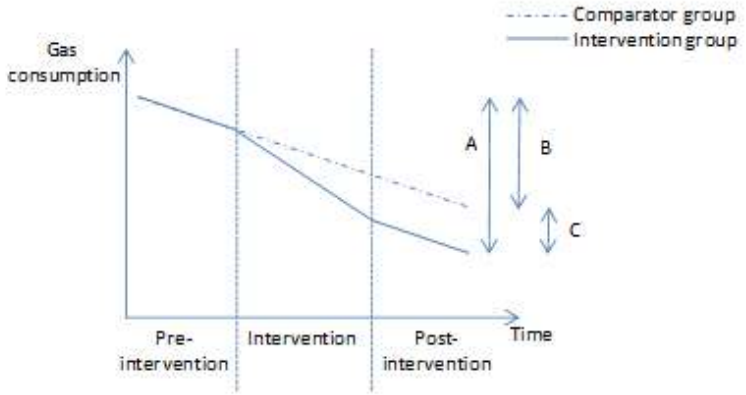
In this case, without appropriate market data, minimum energy performance levels were set too low to impact the broader market

Evaluating impacts requires tailored data/methods for each policy

Department of Energy & Climate Change

Impact of measures methodology

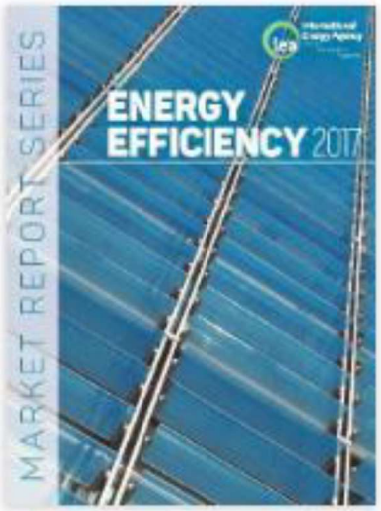
- Difference in differences approach



- Each property in the intervention group is also matched to an equivalent property in the comparator group to allow comparisons of median, and distributions.

Estimating impacts compared to "control" group (what would have happened)

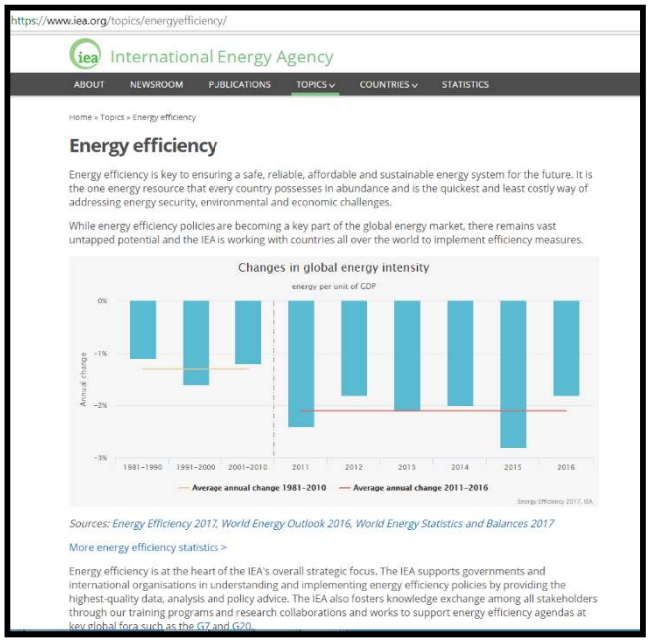
Integration of data in policy work is vital, as in IEA approach

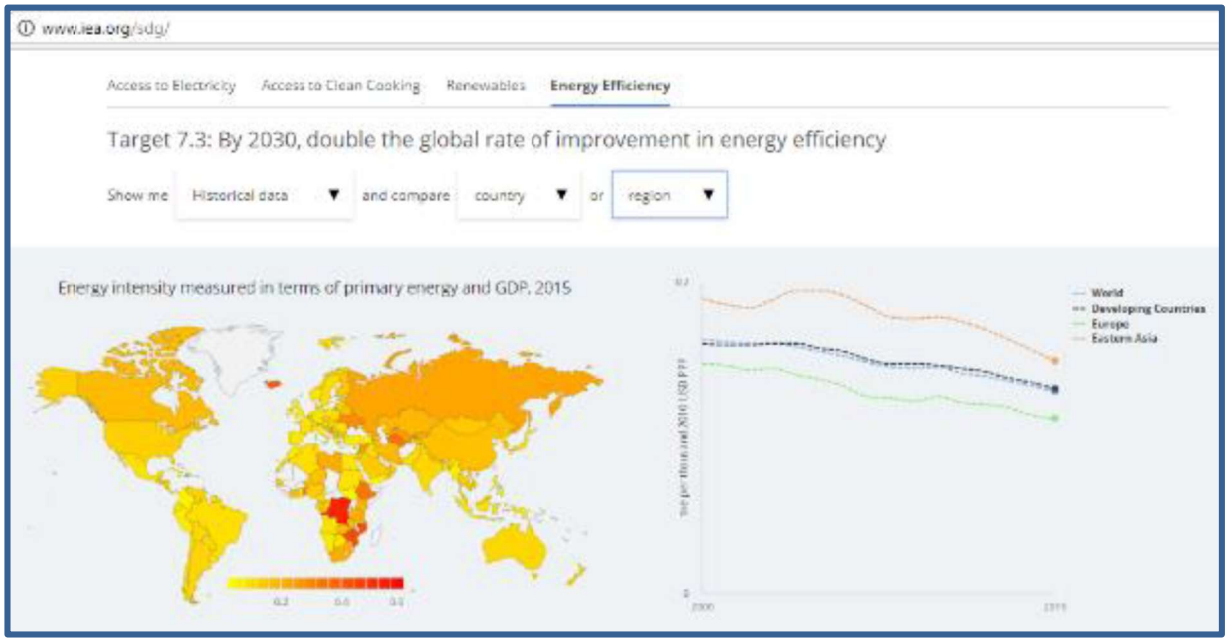


Energy efficiency data/indicators feed all IEA policy analysis and projections. Conversely, IEA data quality assessment benefits from broader IEA expertise

What data to track efficiency progress: the IEA experience on indicators

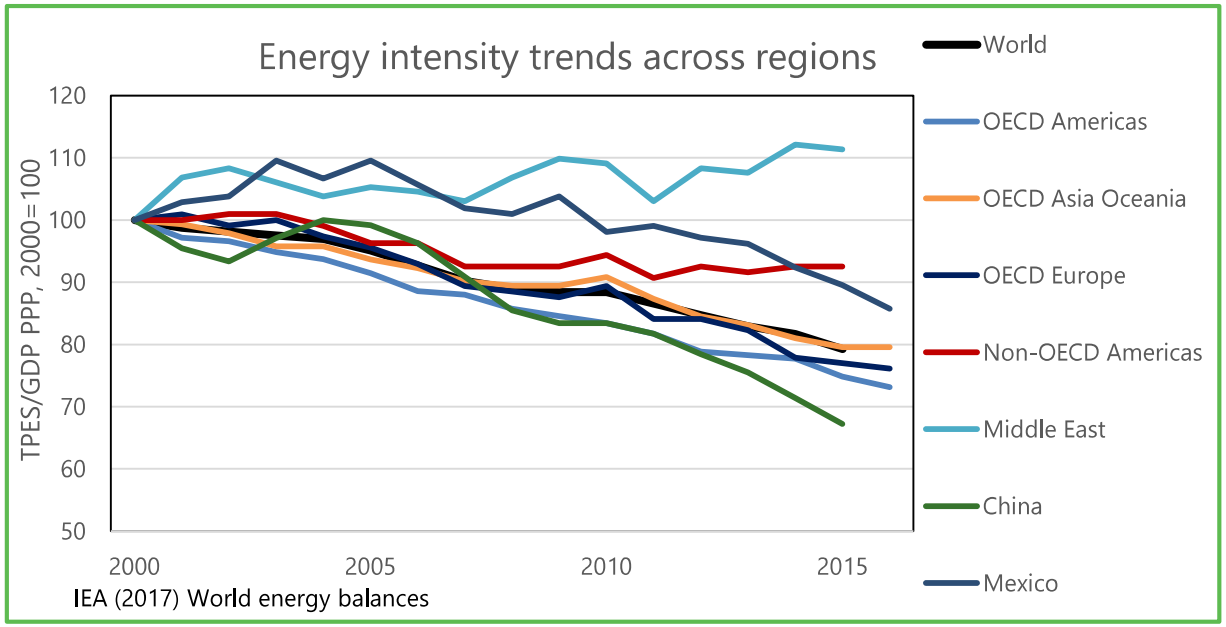
Energy intensity is widely used to monitor high-level efficiency trends





We generally observe decreasing trends of energy intensity over time

How to interpret the economy-wide energy intensity decrease?



IEA (2017) World energy balances

At national level:

Have we been more efficient in supply or demand side?

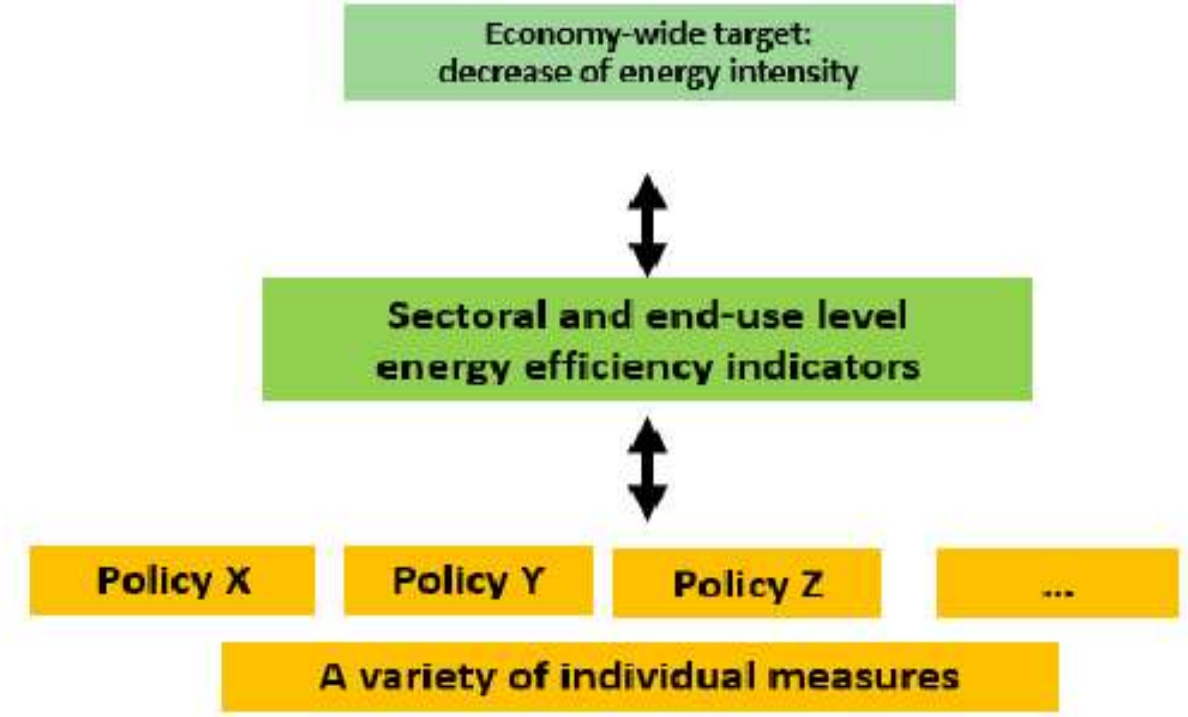
...and in what sectors/end-uses?

Has the economic structure changed?

What are the implications for future energy needs?

More detailed information on demand is essential: efficiency data and indicators

End-use indicators to assess efficiency progress from portfolio of measures



Efficiency indicators require "energy end-use" and "activity" data

“Energy end-use” data more sharply track demand trends

What are the largest end-uses within the total final consumption?

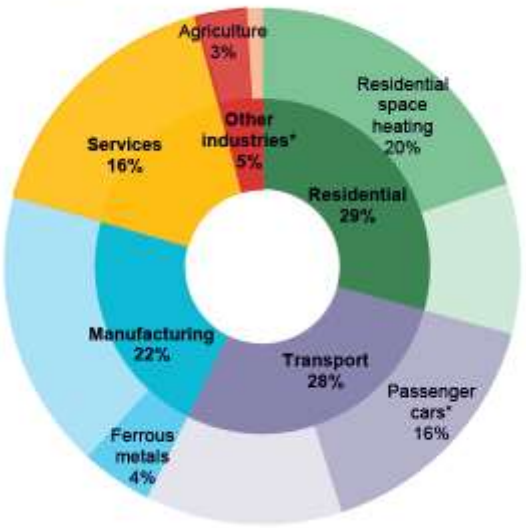
How are they changing over time?

What are the priority areas for policy?

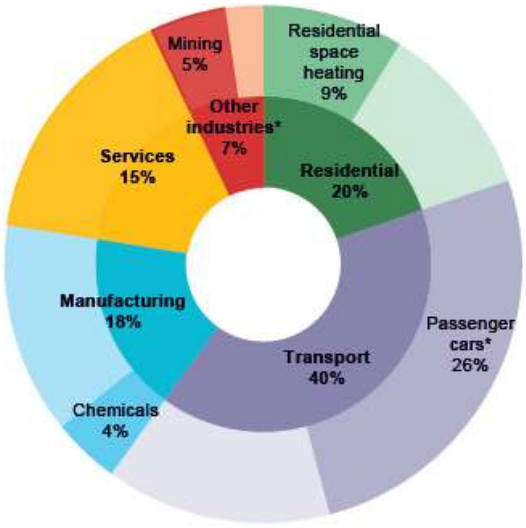
…

Largest end-uses by sector

France



United States



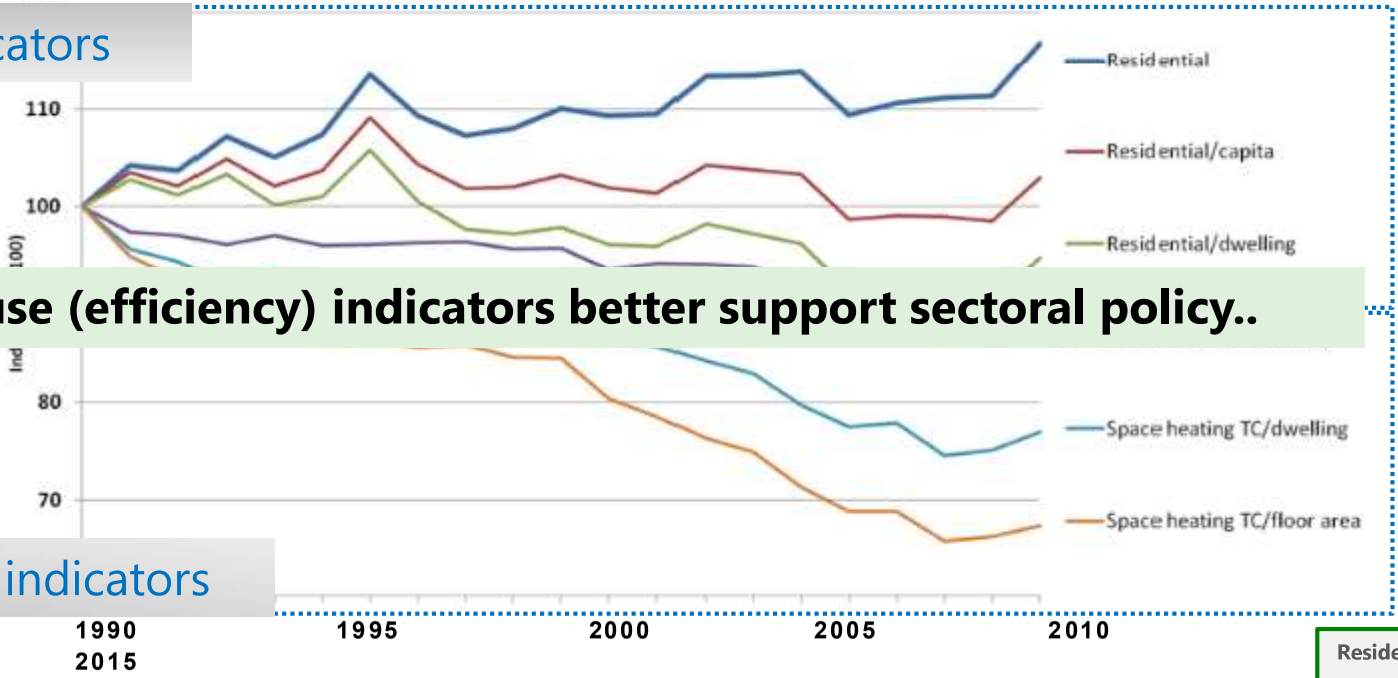
Source: *IEA Energy Efficiency Indicators Highlights*

Each energy end-use is linked to specific “activities” …

Indicators relate energy and activity data

Residential energy consumption index (IEA20)

High level indicators



End-use (efficiency) indicators better support sectoral policy..

Disaggregated indicators

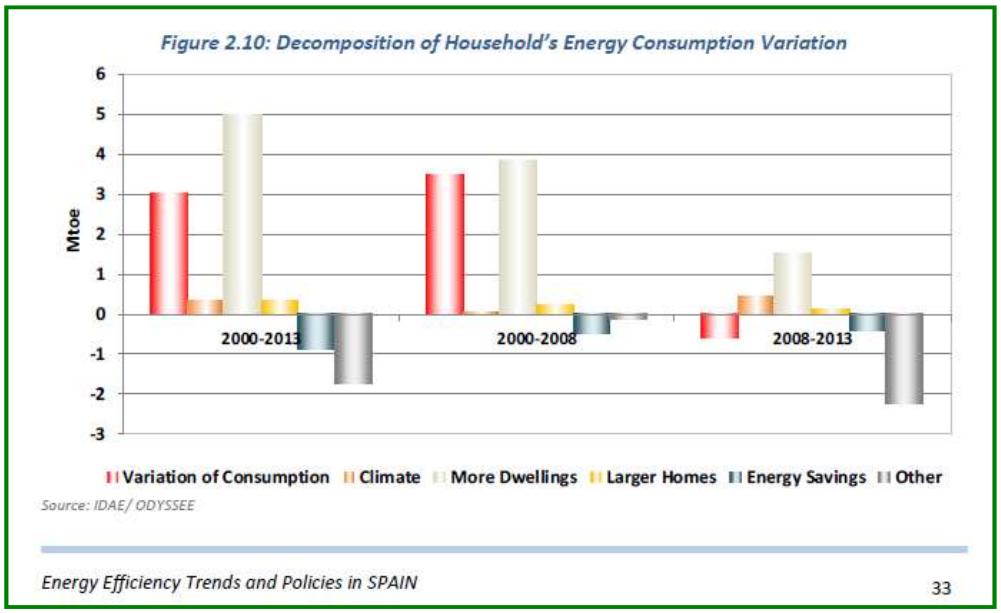
Data for IEA 20
* Temperature correction using heating degree days
Data source: IEA, Energy efficiency indicators database

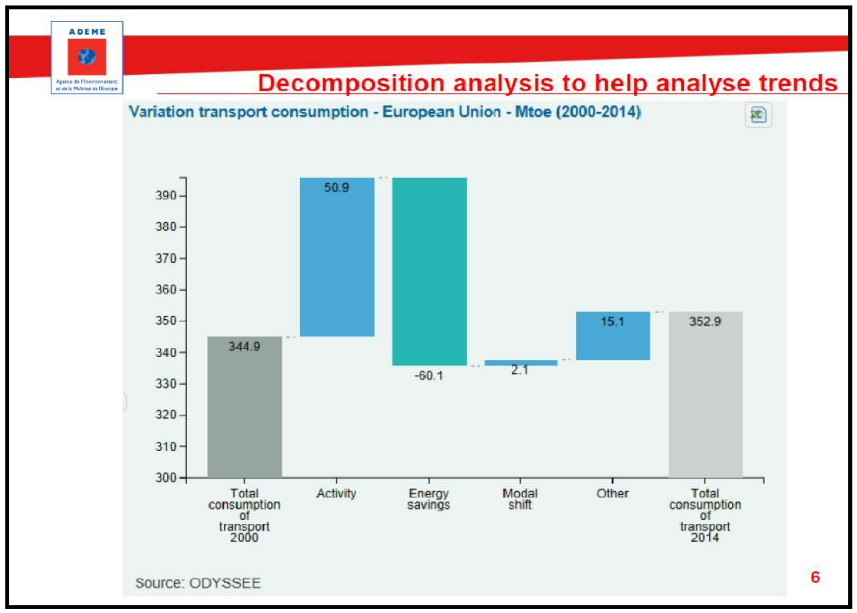
Residential end-uses

- Space heating*
- Space cooling*
- Water heating
- Cooking
- Lighting
- Appliances

..and require more disaggregated data than traditional energy balances

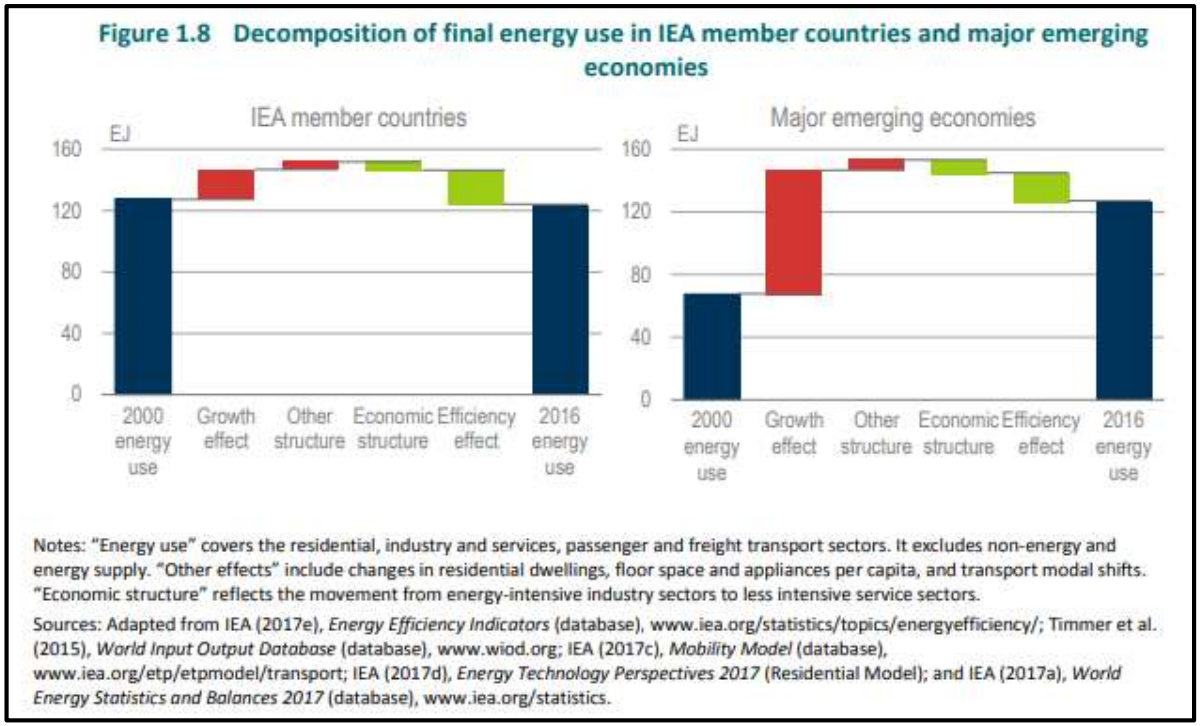
End-use analysis to estimate efficiency impacts on sectoral energy





The examples of transport and residential sectors

And overall efficiency impacts on energy use for the economy

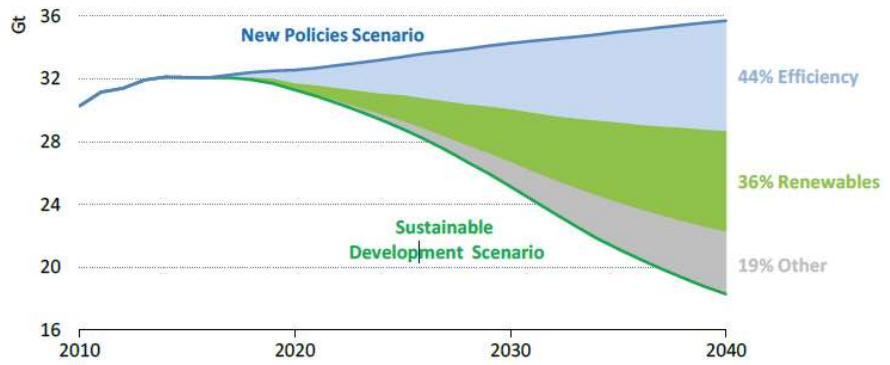


Source: IEA, Energy Efficiency 2017

A tool to assess energy efficiency progress

End-use data across sectors are also essential for demand projections

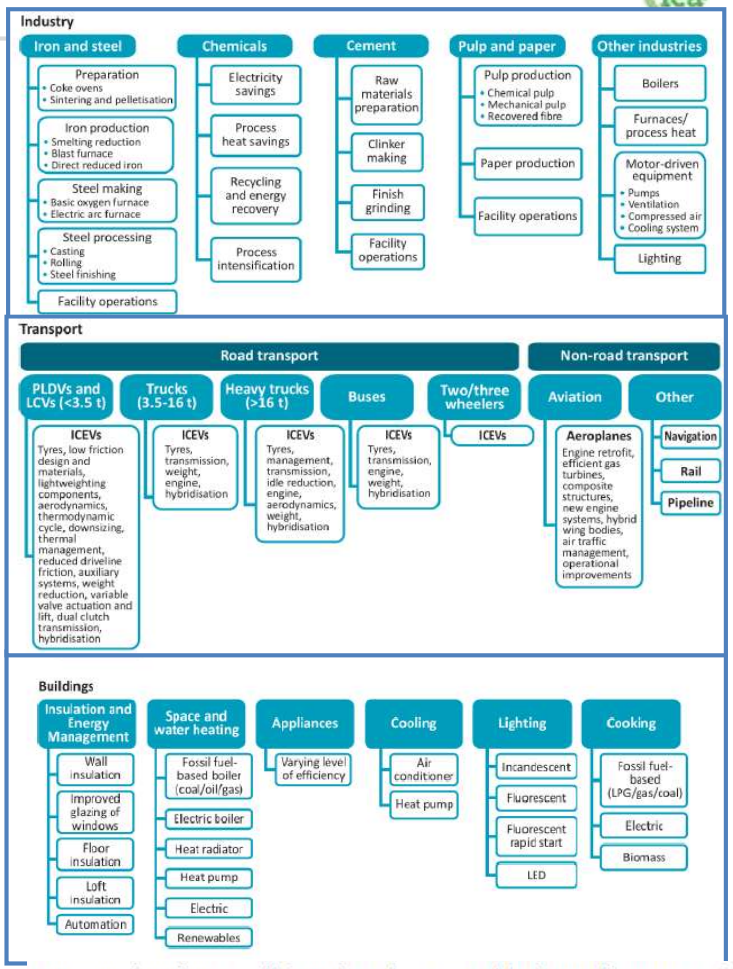
Figure 7.21 ▷ Global energy-related CO_2 emissions abatement and key contributions in the Sustainable Development Scenario



Energy efficiency and renewables are the two key abatement measures in the New Policies and Sustainable Development Scenarios

Notes: Other refers to carbon capture and storage, nuclear, and fuel switching. The shares on the right-hand side of the graph represent the cumulative contributions by measures.

World Energy Outlook 2017 | Global Energy Trends

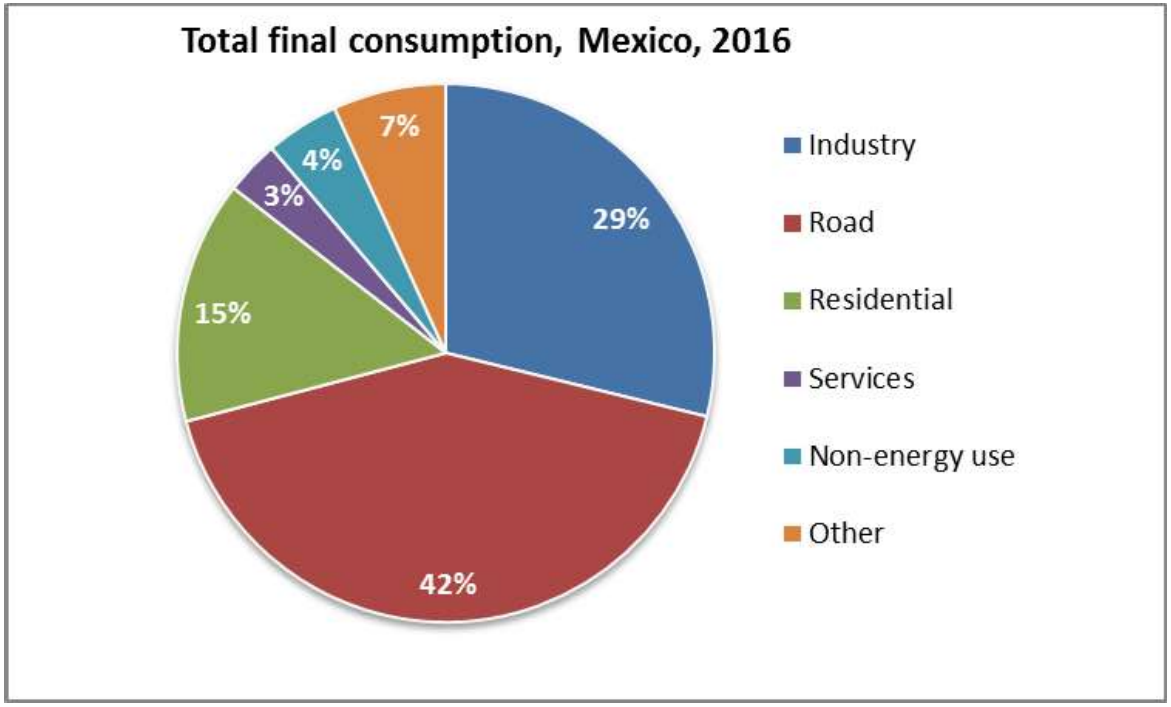


Representation of energy efficiency by end-use sector* in the World Energy Model

Data for efficiency indicators:

few key points

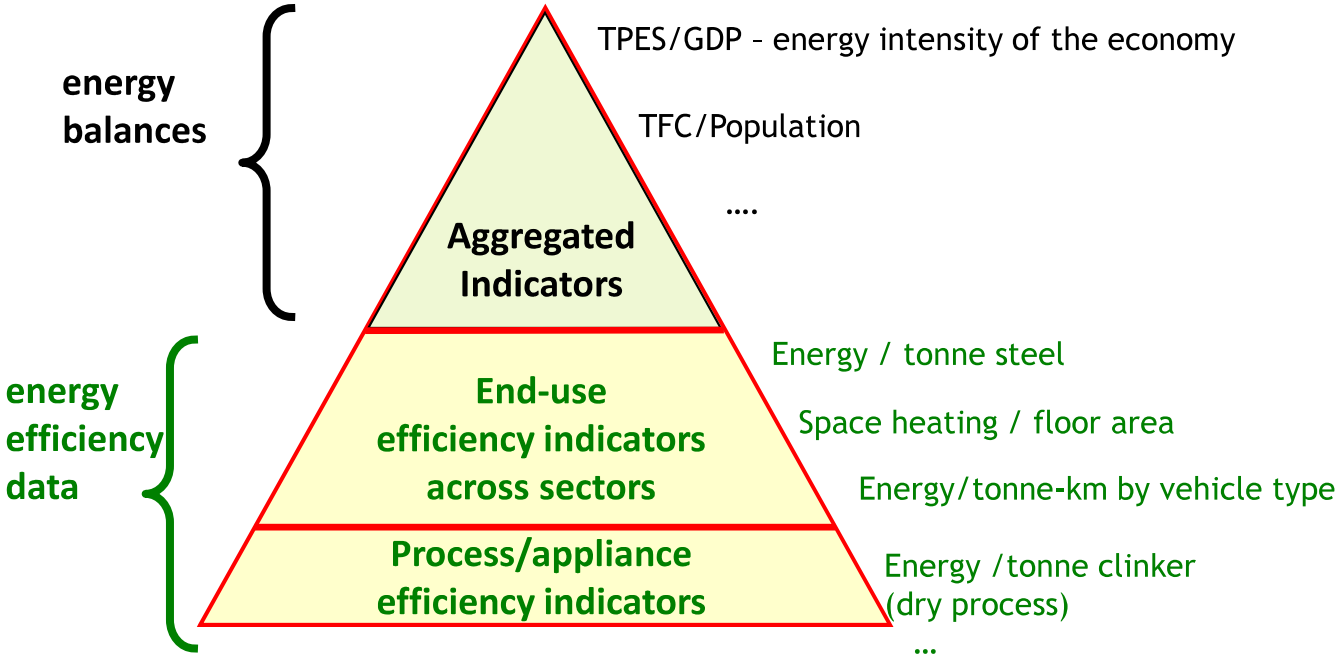
The energy balance is a starting point to study trends in energy demand



Good demand-side data in the national energy balance are essential

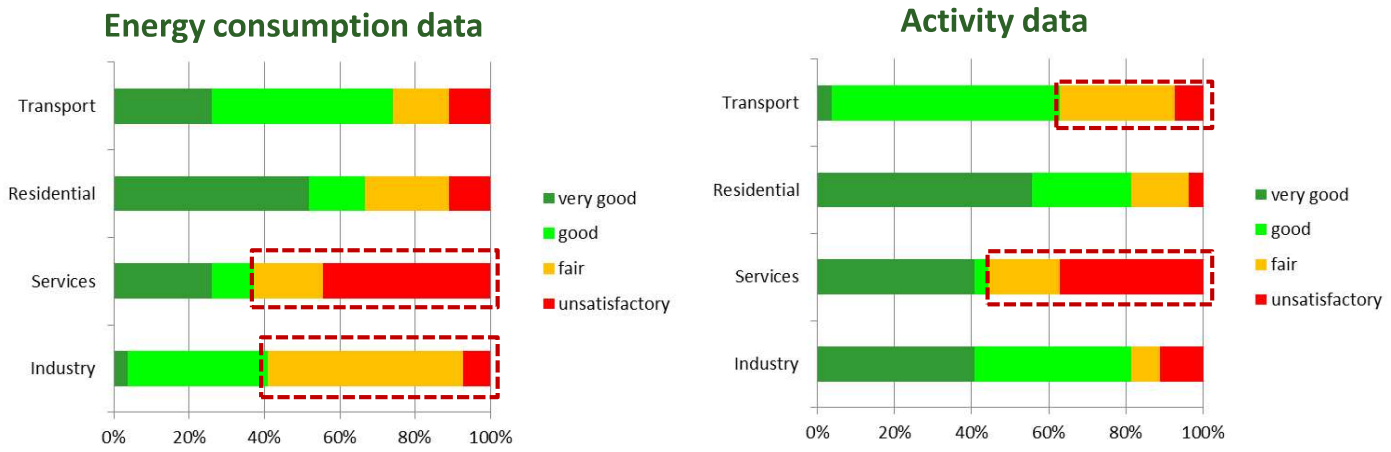
Data source: IEA (2017), World energy balances, based on SENER submission

From balances to end-uses: data quality / data needs implications



We need consistent, more detailed information than in energy balances. Further data collection (e.g. surveys) and cooperation among focal points.

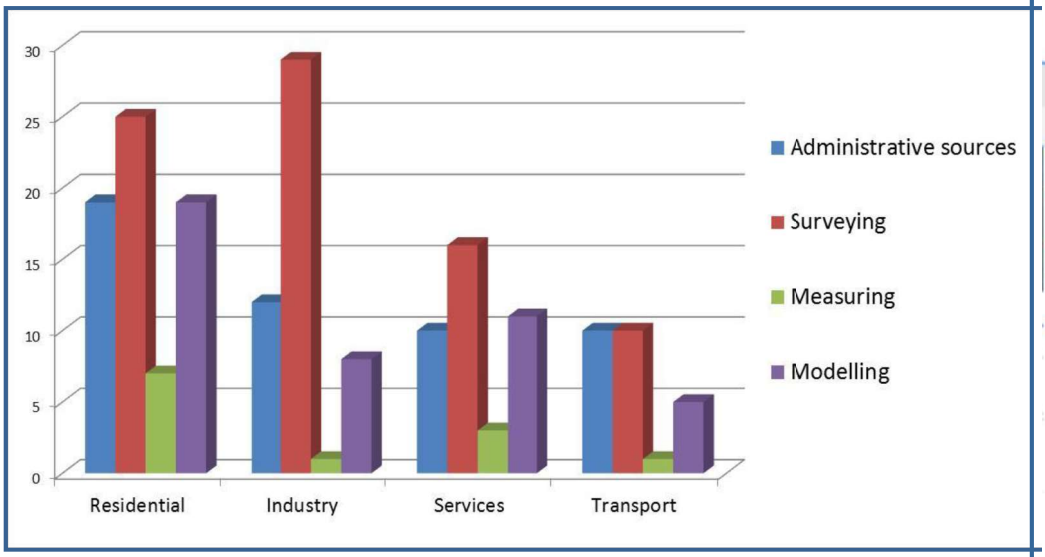
Assessment of IEA Member data completeness (2016/2017 cycle)



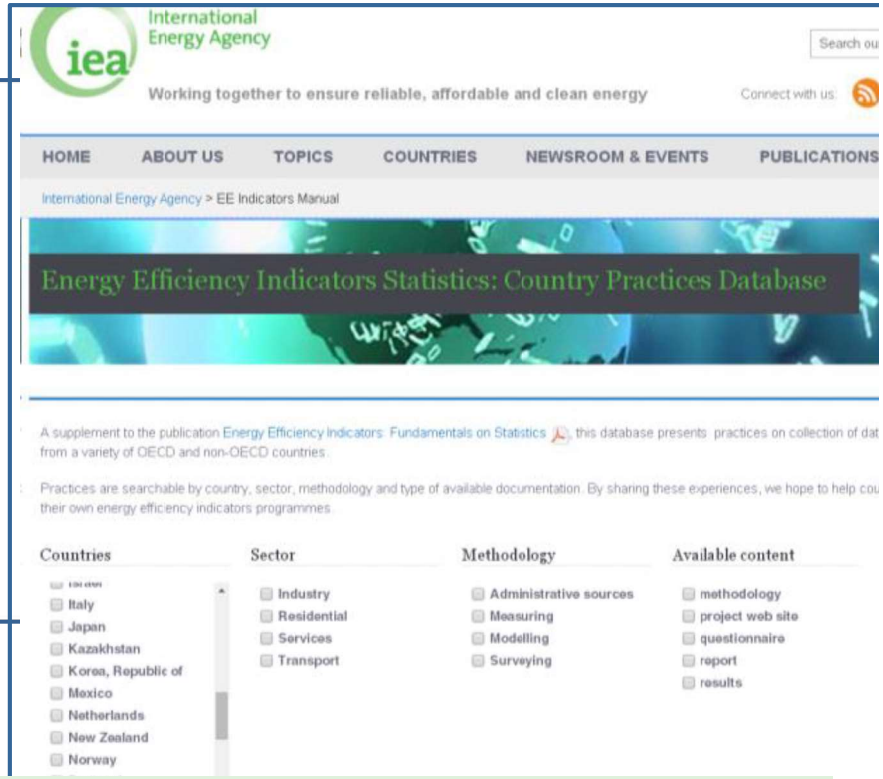
Data for 27 countries with direct submission of energy efficiency data or submitted through the ODYSSEE database

Great progress, but data gaps still exist across IEA
Generally less data available beyond IEA, although other regional initiatives exist

How are countries collecting end-use data?

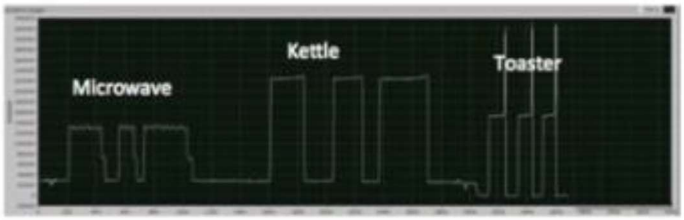


Results from an IEA survey for 160 practices from 40 countries



IEA online database of country practices
http://www.iea.org/eeindicatorsmanual

Emerging opportunities for end-use energy statistics from digital technologies



- Every appliance has its own energy draw on the power line

Beyond models, EIA has begun testing new technologies to objectively measure end use demand. Recent research shows:

- So-called "NILMs" (Non-Intrusive Load Monitoring) are definitely *the* hot topic, and shared by different interests:
  - Energy Efficiency, Demand Response, Measurement & Verification, Energy Audits, Appliance Diagnostics, Cost of Service, etc.

In this initial pilot study of NILM technologies, EIA will conduct analyses to…

- Compare usage patterns between NILM device and respondent, (e.g., number of clothes washer cycles
- Compare usage characteristics (e.g., self-reported versus observed water temperature for a clothes washer or heated drying for a dishwasher)
- Compare actual consumption by end use to the RECS 2015 model results

We'll prioritize the research in three tiers in preparation for the 2020 RECS:

Priority	Products
Tier 1	Refrigerators, Dishwashers, Clothes Washers, Dryers, Cooking, Air Conditioning, Heating
Tier 2	Computers, Televisions, Home Entertainment
Tier 3	Lighting, Rare End Uses, Residual

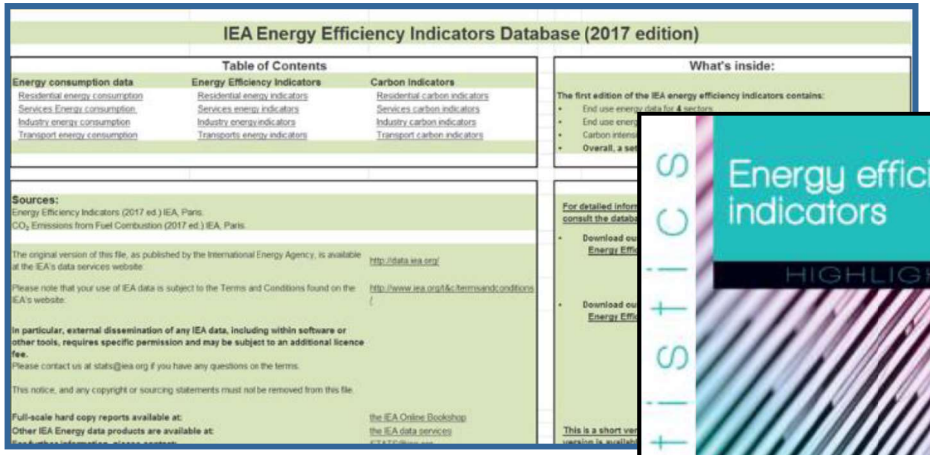
Eileen O'Brien, Buenos Aires
February 2018

Pilot experiences across countries to assess statistical applicability

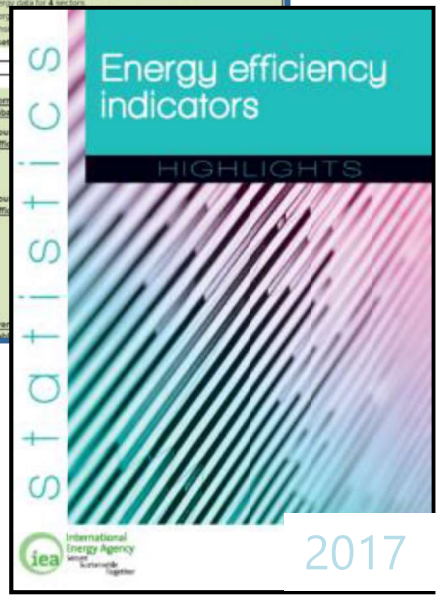
IEA energy efficiency statistics tools

The IEA Efficiency statistics: Highlights publication and excel database

- Covers **4 sectors** (residential, services, industry and transport)
  - Annual end use energy data, by product
  - End use energy efficiency indicators
  - Carbon intensity indicators
- Available online



http://www.iea.org/media/statistics/EnergyEfficiencyIndicators.xls

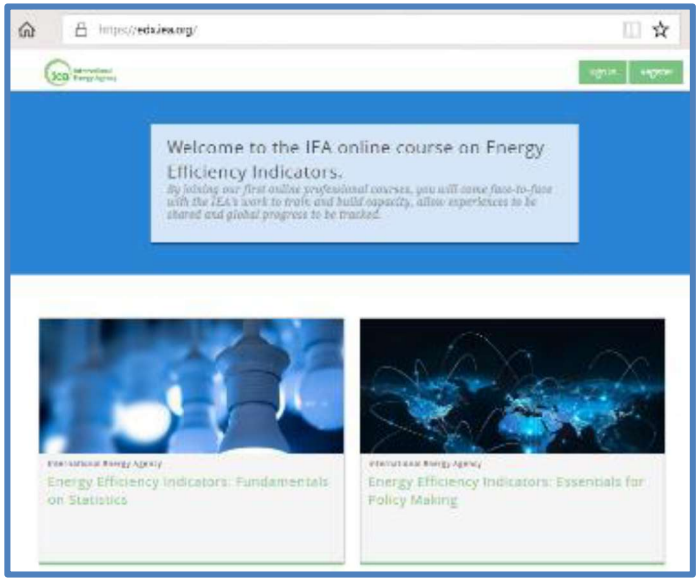


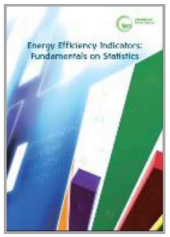
https://webstore.iea.org/energy-efficiency-indicators-2017-highlights

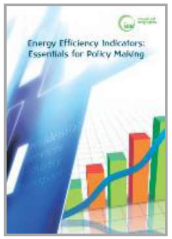
Energy efficiency indicators: an area of fast development

IEA indicators manuals are now an online course accessible to all

- Global tool; self-paced and interactive
- For policy makers and statisticians
- Use by all countries is welcome







https://edx.iea.org/

Recently launched in Mexico by E4

The importance of end-use data for energy efficiency policy

- Detailed end-use energy / activity data and indicators are vital for energy demand policy and planning, across sectors and end-uses.

- Data collection needs appropriate resources - Having no data will cost more!

- Collaboration among statistics and policy experts -and among institutions that may contribute relevant data – is essential to enhance outcomes.

The IEA is committed to facilitate national work and exchange across countries, with a view to strengthening the long-term institutional capacities

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Energy Efficiency Indicators Highlights 2017

Download publication

Edition: 2017
150 pages

This statistical report is designed to help understand what drives final energy use in IEA member countries in order to improve and track national energy efficiency policies. It is the second edition of a comprehensive selection of data that the IEA has been collecting each year, after its member states recognised in 2009 the need to better monitor energy efficiency policies.

The report includes country-specific analysis of end uses across the largest sectors – residential, services, industry and transport. It answers questions such as:

- What are the largest drivers for energy use trends in each country?
- Was energy saved because of efficiency progress over time?
- How much energy is used for space heating, appliances or cooking?
- What are the most energy-intensive industries?

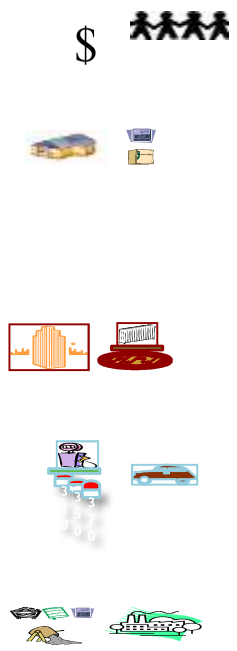
Improving energy efficiency is a critical step for governments to take to move towards a sustainable energy system. This report highlights the key role of end-use energy data and indicators in monitoring progress in energy efficiency around the world.

This publication is complemented by the new ***Energy Efficiency Indicators* database**, which contains annual data from 2000 to 2015, covering end use energy consumption by energy product, end use energy efficiency indicators, and carbon intensity indicators for the four sectors.

Download the free database: Energy Efficiency Indicators 2017

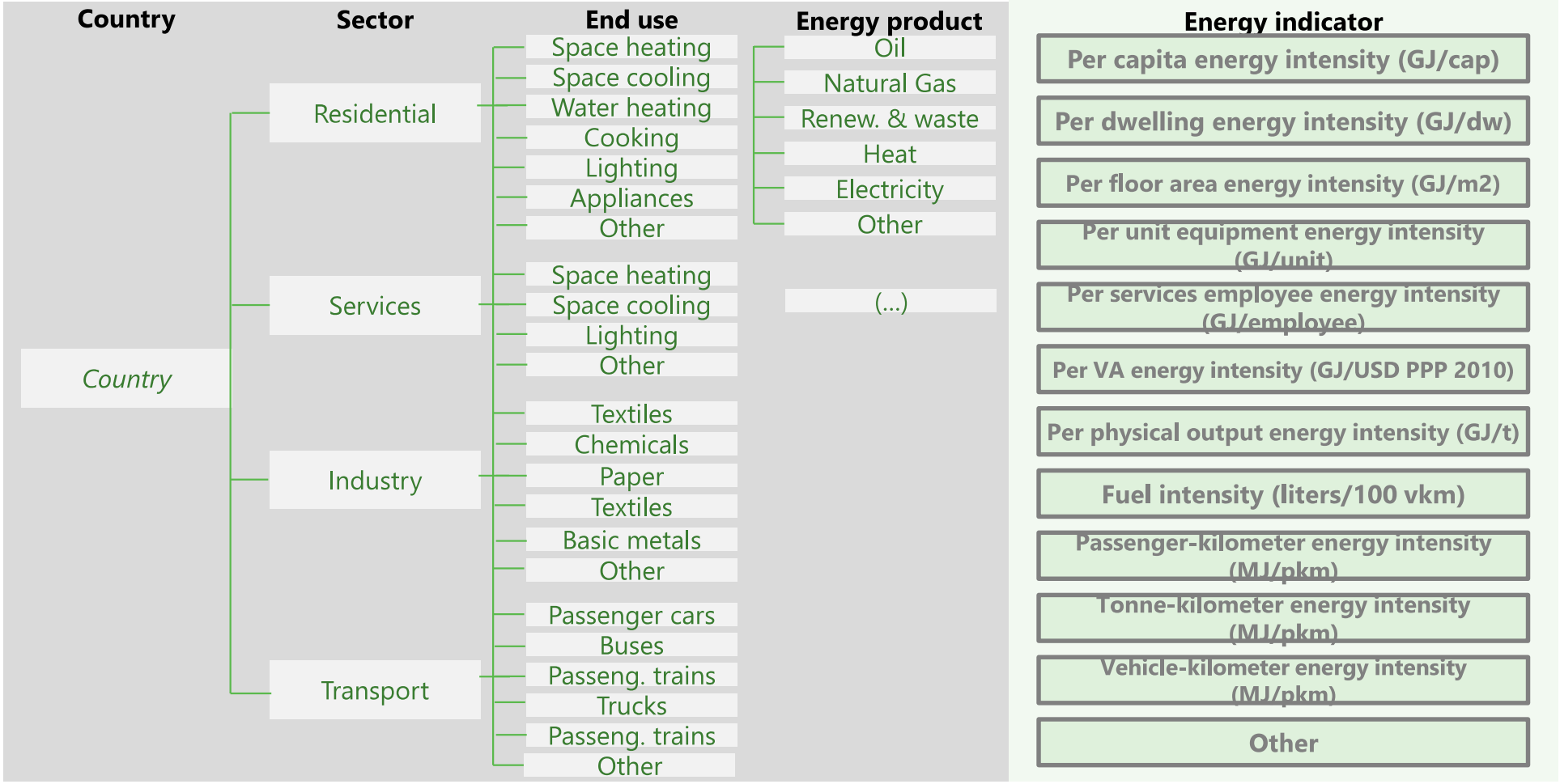
A large variety of activity data – may be collected across several institutions

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



It is important to understand what/where data are available; how to share; how to plan collection

The end-use data collected and published by the IEA



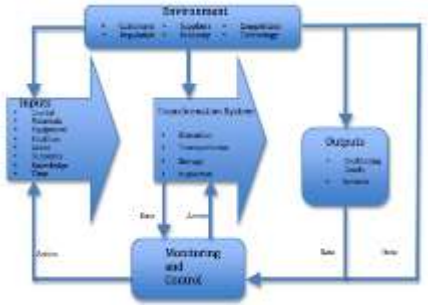
Methods used to collect data for efficiency indicators

- Administrative sources
  - before starting new data collection

- Surveys
  - representative sample
  - possibly expanding existing surveys

- Metering and measuring
  - costly but very effective for monitoring specific equipment efficiency

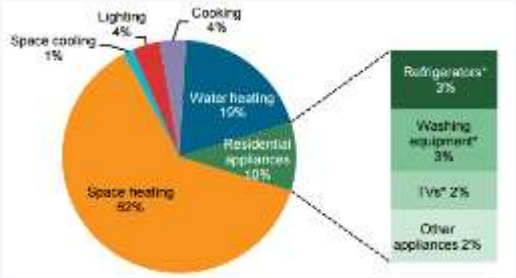
- Modelling
  - complementary to surveys or stand alone



Linking end-uses with activity data: example for residential

Energy end-use data:

- Space heating*
- Space cooling*
- Water heating
- Cooking
- Lighting
- Appliances energy consumption:
  - Refrigerator
  - Freezer
  - Dishwasher
  - Clothes washer
  - Clothes dryer
  - TV
  - Computers



Energy consumption by end-use, country B

* Temperature corrected, using HDD & CDD

Activity data:

- Population
- Number of occupied dwellings
- Residential floor area
- Appliances stock and diffusion




# of people # of dwellings Surface # of appliances

generic energy efficiency indicator = **Energy end-use** / **activity**

Example for transport sector

Energy end-use data:

- Transport segment
  - passenger
  - freight
- Transport modes
  - road,
  - rail,
  - air,
  - water,
  - etc.

Activity data

- Vehicle stocks
- Passenger-kilometers
- Tonne-kilometers

Vehicle stock

Distance travelled

Occupancy

Load

generic energy efficiency indicator = **Energy end-use** / **activity**

Understanding where energy is used: the importance of end-use data