Energy Efficiency Indicators: Fundamentals on Statistics

Roberta Quadrelli
Head - Energy Balances, Prices, Emissions, Efficiency
Energy Data Centre

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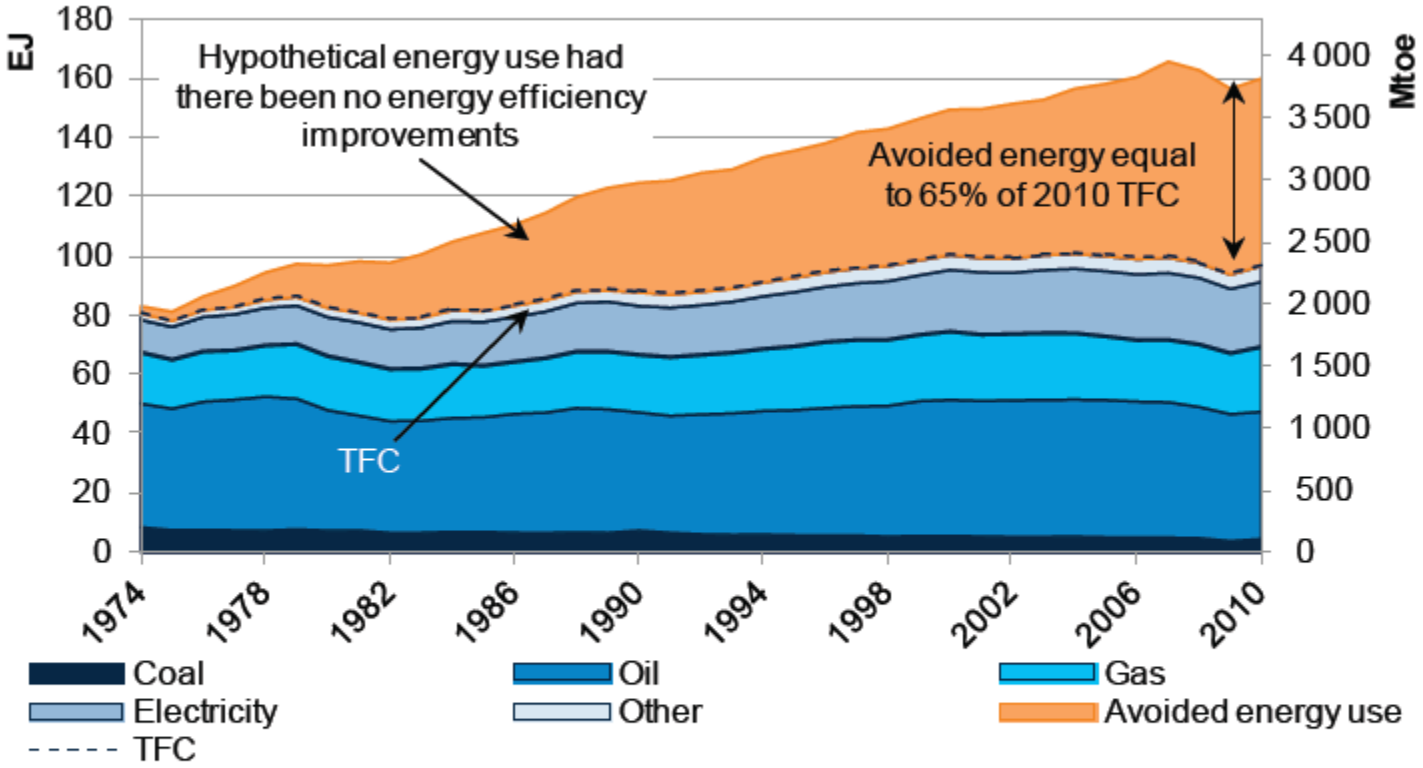
Developing energy efficiency indicators: why and how?

The huge potential of energy efficiency

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



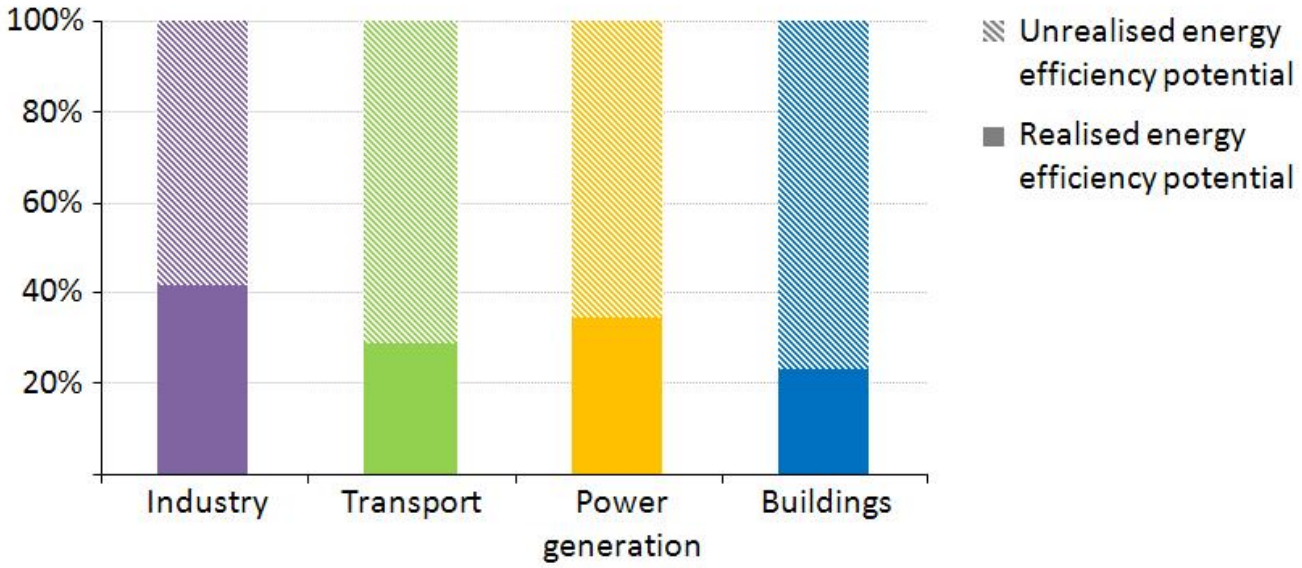
Notes: TFC = total final consumption. The 11 countries are Australia, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom and the United States, those for which sufficient data is available to undertake analysis. "Other" includes biofuels plus heat from geothermal,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

Source: IEA indicators database.

Energy efficiency: a huge opportunity going unrealised in emerging and developing countries

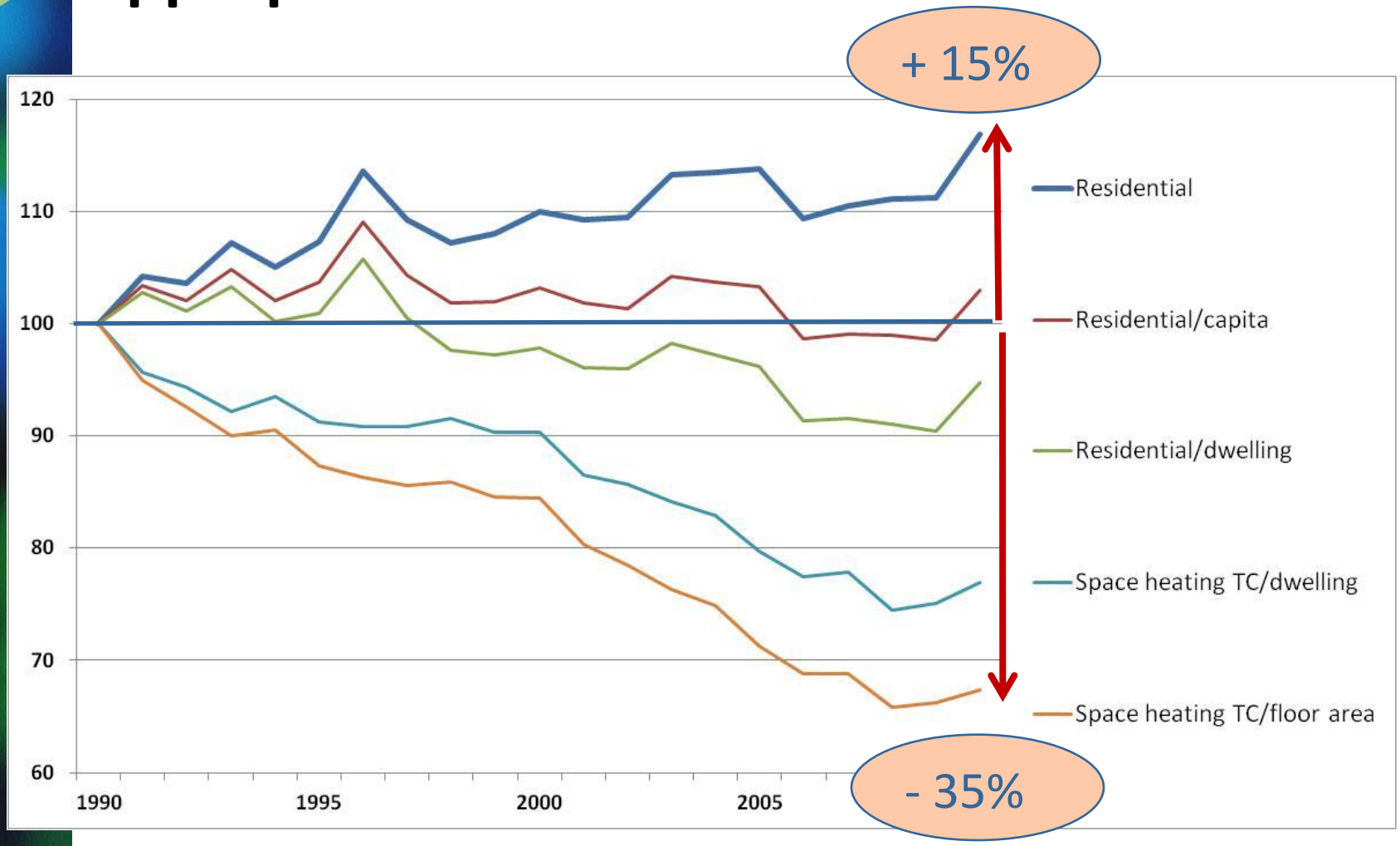
WORLD ENERGY OUTLOOK 2012

Energy efficiency potential used by sector in non-OECD countries in the New Policies Scenario



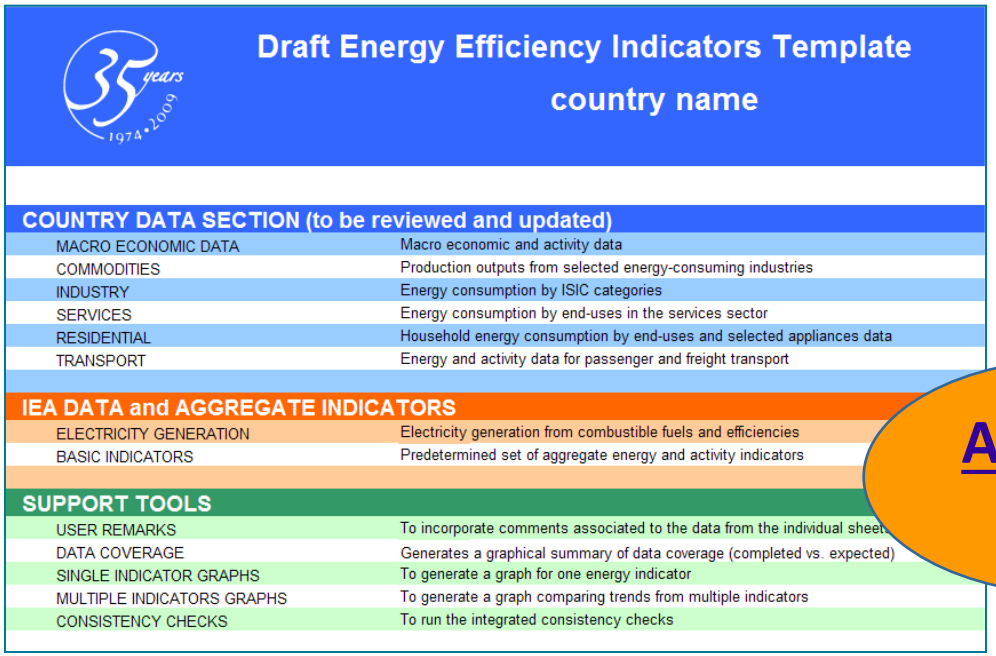
Two-thirds of the economic potential to improve energy efficiency remains untapped in the period to 2035

But what to measure?
Appropriate metrics for sound assessments



Index: 1990=1. Data for IEA18 (Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA). Source: IEA energy efficiency indicators database.
TC: Temperature Corrected.

The IEA effort towards energy efficiency monitoring: data collection



Draft Energy Efficiency Indicators Template

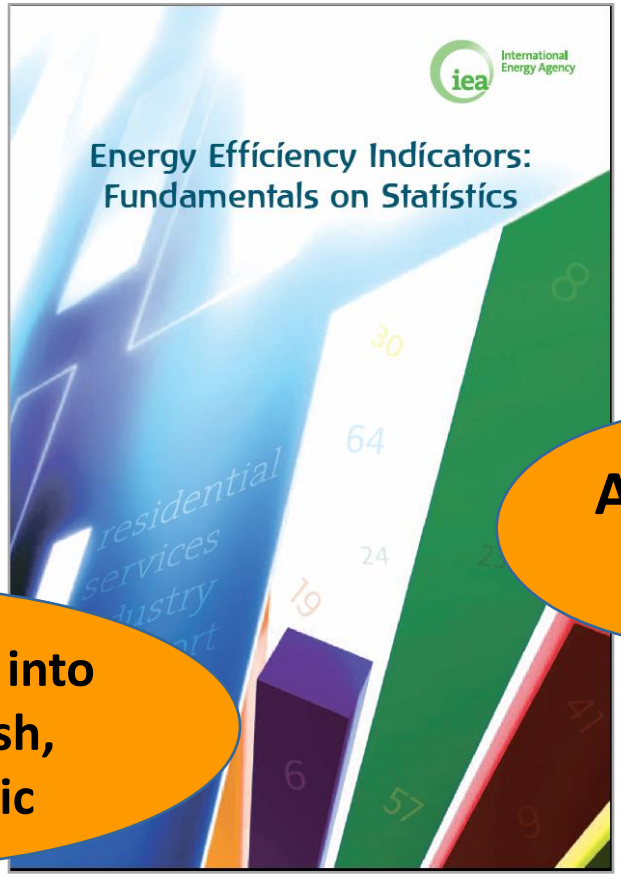
country name

COUNTRY DATA SECTION (to be reviewed and updated)	
MACRO ECONOMIC DATA	Macro economic and activity data
COMMODITIES	Production outputs from selected energy-consuming industries
INDUSTRY	Energy consumption by ISIC categories
SERVICES	Energy consumption by end-uses in the services sector
RESIDENTIAL	Household energy consumption by end-uses and selected appliances data
TRANSPORT	Energy and activity data for passenger and freight transport
IEA DATA and AGGREGATE INDICATORS	
ELECTRICITY GENERATION	Electricity generation from combustible fuels and efficiencies
BASIC INDICATORS	Predetermined set of aggregate energy and activity indicators
SUPPORT TOOLS	
USER REMARKS	To incorporate comments associated to the data from the individual sheet
DATA COVERAGE	Generates a graphical summary of data coverage (completed vs. expected)
SINGLE INDICATOR GRAPHS	To generate a graph for one energy indicator
MULTIPLE INDICATORS GRAPHS	To generate a graph comparing trends from multiple indicators
CONSISTENCY CHECKS	To run the integrated consistency checks

Available online

As an answer to a request from IEA Ministers in 2009, the IEA designed a template to collect data for energy efficiency indicators.
Now starting its fifth year of collection!

The IEA effort towards energy efficiency monitoring: methodological framework

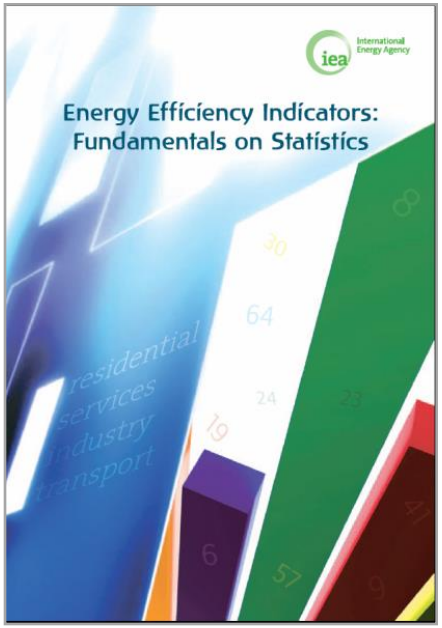


Available online

Being translated into Russian, Spanish, Chinese, Arabic

In response to requests from countries, and in parallel with a manual on indicators analysis

An overview of the statistics manual



Providing a harmonized framework for data collection across sectors and end-uses

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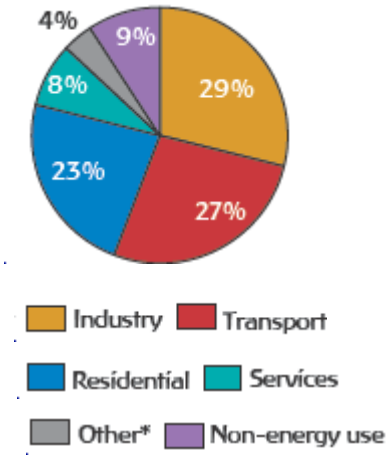
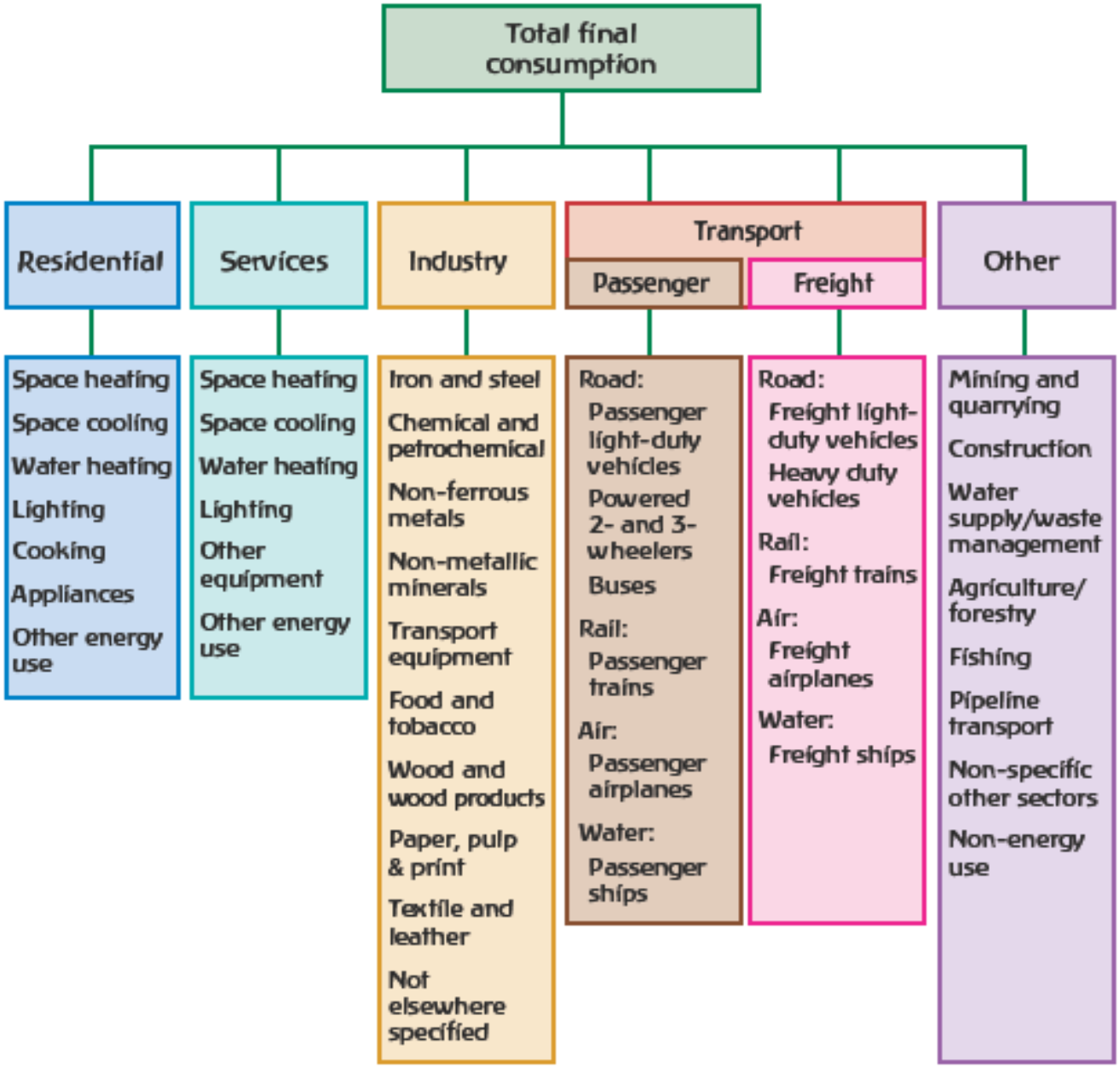
Shares of sectors in total final consumption for the world (1973 and 2011)



Understanding where energy is used



Describing all end uses for each sector

Description of sector-specific end uses:

H -Heating

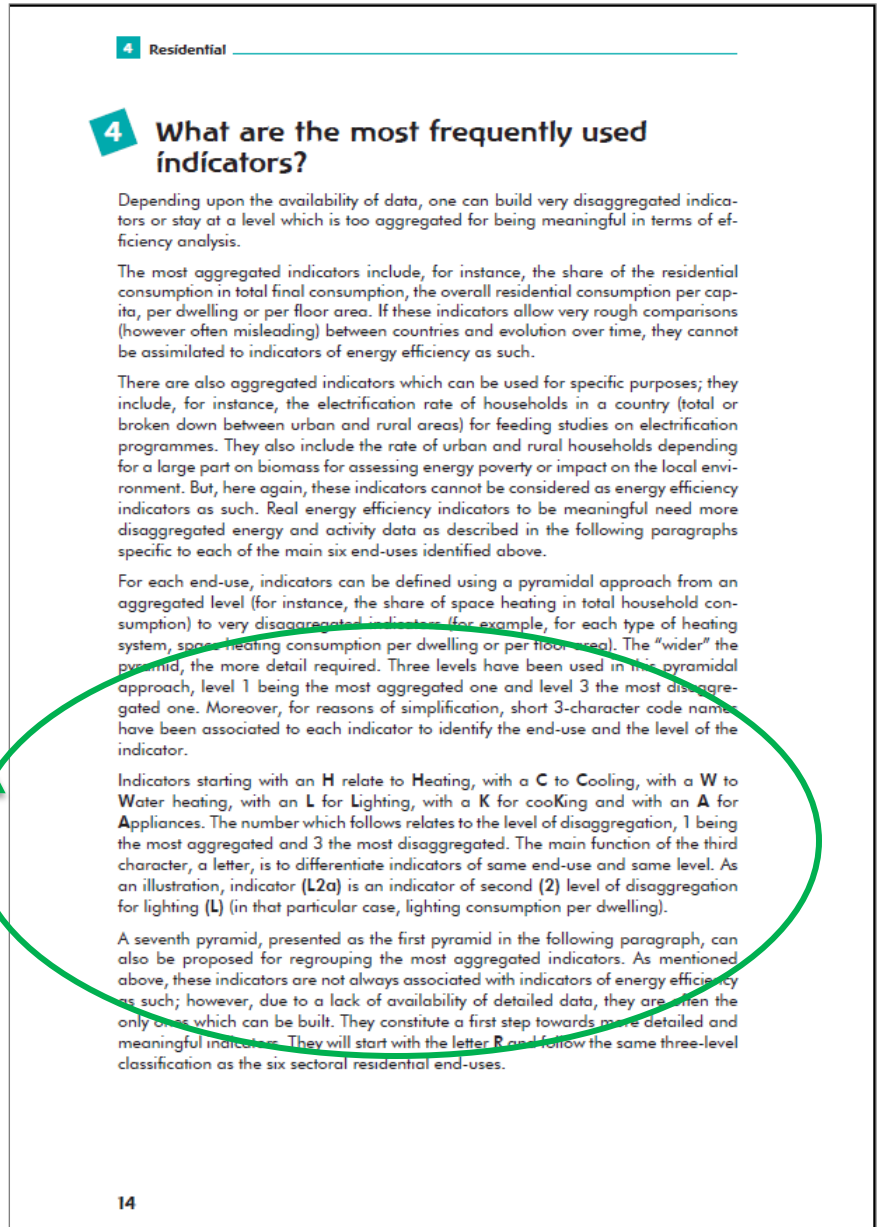
C - Cooling

W – Water Heating

L - Lighting

C - Cooking

A - Appliances



4 Residential

4 What are the most frequently used indicators?

Depending upon the availability of data, one can build very disaggregated indicators or stay at a level which is too aggregated for being meaningful in terms of efficiency analysis.

The most aggregated indicators include, for instance, the share of the residential consumption in total final consumption, the overall residential consumption per capita, per dwelling or per floor area. If these indicators allow very rough comparisons (however often misleading) between countries and evolution over time, they cannot be assimilated to indicators of energy efficiency as such.

There are also aggregated indicators which can be used for specific purposes; they include, for instance, the electrification rate of households in a country (total or broken down between urban and rural areas) for feeding studies on electrification programmes. They also include the rate of urban and rural households depending for a large part on biomass for assessing energy poverty or impact on the local environment. But, here again, these indicators cannot be considered as energy efficiency indicators as such. Real energy efficiency indicators to be meaningful need more disaggregated energy and activity data as described in the following paragraphs specific to each of the main six end-uses identified above.

For each end-use, indicators can be defined using a pyramidal approach from an aggregated level (for instance, the share of space heating in total household consumption) to very disaggregated indicators (for example, for each type of heating system, space heating consumption per dwelling or per floor area). The "wider" the pyramid, the more detail required. Three levels have been used in this pyramidal approach, level 1 being the most aggregated one and level 3 the most disaggregated one. Moreover, for reasons of simplification, short 3-character code names have been associated to each indicator to identify the end-use and the level of the indicator.

Indicators starting with an **H** relate to **H**eating, with a **C** to **C**ooling, with a **W** to **W**ater heating, with an **L** for **L**ighting, with a **K** for coo**K**ing and with an **A** for **A**ppliances. The number which follows relates to the level of disaggregation, 1 being the most aggregated and 3 the most disaggregated. The main function of the third character, a letter, is to differentiate indicators of same end-use and same level. As an illustration, indicator **(L2a)** is an indicator of second **(2)** level of disaggregation for lighting **(L)** (in that particular case, lighting consumption per dwelling).

A seventh pyramid, presented as the first pyramid in the following paragraph, can also be proposed for regrouping the most aggregated indicators. As mentioned above, these indicators are not always associated with indicators of energy efficiency as such; however, due to a lack of availability of detailed data, they are often the only ones which can be built. They constitute a first step towards more detailed and meaningful indicators. They will start with the letter **R** and follow the same three-level classification as the six sectoral residential end-uses.

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Presenting a set of indicators for each end use

For each end use:

Indicators pyramid

1 – general

2 – detailed

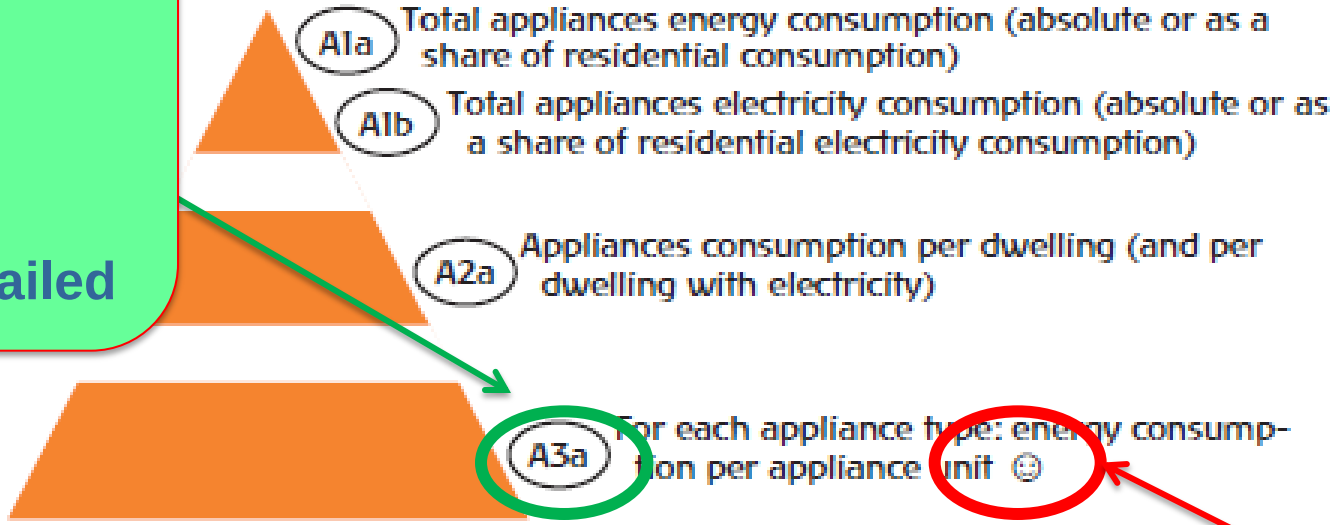
3 – very detailed

4 Residential

Appliance indicators

The top of the pyramid groups all the appliances into two indicators: the first one showing total energy use for appliances either in absolute value or in relative terms compared to total energy consumption of the residential sector (A1a); and the second one, as in the case of cooling and lighting, showing the same indicator but just for electricity since electricity is almost the only energy source used for appliances

Pyramid of residential appliances indicators



For each indicator of levels 2 and 3, the table gives the name, its coverage (overall or by specific type), the energy data and the activity data to be used. The column before the last gives the code number for the indicator and, when it applies, the last column highlights if the indicator is considered as the preferred indicator for a particular end-use.

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A smiley face indicates the recommended indicator

Summarizing energy and activity data needed

Heating

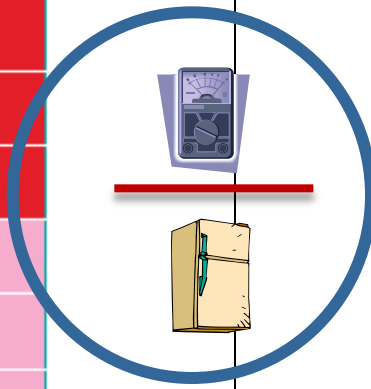
Cooling

Water heating

Lighting

Cooking

Indicator	Coverage	Energy data	Activity data	Code	Recomm. indic.
Heating consumption per floor area (idem for floor area heated)	Overall	Total heating consumption	Total floor area	H2b	☺
	By dwelling type	Heating consumption of dwellings type X	Floor area of dwellings type X	H3a	
Heating consumption per dwelling	Overall	Total heating consumption	Total number of dwellings	H2a	
	By heating system	Heating consumption of dwellings with system Y	Number of dwellings with heating system Y	H3b	
	By type of fuel	Heating consumption of dwellings with fuel Z	Number of dwellings with fuel Z	H3c	
Cooling consumption per dwelling with air conditioning (A/C)	Overall	Total cooling consumption	Total number of dwellings with A/C	C2a	
	By type of cooling equipment	Cooling consumption of dwelling with a/c system X	Number of dwellings with a/c system X	C3a	
	By energy source	Cooling consumption of dwelling on energy source Y	Number of dwellings on energy source Y	C3b	
Cooling consumption per floor area of dwellings with A/C	Overall	Total cooling consumption	Total floor area of dwellings with A/C	C2b	☺
DHW consumption per capita	Overall	Total energy consumption for domestic hot water	Total population	W2a	
DHW energy consumption per dwelling	Overall	Total energy consumption for domestic hot water	Total number of dwellings	W2b	
	By type of DHW system	DHW energy consumption produced by DHW system X	Total number of dwellings with DHW system X	W3a	
	By type of energy	DHW energy consumption	Total number of dwellings		



Systematic summary tables: indicators, energy and activity data by end-use

Describing possible sources for data

Table 7.3 • Summary of the main data needed for transport indicators and examples of possible sources and methodologies

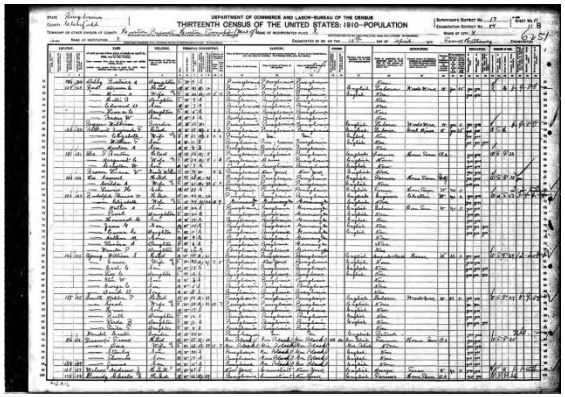
Data	Source	Methodology
Energy data		
Total transport consumption	National energy balance National energy statistics	Administrative sources Modelling
Consumption by sub-sector	National energy balance National energy statistics	Administrative sources Mobility surveys Modelling
Consumption by segment		Mobility surveys Modelling
Consumption by vehicle type		Mobility surveys Modelling
Activity data		
GDP, population	National statistics offices	Administrative sources
Vehicle-km (vkm)	Vehicle registers/ Roadworthiness testing services/ Inspecting organisations Municipalities/Transport authorities National and international databases Transport ministries	Measurements: odometer readings Measurements: road traffic count Administrative sources Mobility surveys Modelling
Passenger-km (pkm)	National and international databases Transport ministries	Administrative sources Mobility surveys
Tonne-km (tkm)	National and international databases Transport ministries	Administrative sources Mobility surveys, freight surveys

How do countries collect data?

Four main types of methods

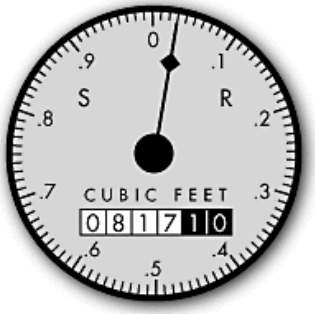
Methods used to collect data for indicators

- Administrative sources

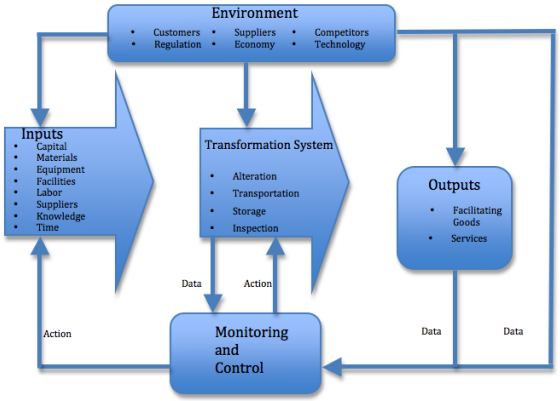


- Surveys

- Metering and measuring



- Modelling



Methods: sharing expertise from countries

160 country practices presented one by one

grouped

by sector

by methodology

Background		
Country	Austria	R/Su/01
Organisation	Statistics Austria	
Name of the survey	Household energy consumption survey	
Survey purpose	• To determine total household energy consumption • To determine household appliances energy consumption • To collect household energy expenditure • To collect dwelling physical characteristics • To collect household occupant characteristics	

Data collection			
Sample design	Stratified random sampling approach		
Sample sources	List of addresses, list of telephone numbers, labour force survey.		
Collection methods	• Computer assisted personal interview (CAPI) • Computer assisted telephone interview (CATI)		
Sample/Population size	14 000 / 3 429 720	Response rate	55%
Frequency	Every two years	Last time surveyed	2010
Time to complete survey	10 minutes	Mandatory	No
Incentive	None		
Survey respondents	Households		
Elements collected	Dwelling type, dwelling floor area, building age, household occupancy, energy-related renovations, household energy consumption and related expenditures.		
End-uses collected	Space cooling, space heating, domestic hot water, other: cooking.		

Notes and comments	
Main challenges	• Inconsistent responses • Response quality
Possible improvements	
Key best practice	A new approach to data control compared with previous surveys was taken for the first time in 2004 and continued in the follow-up survey runs. Up to and including the 2000 survey, only the individual energy sources themselves were checked for plausibility, any missing data were calculated (quantity-value pairs) and substitutions were made if necessary. Such routines of course continue to be used, with the additional step that the total of the reported energy consumption is then related to a calculated (fictitious) overall consumption. This fictitious overall consumption by the household is calculated from the data for that household, on the one hand (floor space, number of people in household) and pre-set parameters for the individual types of use (space heating, water heating, cooking, other purposes), on the other hand. Calculating the total reported energy consumption per household in this way involves some quite complicated plausibility routines, because one or more alternative quantities have to be calculated if the quantity-value pairs do not match and these alternative quantities then, when variably applied, lead to a number of different calculated overall energy consumption figures. The fictitious standard value is then used to select the quantity-value pairs that appear most probable.
Other documentation	Available: Surveying Methodology and Questionnaire

Background

Institution

Purpose …

Technical information:

Sample

Frequency

Data collected…

Comments:

Challenges

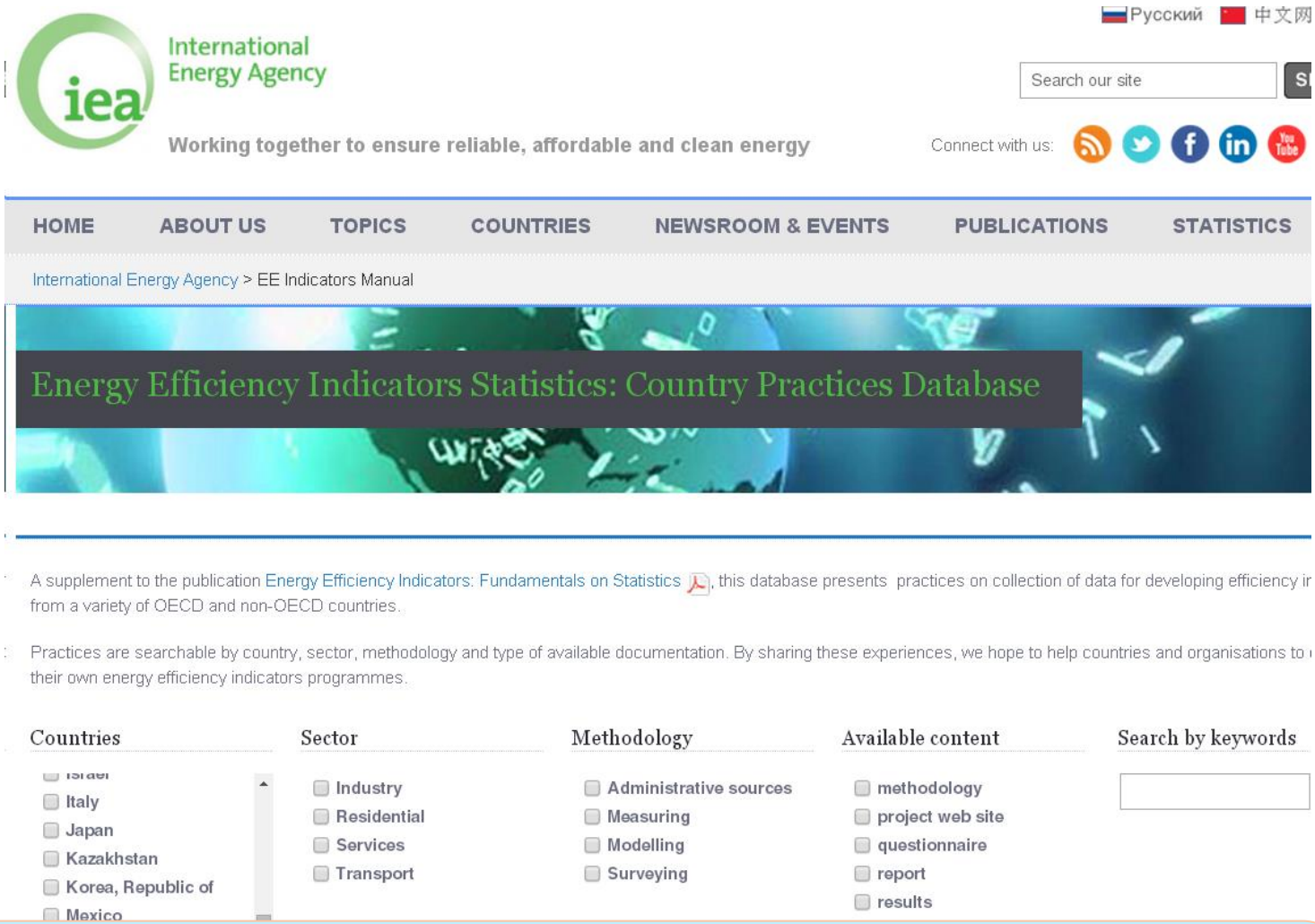
Tips

Documents

Links…

(e.version)

How are countries collecting data?

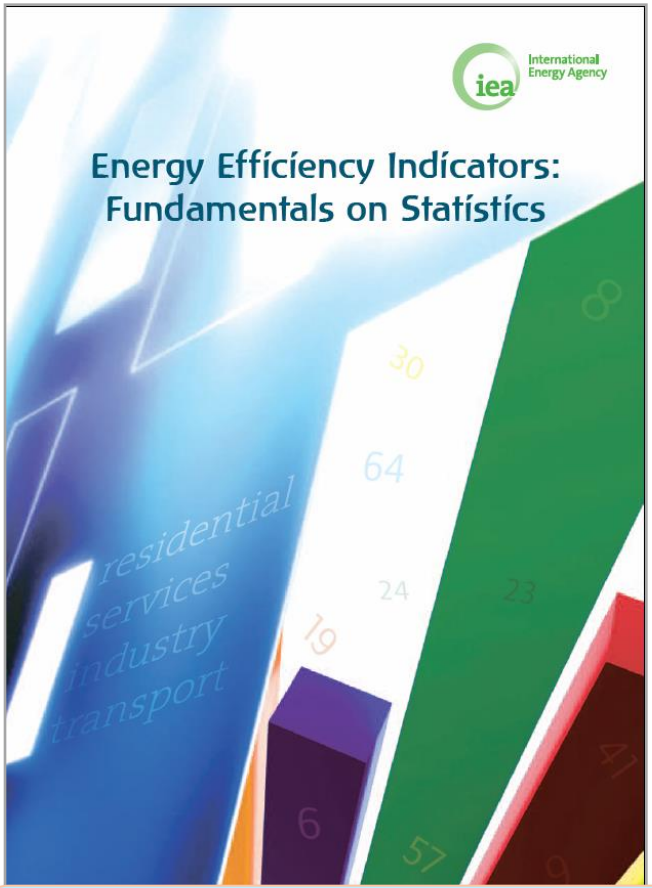


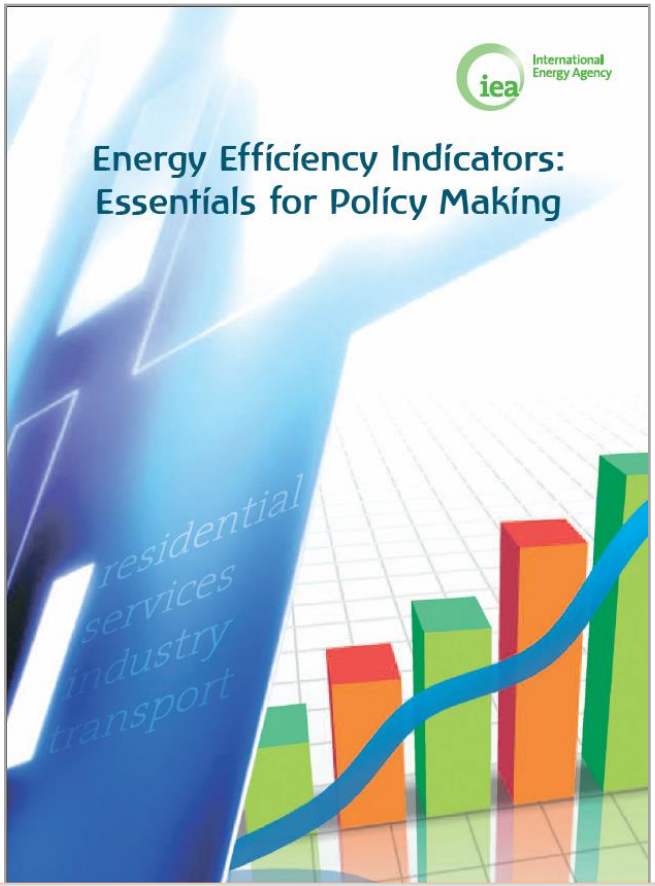
A platform to share expertise worldwide: practices are available in a searchable database. Share your practice!

A few concluding remarks

- A consistent methodological framework to monitor efficiency across sectors and end uses
- Varying levels of information detail across sectors depending on country-specific priorities, policy needs, data availability, …
- A global community of experts and a database of practices used across countries in support of developing programmes

From data to analysis: Essentials for Policy Making





Policy, analysis and monitoring: together to ensure successful implementation

Thank you

Energyindicators@iea.org