The IEA work on data and methodologies for Energy Efficiency Indicators

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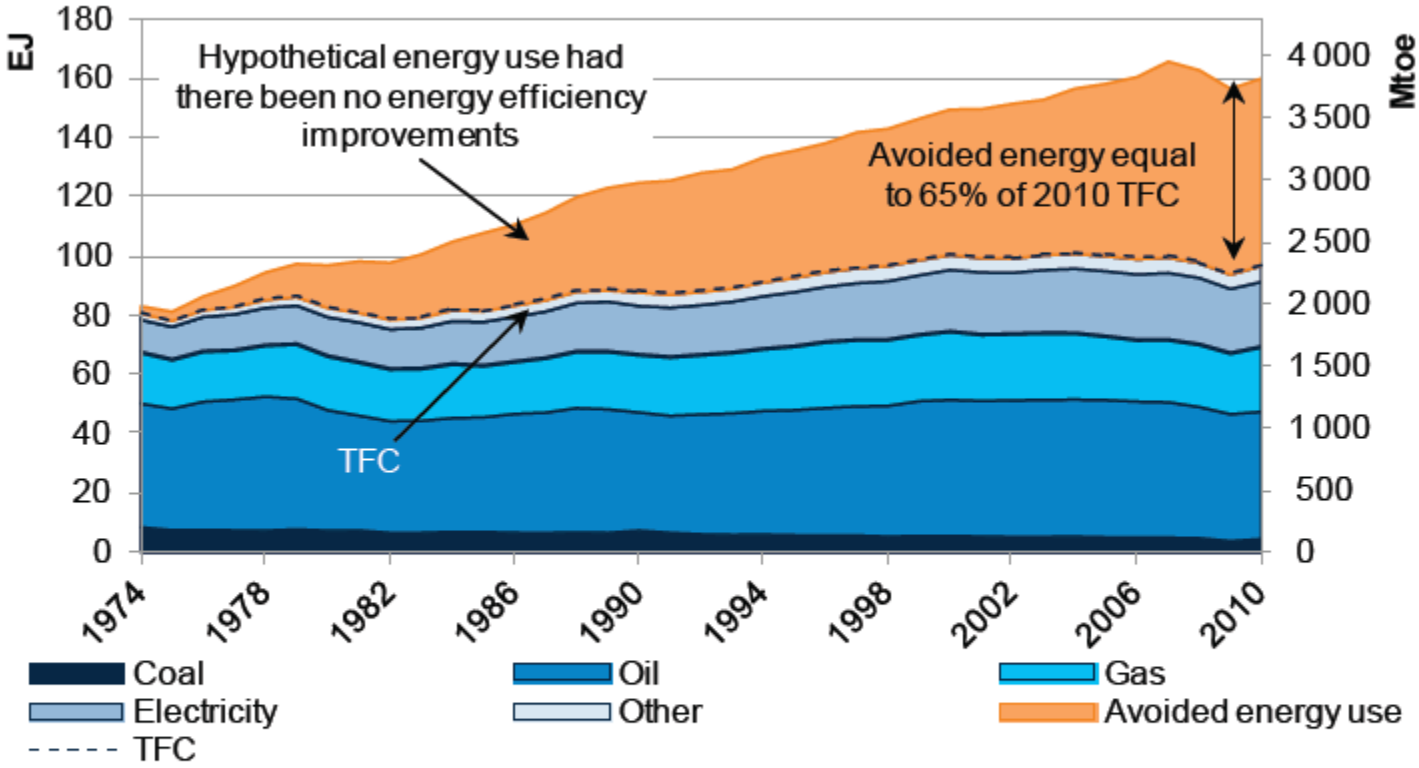
IEA

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.

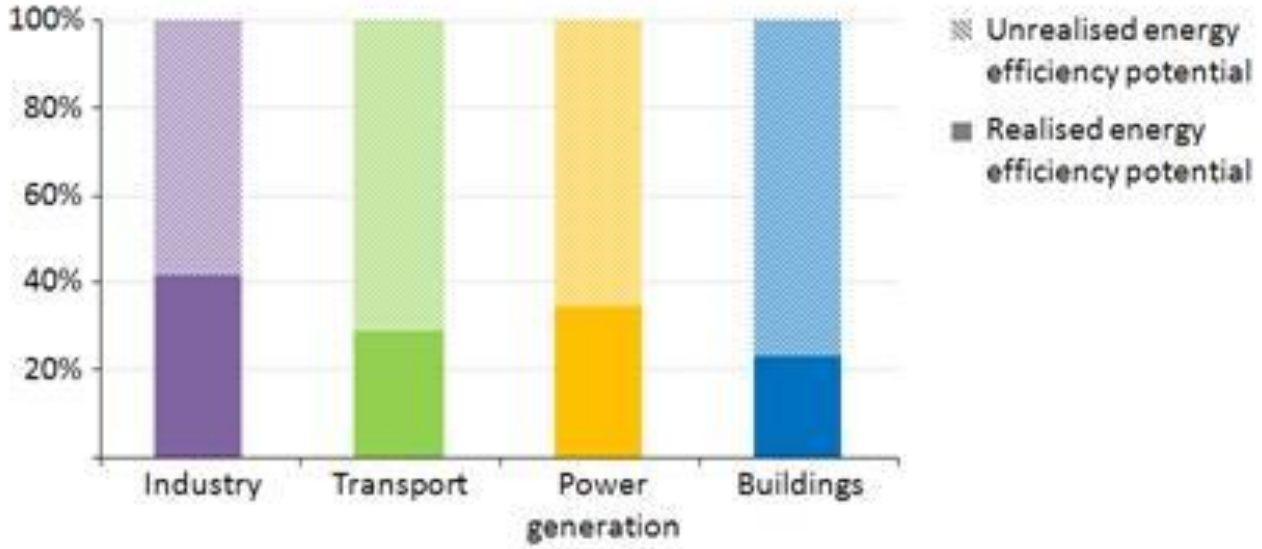
Source: IEA indicators database.

IEA Energy Efficiency Market Report 2013

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

WORLD ENERGY OUTLOO 201

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

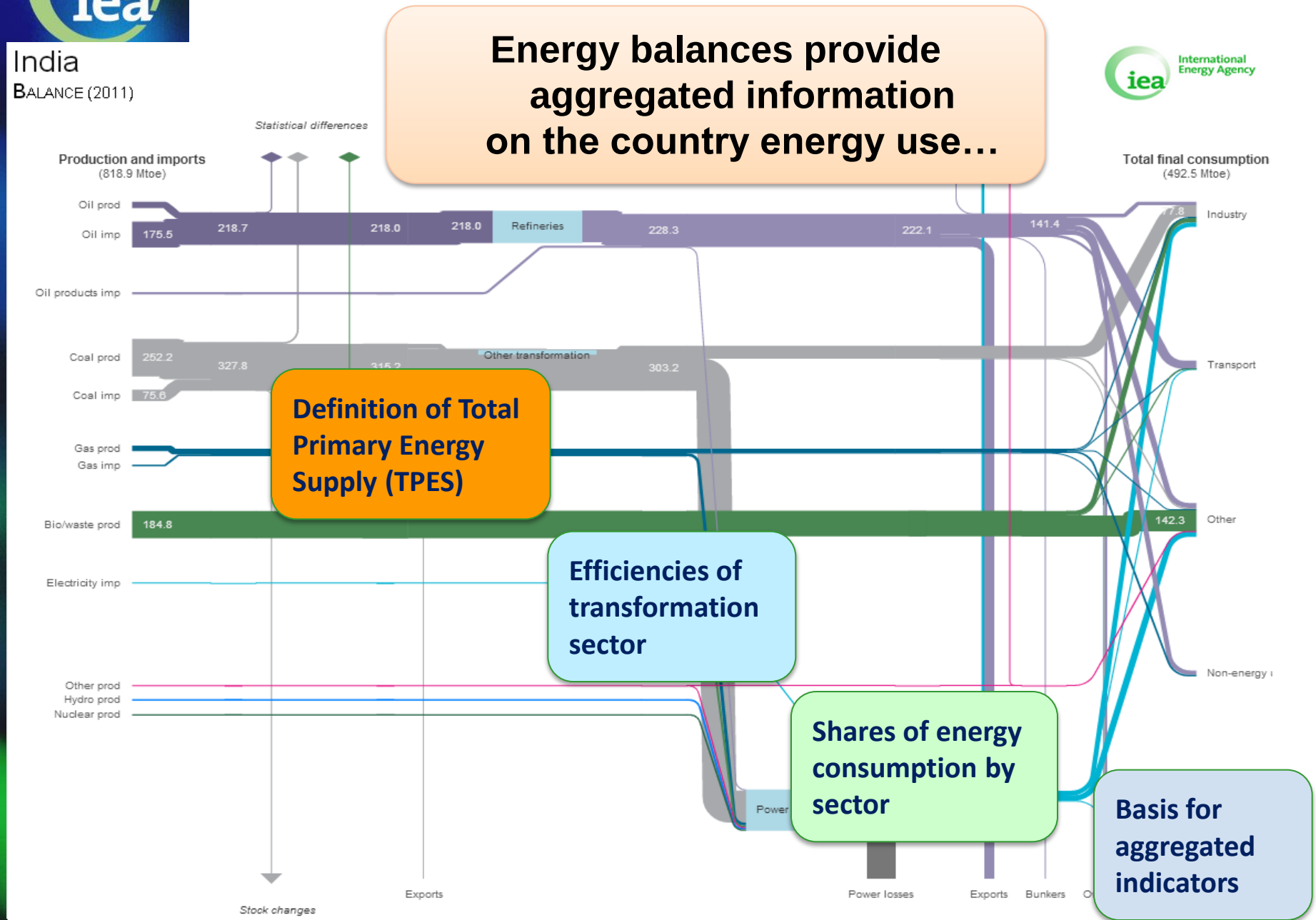
…but what do we mean by energy efficiency?

"…Using less energy to provide the same service…"

So, how can we monitor energy efficiency?

A starting point: how can energy balances help us?

Energy balances provide aggregated information on the country energy use…



Definition of Total Primary Energy Supply (TPES)

Efficiencies of transformation sector

Shares of energy consumption by sector

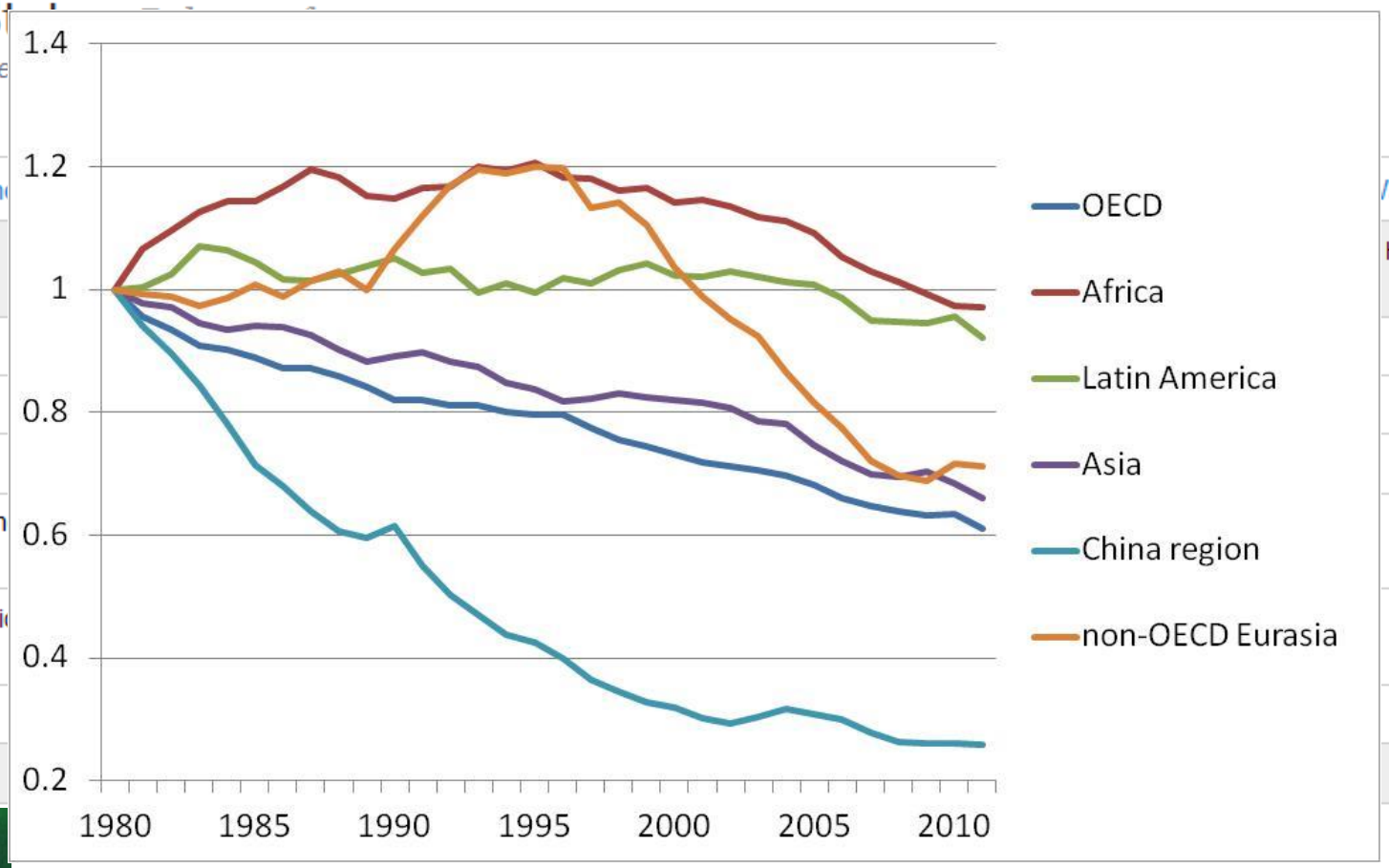
Basis for aggregated indicators

Aggregated indicators: energy intensity

United St
in thousand tonne

2011

	Heat	Total*
Production	0	1784773
Imports	0	701422
Exports	0	-243803
International marin bunkers**	0	-26389
International aviati bunkers**	0	-21839
Stock changes	0	
TPES	**0**	**2191193**



Energy intensity of the economy: TPES/GDP
Driven by many factors… not only energy efficiency

Russian Federation: Balances for 2011

in thousand tonnes of oil equivalent (kt

2011 ▼ | Indicators | Balanc

	Coal and peat										
Production	180042										
Imports	16334										
Exports	-80572	-24									
International marine bunkers**	0	0	-2990	0	0	0	0	0	0	0	-2990
International aviation bunkers**	0	0	-6426	0	0	0	0	0	0	0	-6426
Stock changes	131	511	-522	-2797	0	0	0	-3	0	0	-2680
TPES	**115935**	**267031**	**-108508**	**391213**	**45439**	**14263**	**449**	**7088**	**-1940**	**0**	**730970**
Transfers	0							0	0	0	0
ferences	-4096							0	0	0	-4097
	0							0	29803	0	-32935
	-59005							-1931	60755	69711	-106303
	-14126							-2562	0	82677	-9025
	0							0	0	0	0
	0							0	0	0	-8801
on	-20795							0	0	0	-20795
ts	0							0	0	0	0
ion	0							0	0	0	-1728
wn	-2225	-134	-11383	-3732	0	0	0	-146	-16909	-18870	-60059
	0	-4723	0	-4931							-28656
Total final consumption	**15689**	**97**	**116161**	**137951**							**458571**
Industry	**11351**	**65**	**10119**	**31214**							**128113**
Transport	**0**	**0**	**59346**	**31296**							**98413**
Other	**4038**	**32**	**13050**	**42708**							**165366**
Residential	1553	0	5768	39692							117516
Commercial and public services	2416	0	2507	2485							35879
Agriculture / forestry	64	14	3978	526							11111
Fishing	6	0	796	5							841

….However, balances do not provide enough information to monitor energy efficiency

Residential:
No breakdown by end use
- space heating
- space cooling
- water heating
- lighting
- cooking
- appliances

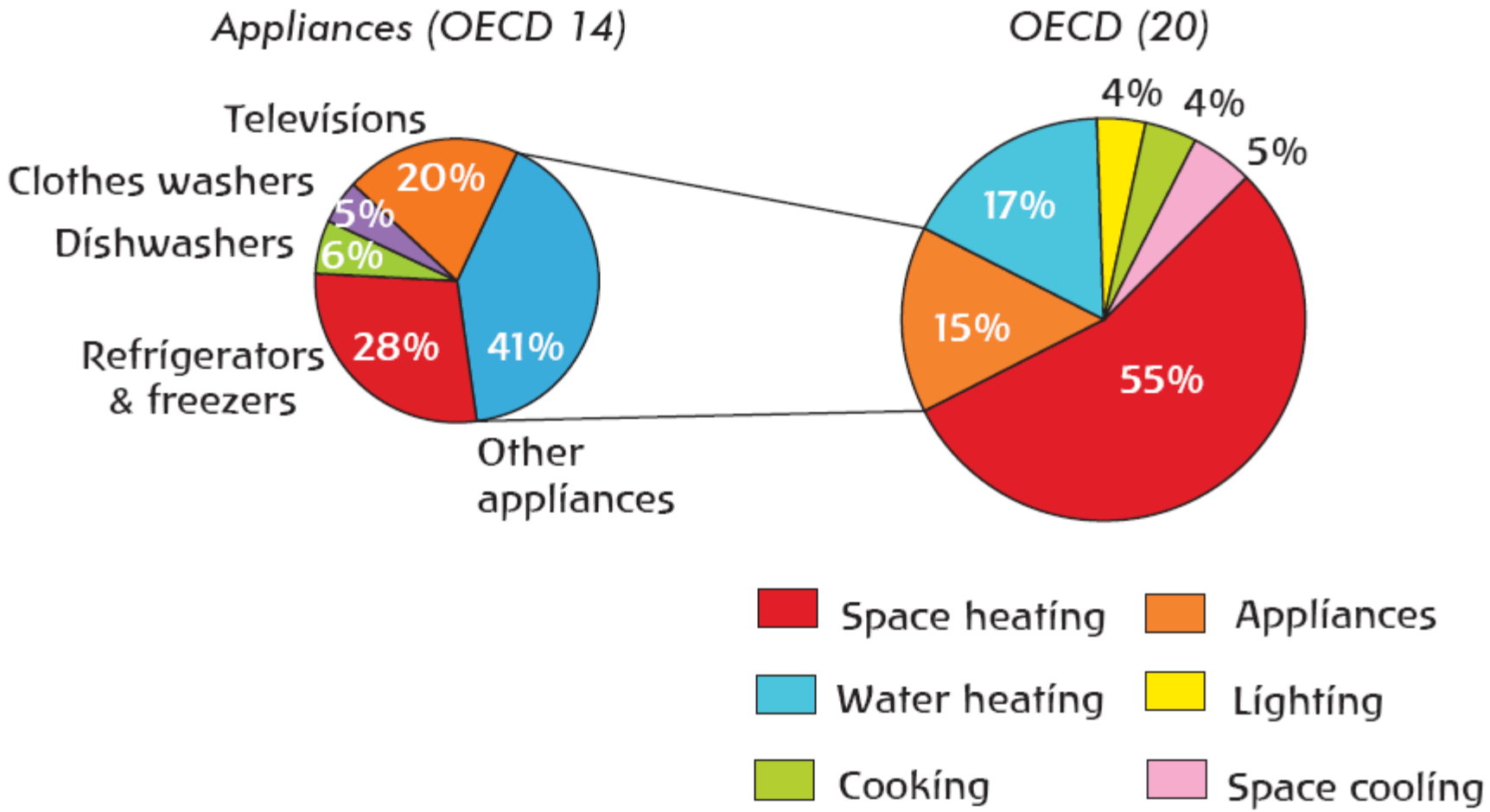
Transport:
No breakdown by segment
- passenger / freight

nor by vehicle type
- Light duty vehicles / trucks, ….

Services:
No breakdown by end use
- space heating
- space cooling
- water heating
- lighting
- other equipment

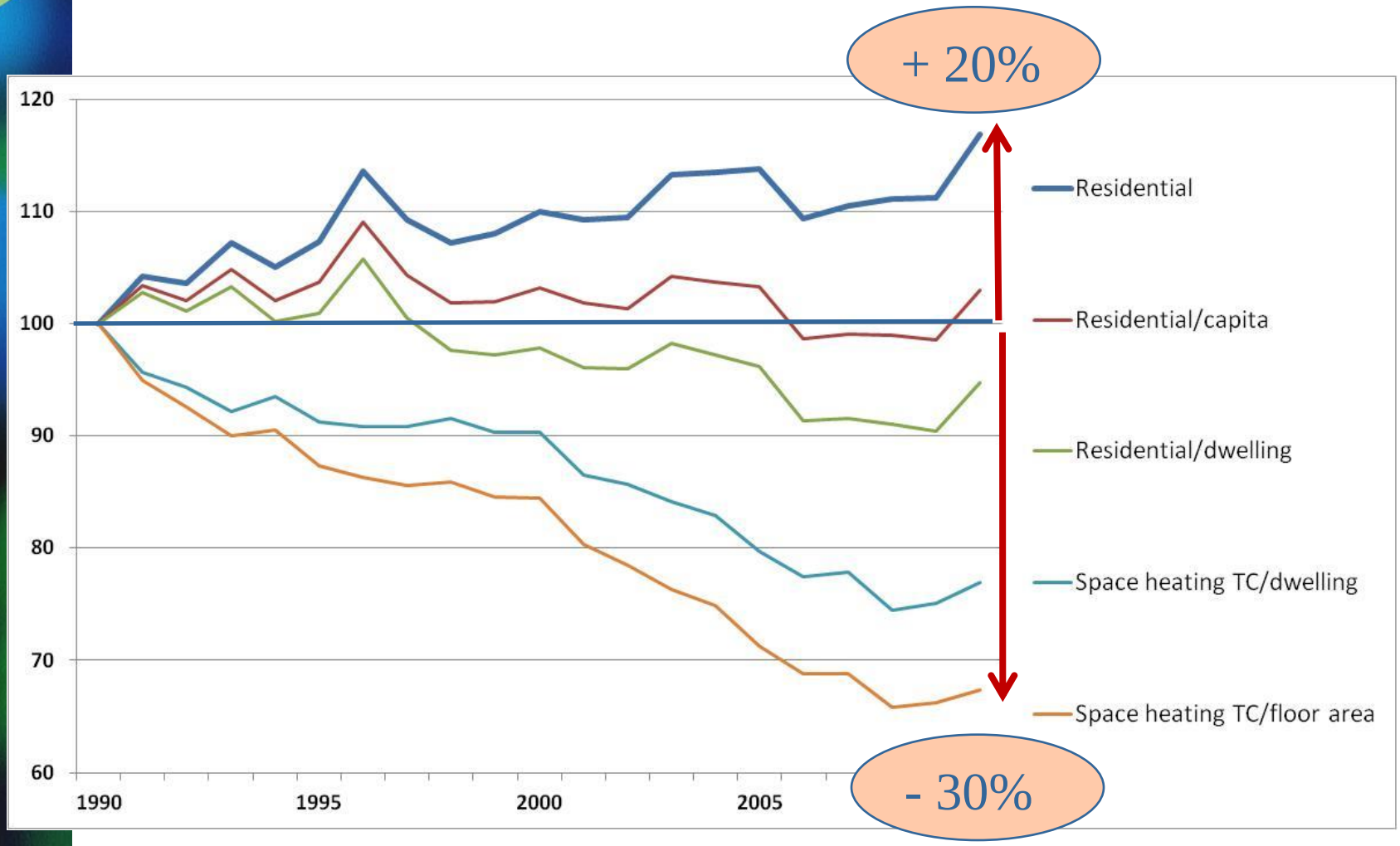
Different end-uses drive sectoral consumption

Figure 4.4 • Breakdown of residential consumption by end use in 2010 for 20 selected OECD countries



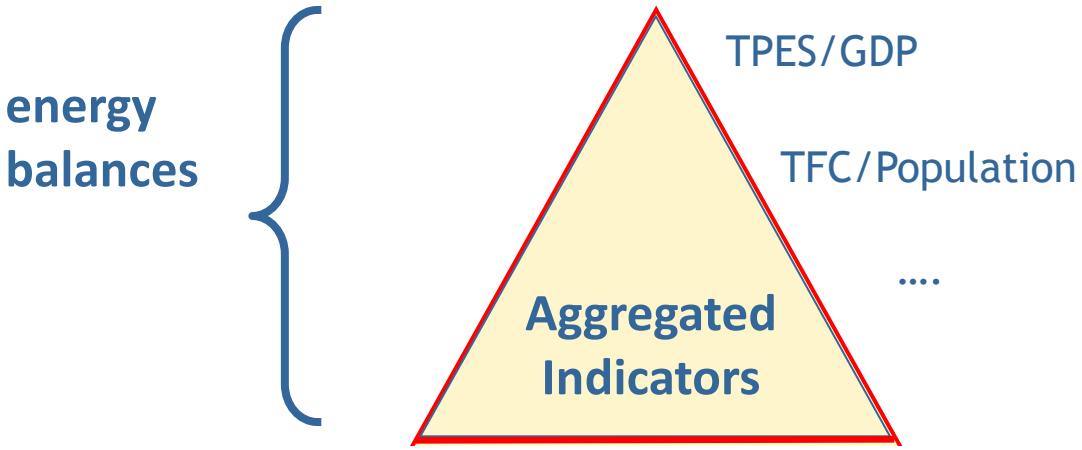
Note: The breakdown into individual appliances is available only for 14 countries.

Choosing appropriate metrics to convey sharp messages

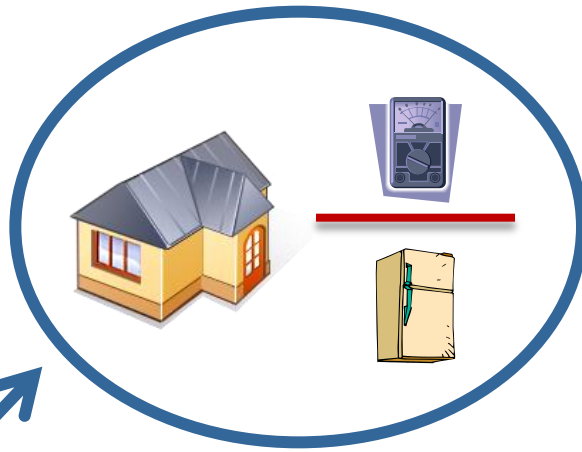


Index: 1990=1. Data for IEA18 (Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA). Source: IEA energy efficiency indicators database.
TC: Temperature Corrected.

The need to collect more disaggregated data

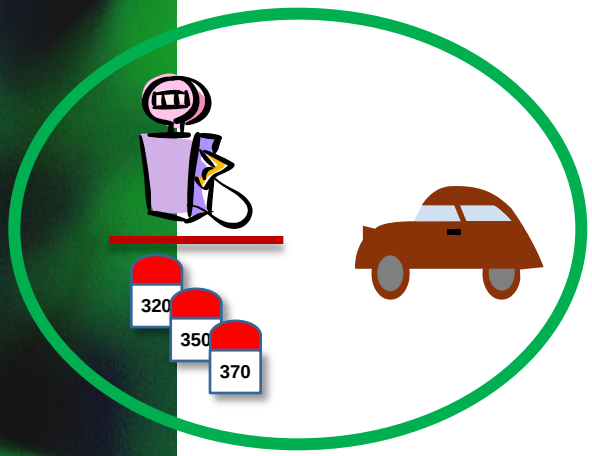


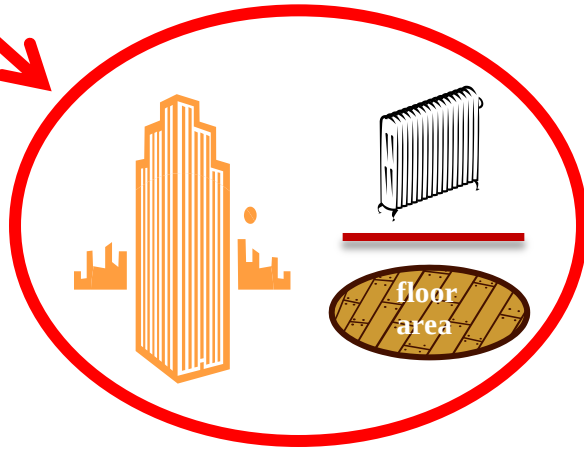
What data for what indicators?



Energy

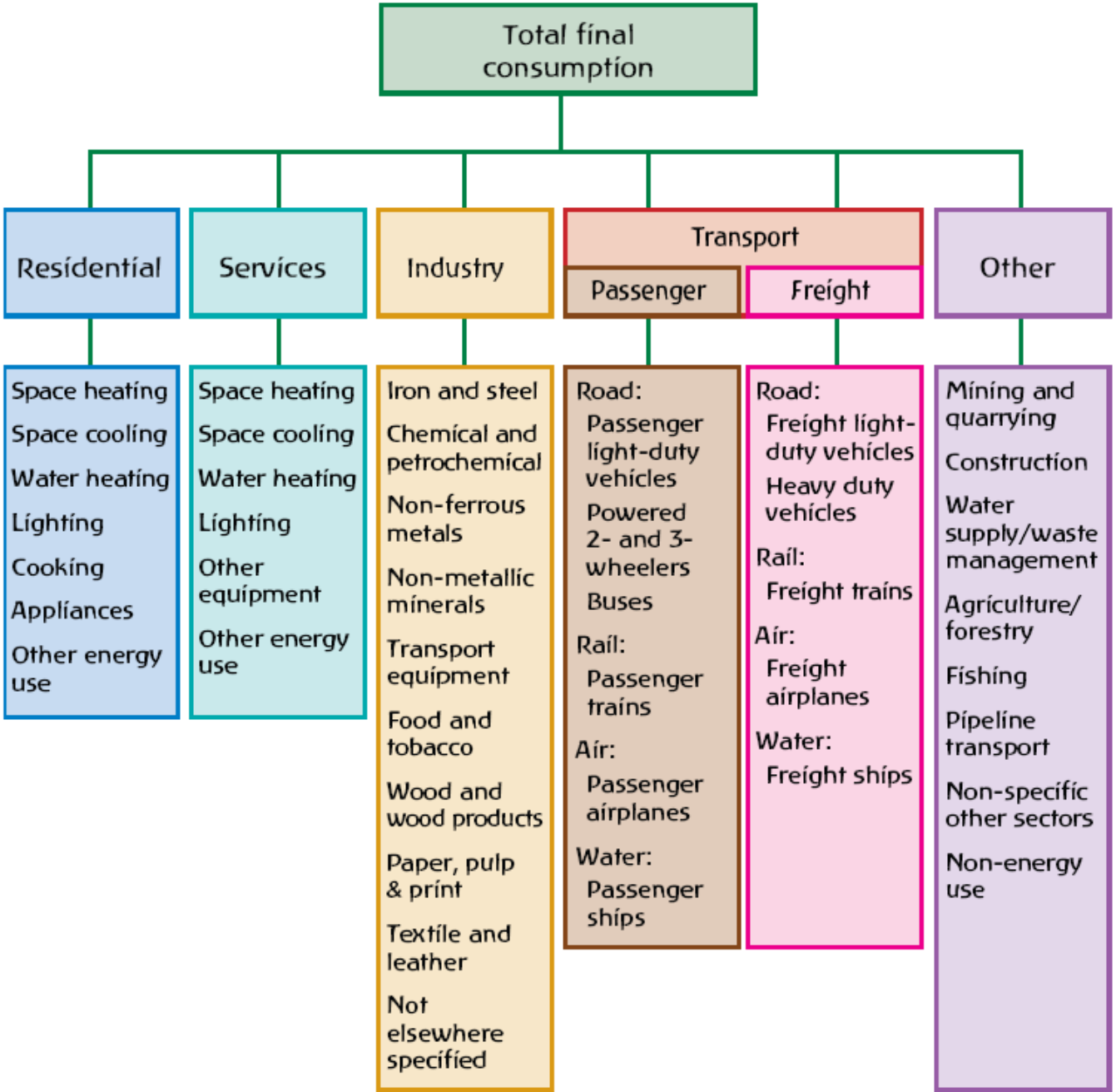
Activity



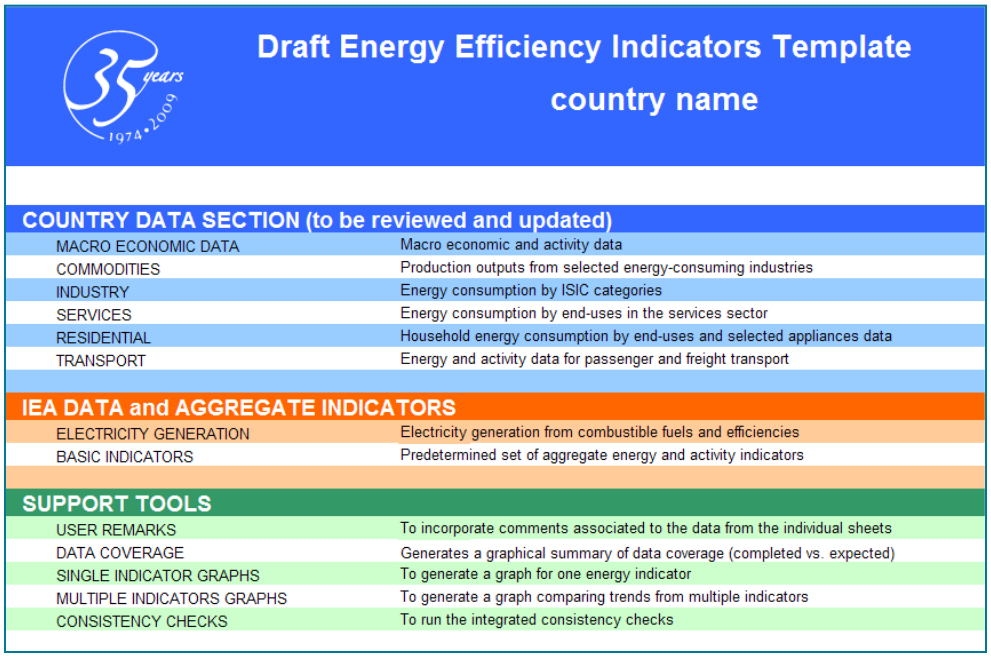


Not only energy data, but also activity data are necessary.

What detail do we need across consumption sectors?



The IEA effort towards energy efficiency monitoring: data collection



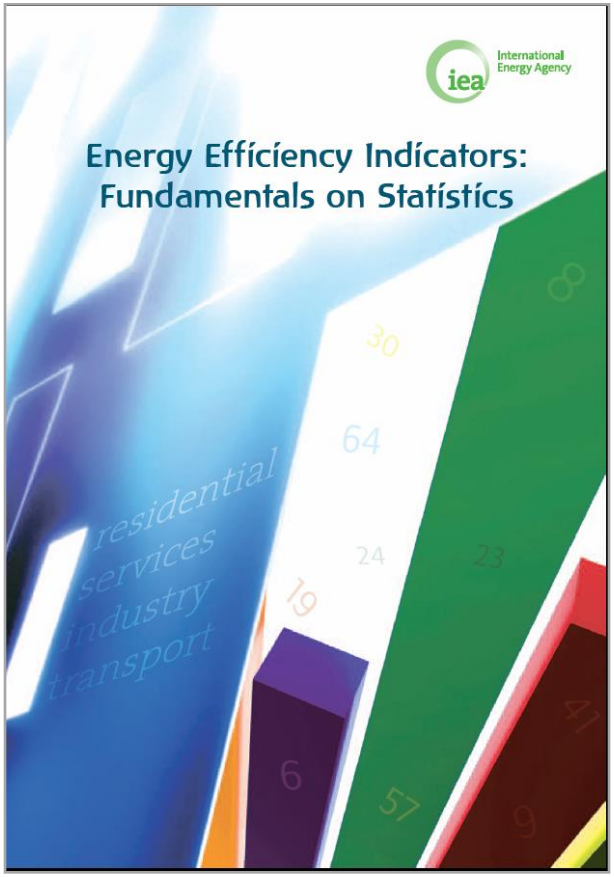
Draft Energy Efficiency Indicators Template

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 sheets
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

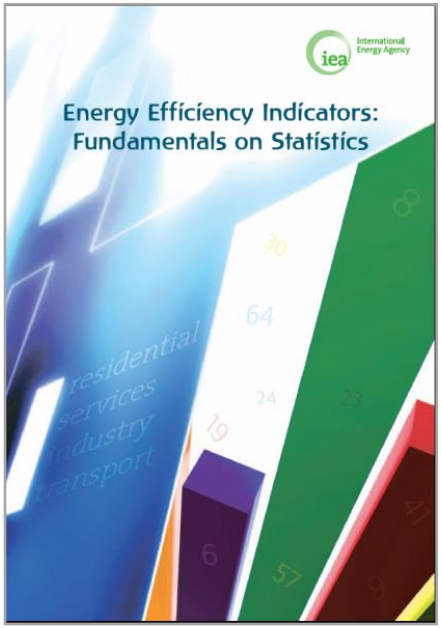
As an answer to a request from IEA Ministers in 2009, the IEA designed a template to collect data for energy efficiency indicators

The IEA effort towards energy efficiency monitoring: methodological framework



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

An overview of the statistics manual

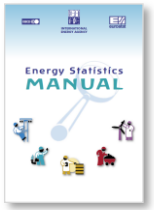


Fundamentals on Statistics: Table of Contents

Focus on four sectors and their end uses

A user-friendly format

Same approach as for the *Energy Statistics Manual*



Questions and Answers

Collecting What and How for the Residential Sector

1 What does the residential sector mean and cover?

According to the United Nations International Recommendations on Energy Statistics (IRES), a household is defined as: "a group of persons who share the same living accommodation, who pool some, or all, of their income and wealth and who consume certain types of goods and services collectively, mainly housing and food." The residential sector, also known as the households sector, is therefore, a collective pool of all the households in a country.

More concretely in terms of energy consumption, the residential sector includes all energy-using activities (*i.e.* heating, cooking, appliances, etc.) related to a private dwelling where one or more persons reside. A wide range of dwellings would qualify ranging from a modern multi-storied apartment building in the centre of a megalopolis to a nomad tent in the middle of the desert.

It is important to note that the energy consumption associated with personal transport related to households should be reported in the transport sector. Therefore, daily commuting to and from work or to any other place in personal vehicles or in public transport should be captured under the transport sector and not in the residential sector.

Questions and Answers:

Q1. Is there a difference between dwellings and households?

Something to be added on the difference between dwellings and households since we often use one or the other in the text.

Q2. What should be included in "total dwellings"?

Total dwellings: *Includes all dwellings in the residential sector: primary and secondary residences, regardless if they are occupied or not. However, dwellings under construction are excluded.*

Total occupied dwellings: *Only primary residences are covered; unoccupied dwellings and secondary residences such as vacation homes and country houses are excluded.*

1

Each topic is introduced by a clear question

Describing all end uses for each sector

Description of sector-specific end uses:

H -Heating

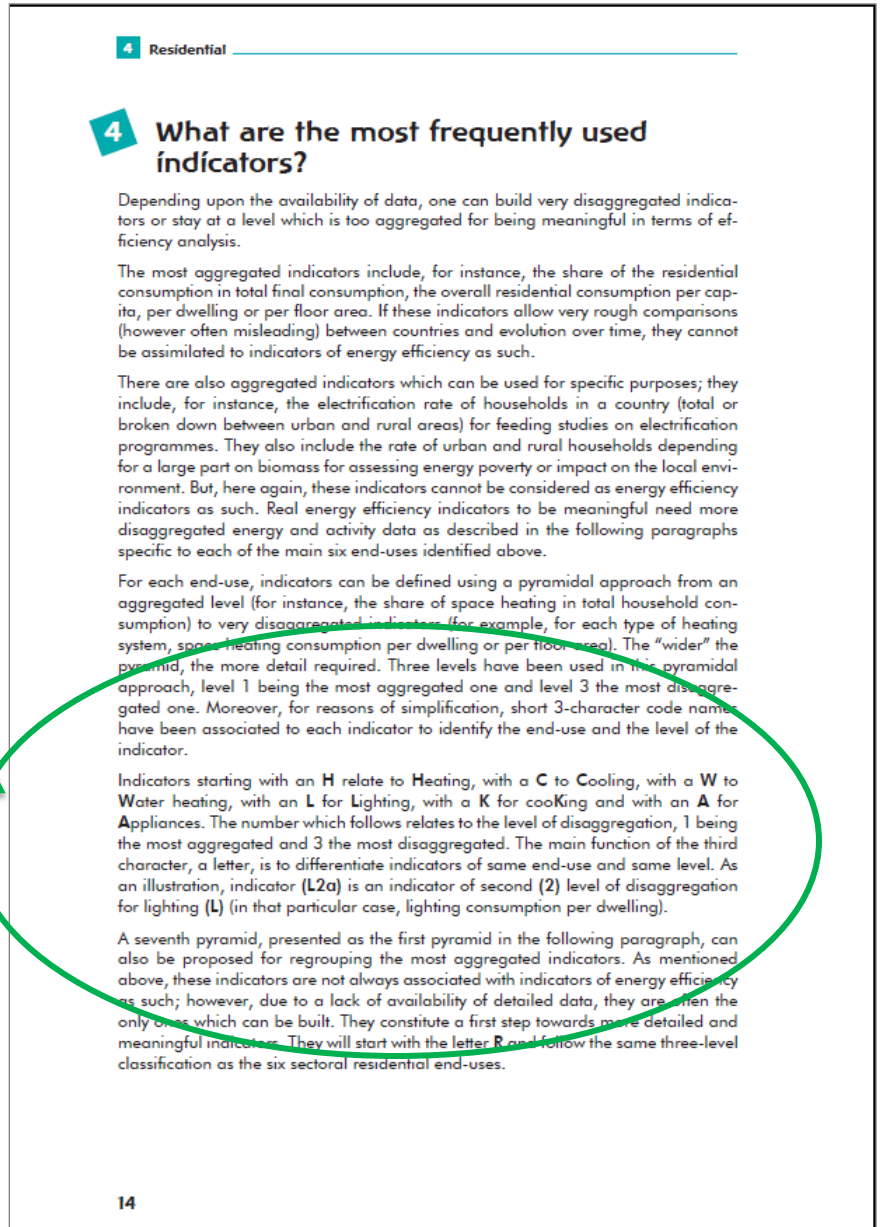
C - Cooling

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

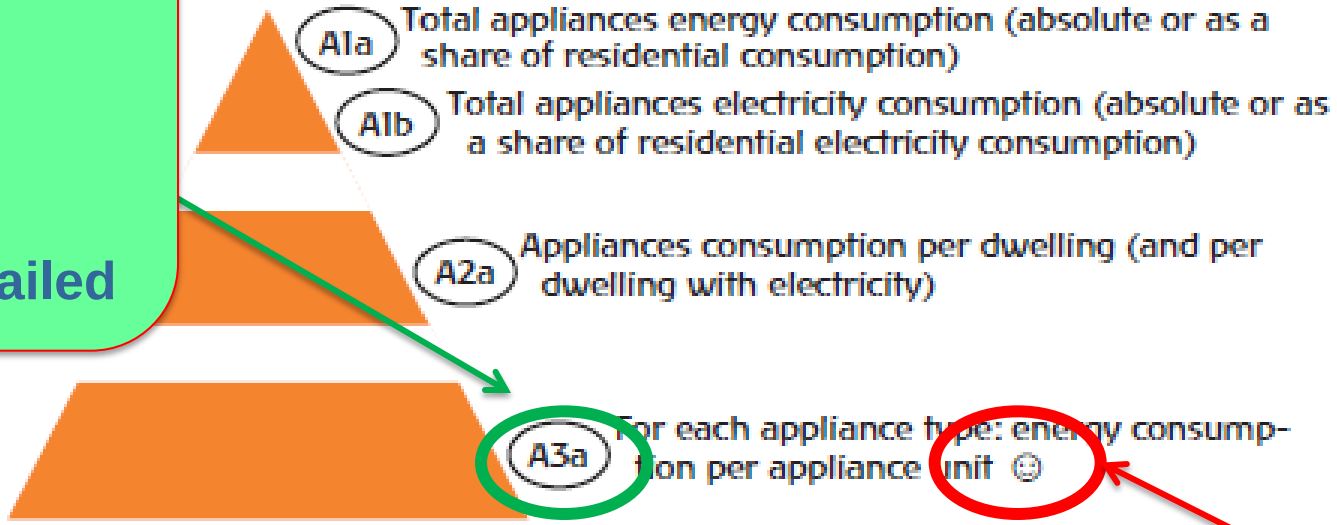
3 – very detailed

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

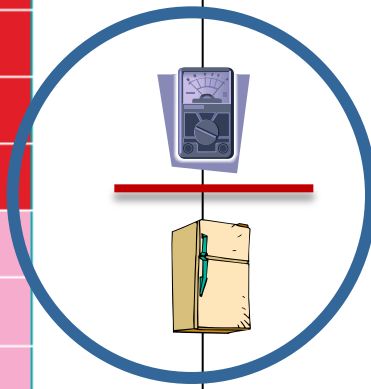
Cooling

Water heating

Lighting

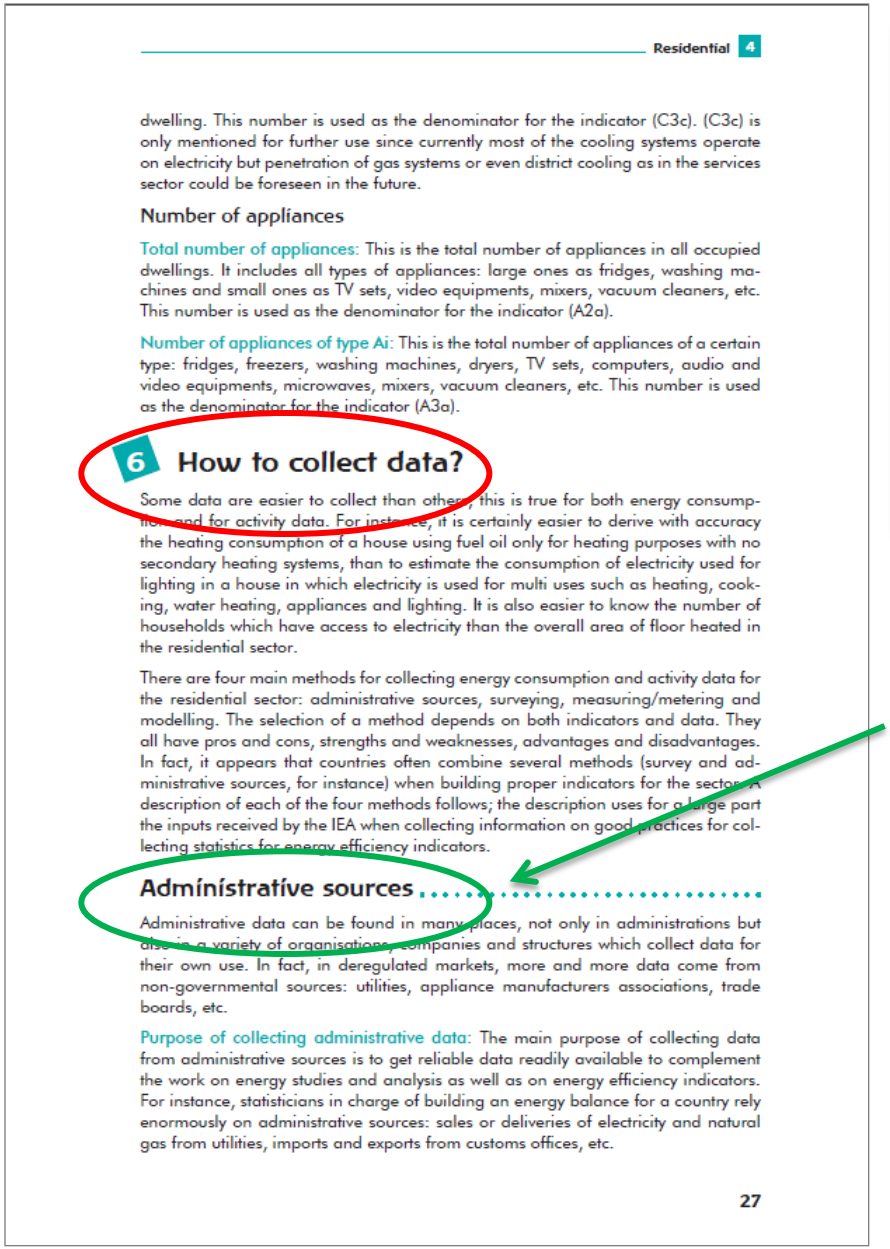
Cooking

Indicator	Coverage	Energy data	Activity data	Code	Recommend indicator
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 source	DHW energy consumption produced on energy source Z	Total number of dwellings with DHW source Z	W3b	



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

Describing data collection methodologies



Residential 4

dwelling. This number is used as the denominator for the indicator (C3c). (C3c) is only mentioned for further use since currently most of the cooling systems operate on electricity but penetration of gas systems or even district cooling as in the services sector could be foreseen in the future.

Number of appliances

Total number of appliances: This is the total number of appliances in all occupied dwellings. It includes all types of appliances: large ones as fridges, washing machines and small ones as TV sets, video equipments, mixers, vacuum cleaners, etc. This number is used as the denominator for the indicator (A2a).

Number of appliances of type Ai: This is the total number of appliances of a certain type: fridges, freezers, washing machines, dryers, TV sets, computers, audio and video equipments, microwaves, mixers, vacuum cleaners, etc. This number is used as the denominator for the indicator (A3a).

6 How to collect data?

Some data are easier to collect than others; this is true for both energy consumption and for activity data. For instance, it is certainly easier to derive with accuracy the heating consumption of a house using fuel oil only for heating purposes with no secondary heating systems, than to estimate the consumption of electricity used for lighting in a house in which electricity is used for multi uses such as heating, cooking, water heating, appliances and lighting. It is also easier to know the number of households which have access to electricity than the overall area of floor heated in the residential sector.

There are four main methods for collecting energy consumption and activity data for the residential sector: administrative sources, surveying, measuring/metering and modelling. The selection of a method depends on both indicators and data. They all have pros and cons, strengths and weaknesses, advantages and disadvantages. In fact, it appears that countries often combine several methods (survey and administrative sources, for instance) when building proper indicators for the sector. A description of each of the four methods follows; the description uses for a large part the inputs received by the IEA when collecting information on good practices for collecting statistics for energy efficiency indicators.

Administrative sources

Administrative data can be found in many places, not only in administrations but also in a variety of organisations, companies and structures which collect data for their own use. In fact, in deregulated markets, more and more data come from non-governmental sources: utilities, appliance manufacturers associations, trade boards, etc.

Purpose of collecting administrative data: The main purpose of collecting data from administrative sources is to get reliable data readily available to complement the work on energy studies and analysis as well as on energy efficiency indicators. For instance, statisticians in charge of building an energy balance for a country rely enormously on administrative sources: sales or deliveries of electricity and natural gas from utilities, imports and exports from customs offices, etc.

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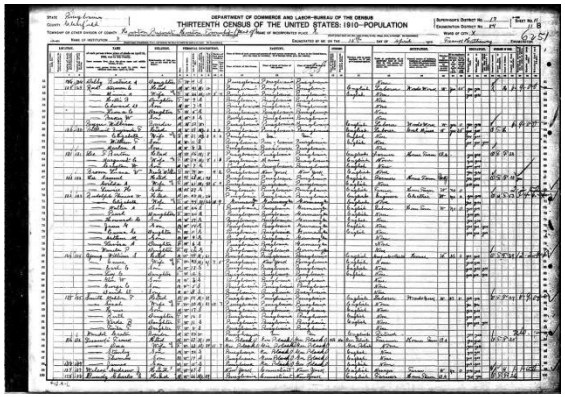
How do countries collect data?

Four main types of practices

- **Administrative sources**
- **Survey**
- **Measuring**
- **Modeling**

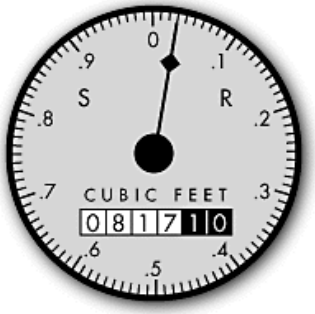
How to get data for indicators?

- Administrative sources

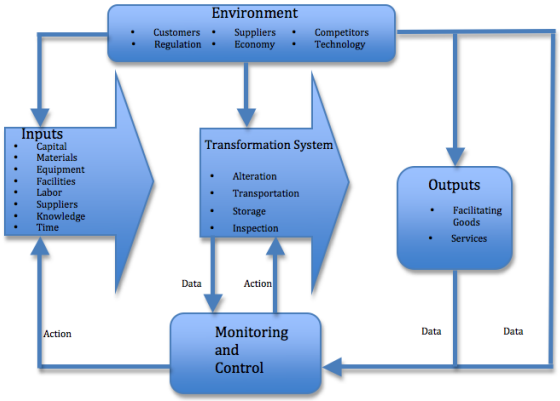


- Surveys

- Metering and measuring



- Modelling



The Annex: an essential part of the Manual

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.		

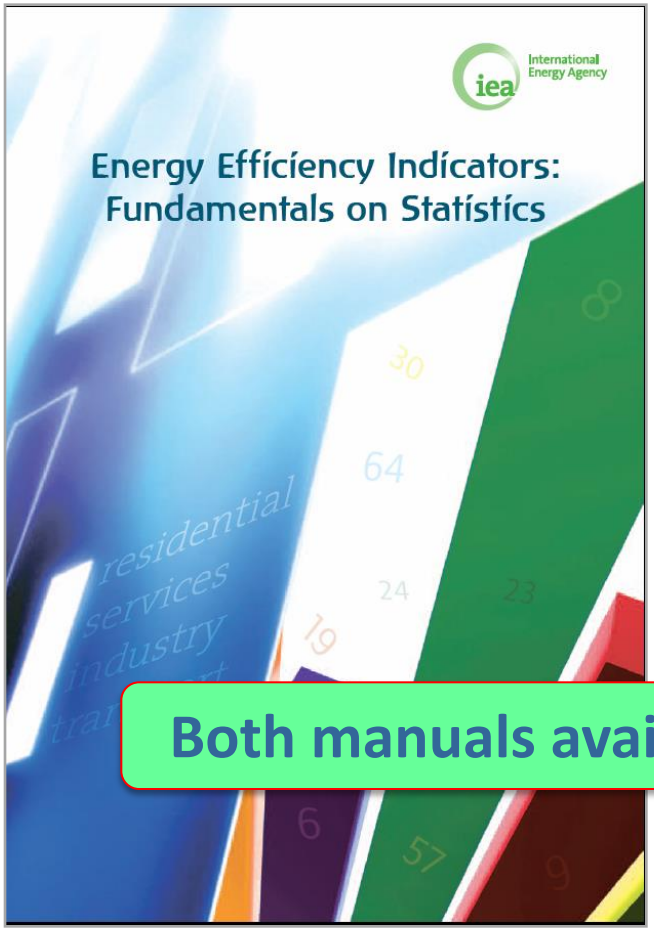
Notes and comments	
Main challenges	• Inconsistent responses • Response quality
Possible improvements	
Key best practice	A new approach to data control compared with previous surveys was taken for the first time in 2004 and continued in the follow-up survey runs. Up to and including the 2000 survey, 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

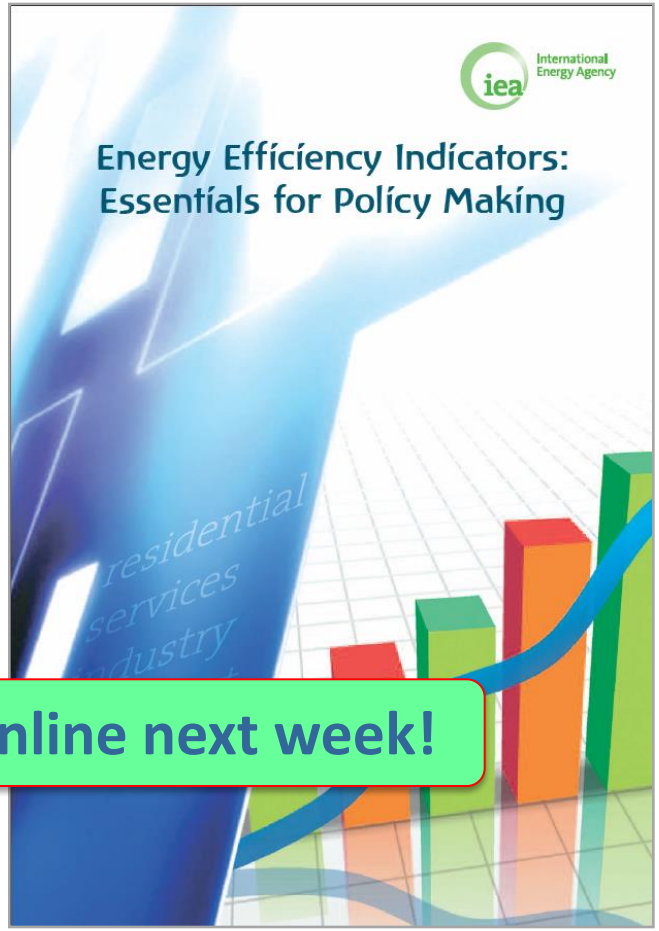
Background
Institution
Purpose …

Technical information:
Sample
Frequency
Data collected…

Comments:
Challenges
Tips
Documents
Links…
(e.version)

From data to analysis: Essentials for Policy Making

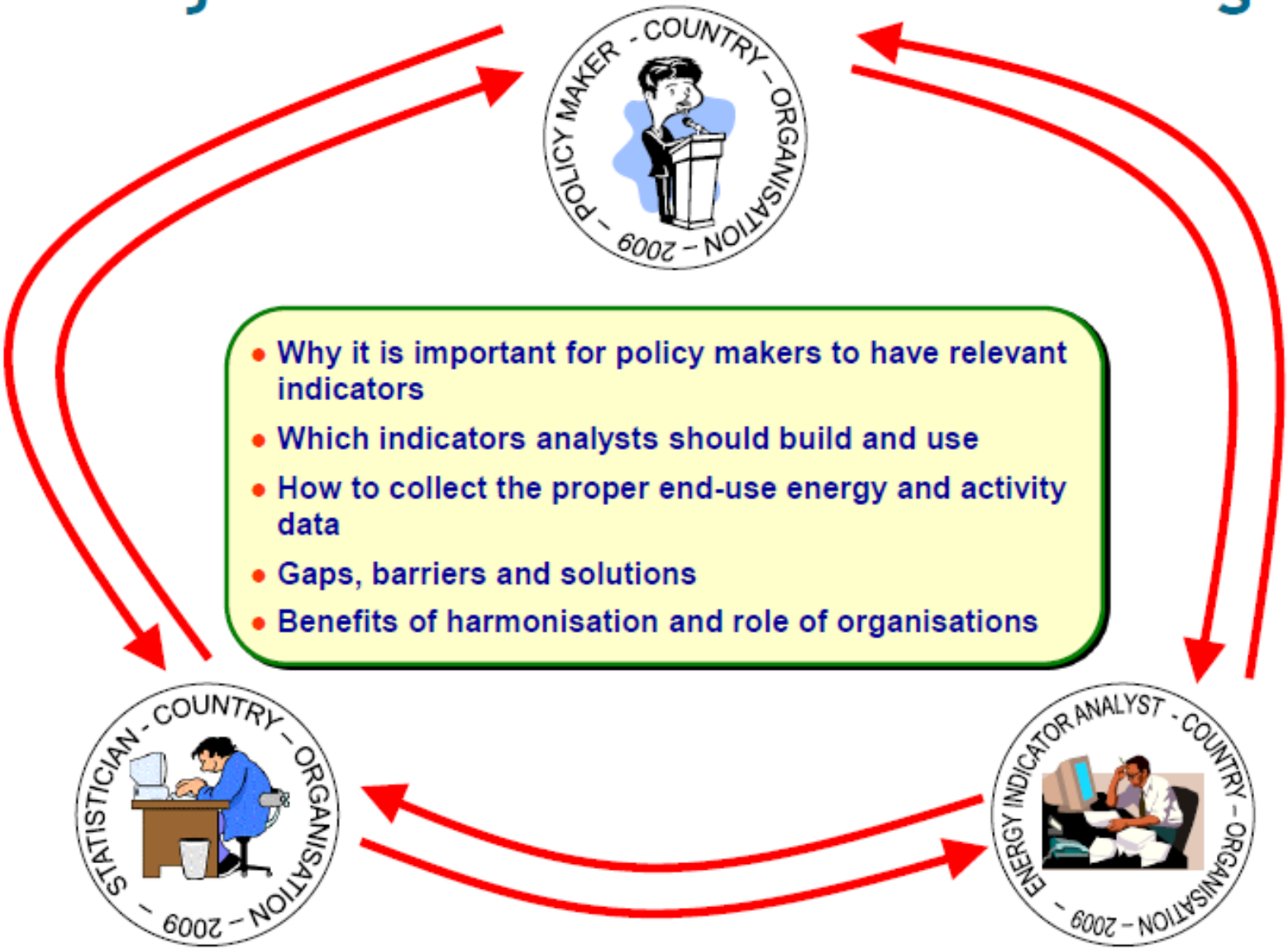




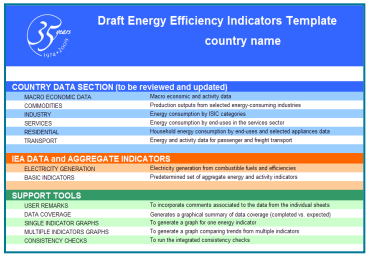
Both manuals available online next week!

The three sides of Energy Efficiency

Objectives: a Better Understanding



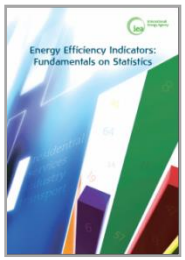
The broader IEA effort to help countries develop Energy Efficiency Indicators


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 sheets
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

Improve clarity and user-friendliness of the template

Strengthen communication with each other



Provide guidance through Manuals (also available in different languages)

Organise training on statistics and on energy efficiency data

Thank you

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