



Overview of the IEA Energy End-uses and Efficiency Indicators Questionnaire: Residential module

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- Background
- IEA Energy End-uses and Efficiency Indicators: Residential module
- Data quality assurance
- Data challenges across OECD countries

Background

Why is the buildings sector important?



Homes and appliances determine our quality of life!

Balances are very useful but do not track end-uses

ENERGY BALANCE

	Coal	Crude	Oil Products	Gas	Geoth /Solar	Biofuels & Waste	Electricity	Heat	Total
OTHER	136.42	0.23	425.87	633.44	14.37	834.05	820.32	145.22	3036.92
Residential	76.58	-	222.89	418.55	6.98	805.42	395.81	97.97	2024.19
Commercial and public services	23.3	-	107.32	173.79	1.15	16.33	338.31	32.47	692.67
Agriculture/forestry	9.57	0.02	102.97	5.58	0.16	7.02	36.2	3.36	164.88
Fishing	0.01	-	5.69	0.02	0.03	-	0.36	0.06	6.17

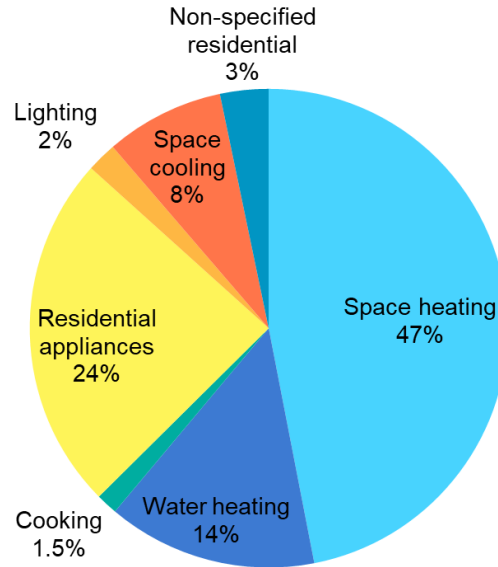
Residential:

no breakdown by end-use

- space heating
- space cooling
- water heating
- lighting
- cooking
- appliances

Focus on residential energy use: what are the key end-uses?

Residential energy consumption by end use, 2022, United States

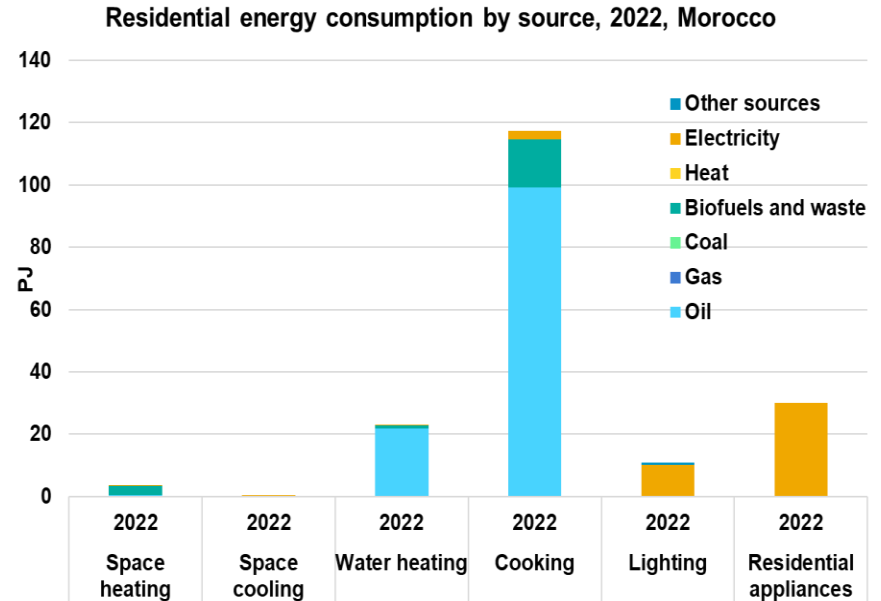
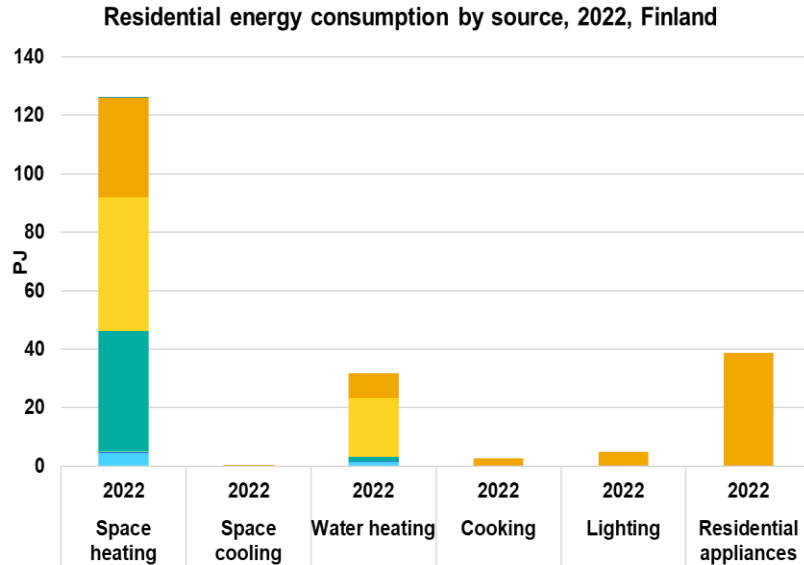


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Priority subsectors require more detailed data for energy and activities to understand “structure”.

Fuel split by end-uses gives crucial insights on our standard of living

Residential energy consumption by fuel and end use, in **Finland** (left) and **Morocco** (right), in 2022



Consumption data split by end use and by fuel allows to understand the impact of weather, technology deployment and cultural habits on the energy system.

Indicators are key to set targets and monitor impacts

Energy Efficiency Reporting targets

Under Article 24, paragraph 11, of the Energy Efficiency Directive the "Commission shall make the reports referred to in paragraphs 1 and 2 publicly available".
Reports are published on this page as soon as they are received from Member States.

EU Member State	Article 3 indicative national energy efficiency target for 2020	Absolute level of energy consumption in 2020 [Mtoe]		Annual 2013 report and NRP
		Primary	Final	
Austria	Final energy consumption of 1100 PJ	31.5	26.3	<ul style="list-style-type: none"> DE/EN [4 MB] NRP
Belgium	18% reduction in primary energy consumption by 2020 relative to the Primes 2007 baseline (53.3 Mtoe)	43.7	32.5	<ul style="list-style-type: none"> EN [469 KB] NRP
Bulgaria	Increase of energy efficiency by 25% until 2020 (5 Mtoe primary energy savings in 2020) and 50% energy intensity reduction by 2020 compared to 2005 levels	15.8	9.16	<ul style="list-style-type: none"> BG [3 MB] EN [229 KB] NRP
Croatia	Increase in energy efficiency resulting in final energy consumption reduction of 19,77 PJ in 2016 and 22,76 PJ in 2020	-	9.24	<ul style="list-style-type: none"> HR/EN [910 KB] NRP
Cyprus	0.463 Mtoe energy savings in 2020	2.8	2.2	<ul style="list-style-type: none"> EN [10 KB] NRP

Energy Efficiency Act (S.C. 1992, c. 36)

Full Document: [HTML](#) | [XML](#) [61 KB] | [PDF](#) [250 KB]

Act current to 2014-09-01 and last amended on 2009-09-21. [Previous Versions](#)

Energy Efficiency Act
S.C. 1992, c. 36
Assented to 1992-06-23

An Act respecting the energy efficiency of energy-using products and the use of alternative energy sources

Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:

Australian Government
Department of Climate Change, Energy, the Environment and Water

National Energy Performance Strategy

Coordinated action to improve energy performance across the economy

5 energy saving

กระทรวงพลังงาน
Ministry of Energy

ประเทศไทย
Thailand

ดำเนินการในครัวเรือนใช้ก๊าซปิโตรเลียมเหลว
ค่าประสิทธิภาพพลังงานร้อยละ 53

The IEA data collection growing since 2009

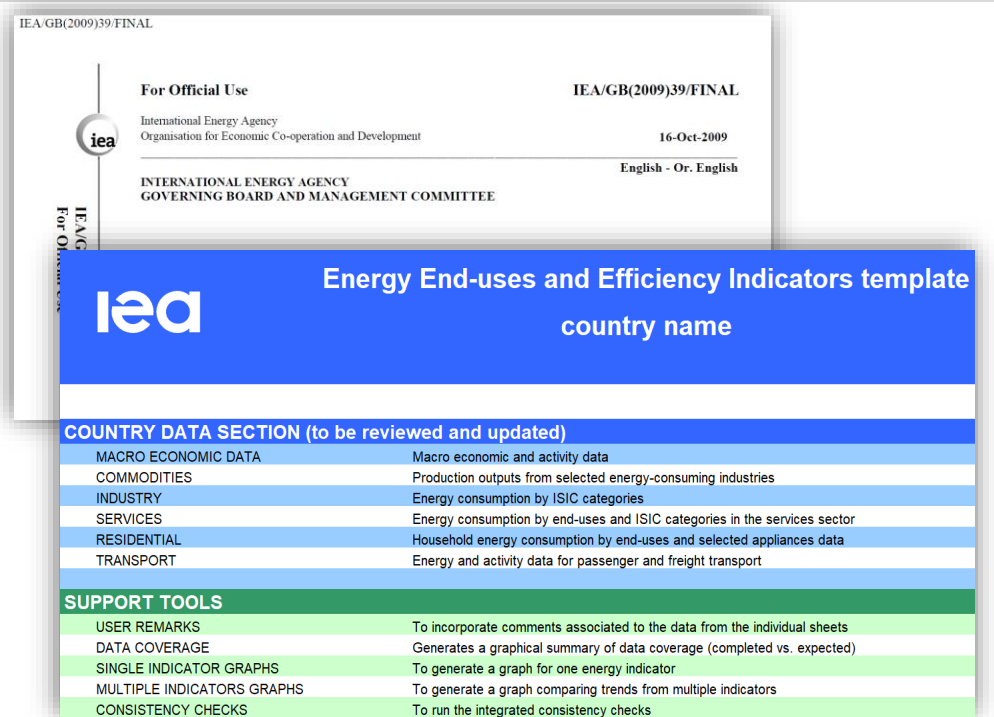
Decided at the **2009 IEA Governing Board** meeting.

Approval of the “**Action plan**”, including energy efficiency objectives.

IEA members must **collect data annually**.

Template developed by the IEA in concert with international experts, along with a **methodological framework**.

International reporting hopes to keep pushing countries towards a more complete and higher quality efficiency data.



Energy Efficiency Indicators

Annual data from 2000 covering end-use energy consumption, now featuring end-use carbon emissions for the IEA member countries and beyond

Subscription

Database containing data for **61 economies**, including 30 not IEA members, representing about **2bn people**.

COUNTRY, TERRITORY OR ECONOMY		
IEA	Albania	Argentina
Armenia	Australia	Austria
Azerbaijan	Belarus	Belgium
Bosnia and Herzegovina	Brazil	Bulgaria
Canada	Chile	Colombia
Croatia	Cyprus	Czechia
Denmark	Estonia	Finland
France	Georgia	Germany
Greece	Hong Kong (China)	Hungary
Ireland	Italy	Japan
Kazakhstan	Korea	Kosovo
Kyrgyzstan	Latvia	Lithuania
Luxembourg	Malta	Mexico
Moldova	Morocco	Netherlands
New Zealand	North Macedonia	Norway
Poland	Portugal	Romania
Serbia	Slovakia	Slovenia
South Africa	Spain	Sweden
Switzerland	Chinese Taipei	Türkiye
Ukraine	United Kingdom	United States
Uruguay	Uzbekistan	

Visit <https://www.iea.org/data-and-statistics/data-product/energy-efficiency-indicators>

Countries' administrations (ministries or agencies) fill an annual questionnaires with the best available data.

IEA Energy End-uses and Efficiency Indicators: Residential module

Dwellings
Floor area



Consumption by end use
Appliances activity data



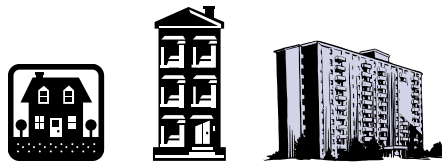
Energy End-uses and Efficiency Indicators template	
country name	
COUNTRY DATA SECTION (to be reviewed and updated)	
MACRO ECONOMIC DATA	Macro economic and activity data
COMMODITIES	Production outputs from selected energy-consuming industries
INDUSTRY	Energy consumption by ISIC categories
SERVICES	Energy consumption by end-uses and ISIC categories 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
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

- The residential sector includes those activities related to private dwellings. It covers all energy-using activities in apartments and houses.
- Using numerous energy consuming end-uses



Space heating and cooling, water heating, lighting,
large and small appliances and electronics

- Different types of dwelling



- It does not include personal transportation, which is covered in the transportation sector



Defining the residential sector: occupied dwellings vs total dwellings



Primary residences



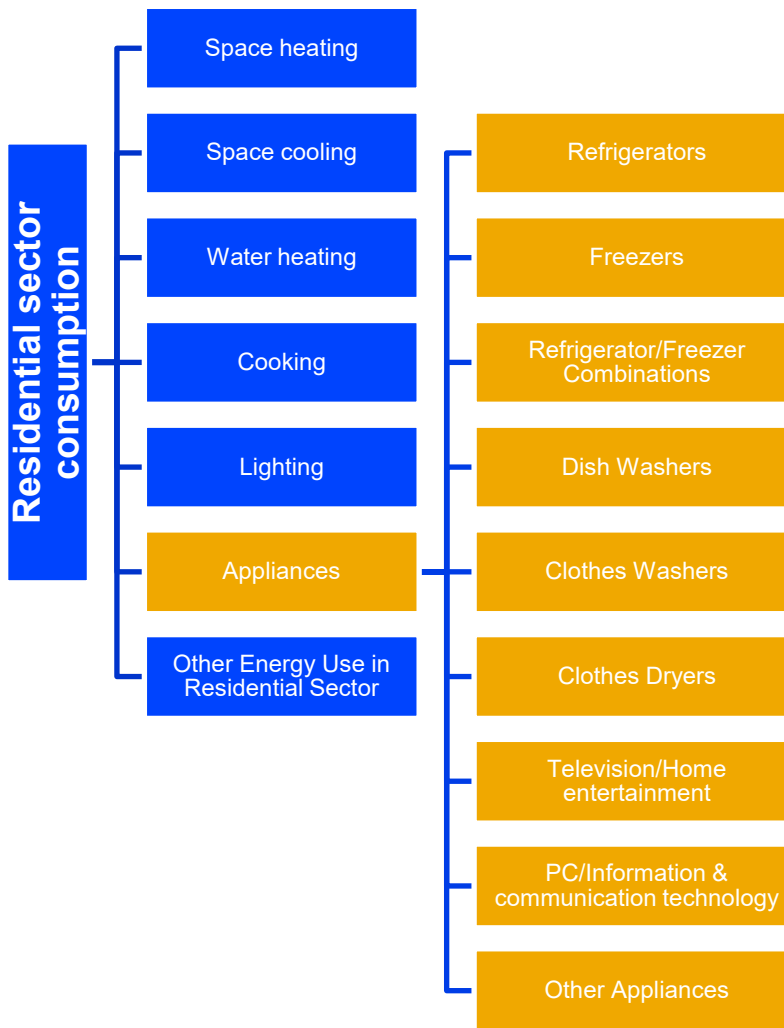
Unoccupied dwellings



Vacation homes

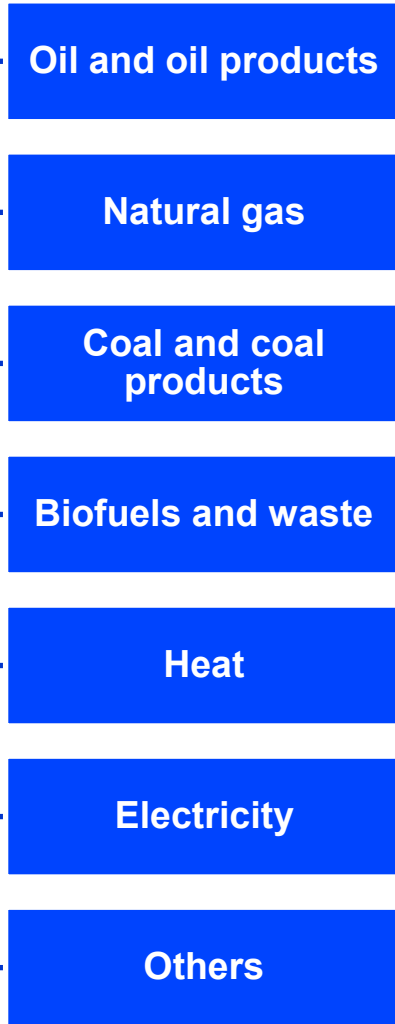
- Energy efficiency indicators are usually calculated based on occupied dwellings.
- In an energy balance, however, residential consumption takes into account all dwellings. There could therefore be a difference between the two.

- Residential data should include all energy uses that occur within the boundaries of a household property.
 - All activities related to stationary dwellings on a property should be accounted for.
 - Examples: an external building that acts as a shed or garage, workshop, or external sleeping quarters.
- Any energy consumption for professional purpose should be excluded from the dwelling consumption,
 - Examples: a doctor receiving patients in a practice inside his/her dwelling, a shopkeeper having his/her shop inside the dwelling.
 - In some cases this is not easy to exclude since there is often only one electrical meter for both, or only one heating system for both.
 - Depending on the relative weight of the professional consumption, the household consumption should be reduced at the pro rata of either the respective areas or occupancy.





Product scope



Residential module – glimpse of the questionnaire

RESIDENTIAL			units	2010	2011	2012	2013	2014	2015	2016
Menu	Legend	Check all/none	Add rem.							
Space Heating										
	Oil & Oil Products		PJ	4.52	4.27	4.12	3.86	3.76	3.48	3.74
	Natural Gas		PJ	78.80	72.16	75.29	76.17	69.95	70.19	78.61
	Coal & Coal Products		PJ	294.29	253.93	268.17	258.21	236.56	232.48	247.69
	Biofuels & Waste		PJ	99.60	101.97	104.11	105.14	96.34	94.10	99.87
	Heat		PJ	136.48	122.48	125.98	123.18	114.08	113.75	114.25
	Electricity		PJ	4.73	4.68	4.69	4.71	4.65	4.68	4.70
	Other		PJ	0	0	0	0	0	0.56	0.59
	Total		PJ	618.42	559.49	582.35	571.27	525.34	519.22	549.45
Space Cooling										
	Natural Gas		PJ	0	0	0	0	0	0	0
	Electricity		PJ	0	0	0	0	0	0	0
	Other		PJ	0	0	0	0	0	0	0
	Total		PJ	0	0	0	0	0	0	0
Water Heating										
	Oil & Oil Products		PJ	1.69	1.60	1.54	1.44	1.40	1.35	1.46
	Natural Gas		PJ	37.01	33.89	35.36	35.77	32.85	32.96	36.92
	Coal & Coal Products		PJ	31.38	27.07	28.59	27.53	25.22	24.76	24.78
	Biofuels & Waste		PJ	12.53	12.83	13.10	13.23	12.12	9.29	9.29
	Heat		PJ	58.49	52.49	53.99	52.79	48.89	48.75	48.75
	Electricity		PJ	7.61	7.52	7.53	7.57	7.47	7.52	7.52
	Other		PJ	0	0	0	0	0	1.77	2.06
	of which: solar thermal		PJ	0	0	0	0	0	1.57	1.85
	Total		PJ	148.70	135.40	140.11	138.33	127.96	126.40	130.78
Cooking										
	Oil & Oil Products		PJ	23.17	21.89	21.10	19.77	19.25	19.56	20.33
	Natural Gas		PJ	32.56	29.82	31.11	31.48	28.90	29.03	29.62
	Coal & Coal Products		PJ	4.46	3.85	4.07	3.92	3.59	3.50	3.53
	Biofuels & Waste		PJ	2.33	2.38	2.43	2.45	2.25	2.28	2.28
	Heat		PJ	0	0	0	0	0	0	0
	Electricity		PJ	11.10	10.97	10.99	11.04	10.90	10.97	11.25
	Other		PJ	0	0	0	0	0	0	0
	Total		PJ	73.62	68.90	69.70	68.66	64.89	65.34	67.00
Lighting										
	Oil & Oil Products		PJ	0	0	0	0	0	0	0
	Electricity		PJ	15.54	13.46	13.02	12.81	11.90	11.84	0
	Other		PJ	0	0	0	0	0	0	0

Activity & Structure Indicators

Total Population

Total Dwellings

Occupied Dwellings

Household Occupancy

Total Dwelling Area (Residential Floor Area)

Appliances Stock (only within occupied dwellings)

- Refrigerators
- Freezers
- Refrigerator/Freezer Combinations
- Dish Washers
- Clothes Washers
- Clothes Dryers
- Television/Home entertainment
- PC/Information & communication technology

Appliances Stock

- Household air conditioners
- Heat Pumps
- Fuel (oil/gas) boilers
- Biofuels boilers
- Electricity boilers
- Share of LED in total light bulbs

Decentralised Production Equipment

- Solar thermal panels
- Solar photovoltaic panels

Appliances Diffusion

(number of units per occupied dwelling)

- Refrigerators
- Freezers
- Refrigerator/Freezer Combinations
- Dish Washers
- Clothes Washers
- Clothes Dryers
- Television/Home entertainment
- PC/Information & communication technology

Appliances, unit energy consumption per year

(average for appliances in stock)

- Refrigerators
- Freezers
- Refrigerator/Freezer Combinations
- Dish Washers
- Clothes Washers
- Clothes Dryers
- Television/Home entertainment
- PC/Information & communication technology

Go to:

<https://www.menti.com/>

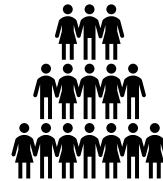
and use this code:

7934 8387

Or join using the QR
code:



Which country/region are you
currently based in or represent?



Data quality assurance

- Verifying where boundaries of a sector are:
 - boundaries between the residential and services sector;
 - data for transport of households should be excluded.
- Clarifying the definitions and the coverage of each end use, to avoid any misallocations:
 - lighting and cooking separated from appliances;
 - data for fans under appliances not cooking;
 - reporting of heating swimming pools, spas or saunas.
- Clarifying the definitions of all types of energy sources should be clear:
 - district heating/cooling may be reported as heat and cold or as input fuel to plants or not reported to all.
- Precising if the period is defined in calendar year or fiscal year.
- Ensuring that calorific values are net.

- Checking arithmetic errors:
 - Appliances energy consumption should be equal to the product of the average energy consumption per unit (unit energy consumption) and the number of units (stock).
 - The number of total dwellings should be larger than the number of occupied dwellings.
 - The number of total dwellings in a given year must be larger than the number of total dwellings the year before plus the number of new dwellings — the difference being the number of demolished dwellings.
 - The total heated/cooled floor area cannot be larger than the total floor area.
 - The average size of a dwelling should be equal to the total floor area divided by the number of dwellings.
- Explaining breaks due to changes in definitions, sources, classifications, coverage, methodologies in the metadata.

- Are the differences with energy balances explainable?
- Does total number of dwellings correspond to the figure published by the national statistics office?

- Checking for negative values, e.g. actual fuel consumption or stocks.
- Precising if data reported as zero represent actual values or simply not available information.
- Monitoring trends of data and indicators:
 - Consistency between appliances diffusion and stocks;
 - Trends of indicators.
- Comparing calculated indicators against benchmark values/reasonable:
 - Unit energy consumption (UEC) of appliances, as well as average daily unit energy consumption, should be within reasonable ranges.
 - The average size of a housing should be within reasonable ranges.

Data challenges across OECD countries

- Some countries still do not collect energy consumption data on end uses.
- Difficulties in separating lighting and appliances. Difficulties in separating cooling and appliances.
- Difficulties in obtaining consumption by appliance type. Limited data on stocks of appliances.
- No use of smart meters when data available.
- Only total number of dwelling available, and assumption made to obtain occupied dwellings. Difficulties in obtaining floor area of occupied dwellings.
- Time series breaks due to new building and housing census/new household survey.
- Issues with definitions/boundaries:
 - Appliances used for cooking purposes are accounted under cooking instead of other appliance, or fans are accounted under cooling.
 - Residential boundaries for solar thermal and photovoltaic panels stocks.
 - Definition of Television/Home entertainment appliances: should it include set top box, DVD/VCR, games consoles and power supply units?
 - Definition of personal computers: Personal Computers, also including other information technology devices. What about desktop computers, laptops, monitors, printers and multifunction devices?



Thank you for your attention

Any question? EnergyIndicators@iea.org