



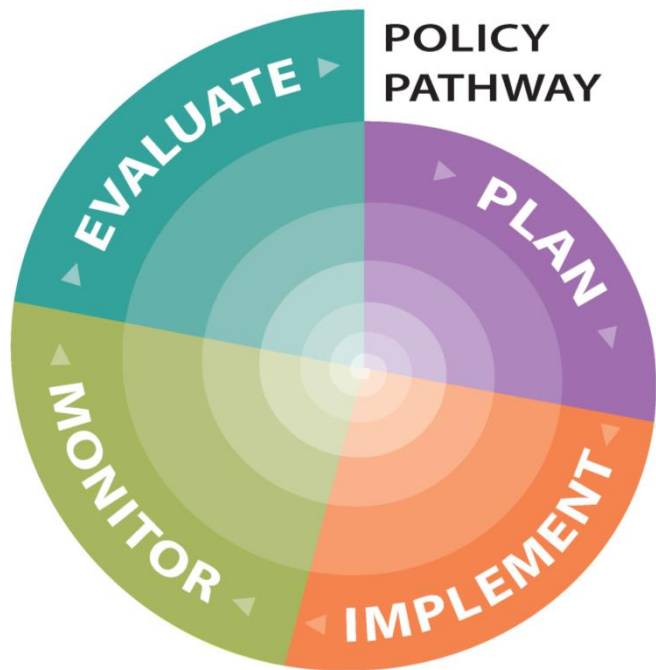
Measuring Energy Efficiency

Why data matters for energy efficiency policy

Brian Dean, IEA

New Delhi, 10 December 2018

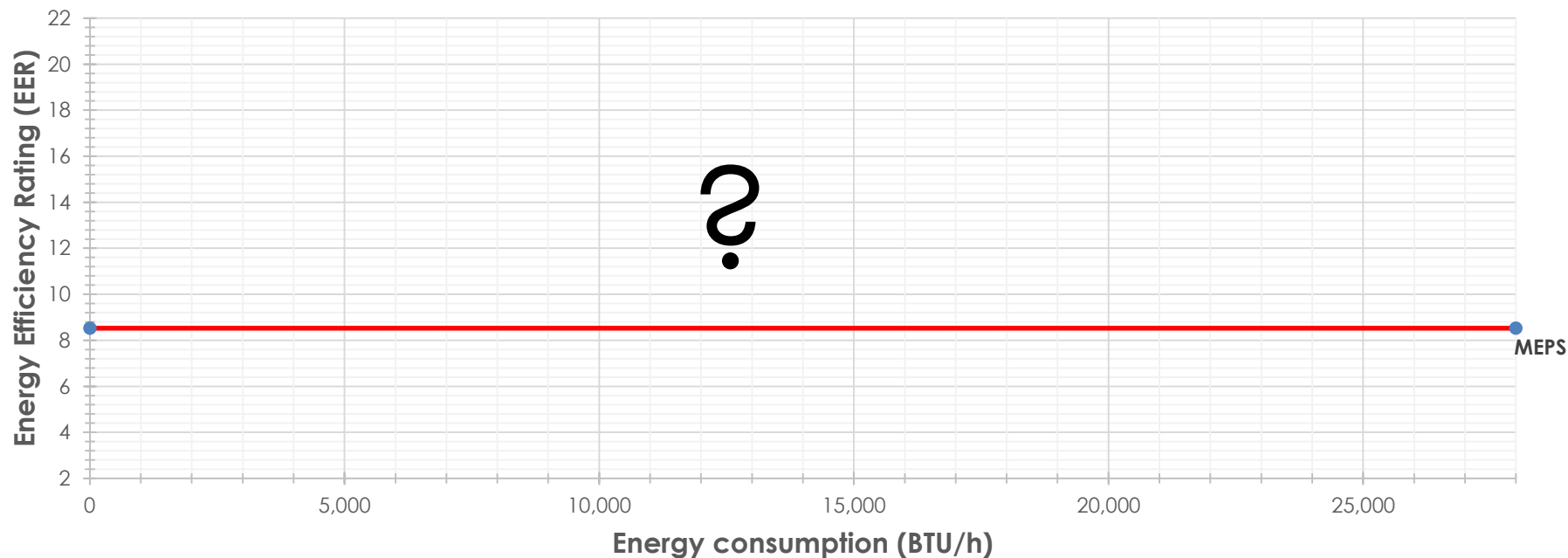
 #energyefficientworld



- **Plan:** Inform policy design based on current state and ambition
- **Implement:** Adapt the policy during adoption and enforcement stages
- **Monitor:** Track how the policy is performing
- **Evaluate:** Use the data to see what happened and why

Each step requires appropriate data to be effective

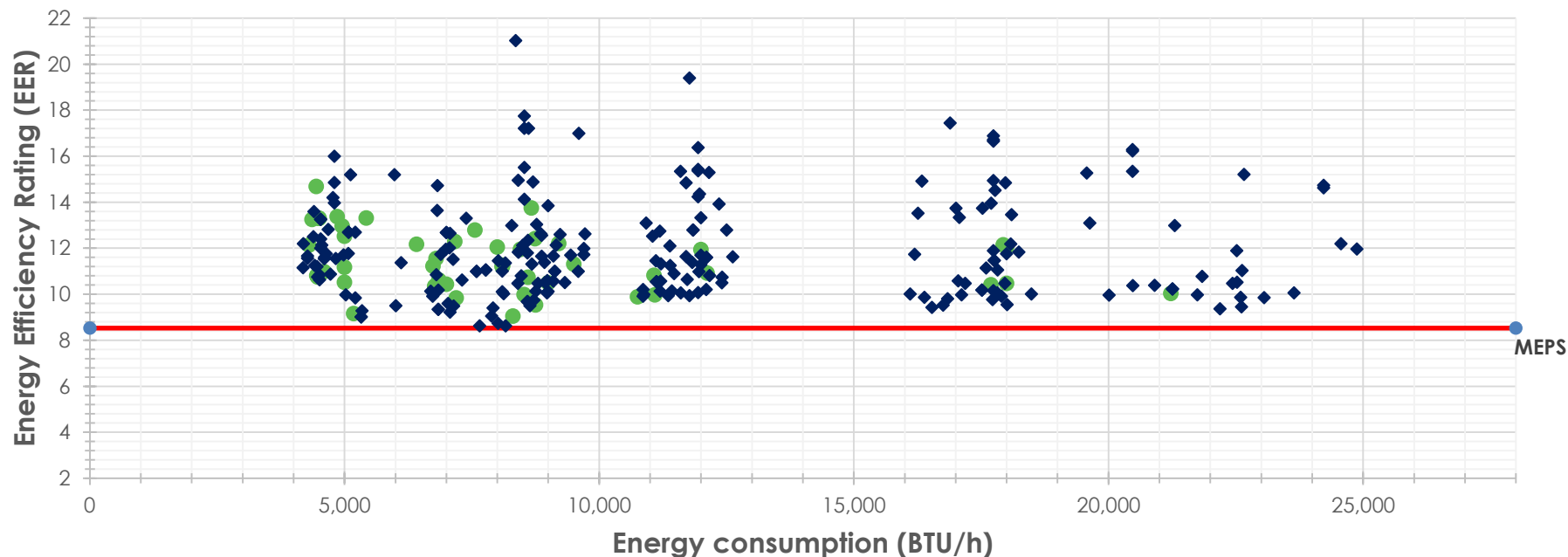
Why do we need data for policy design?



Where do you set your minimum energy performance standards (MEPS)?
Without national market data, you may set the MEPS here...

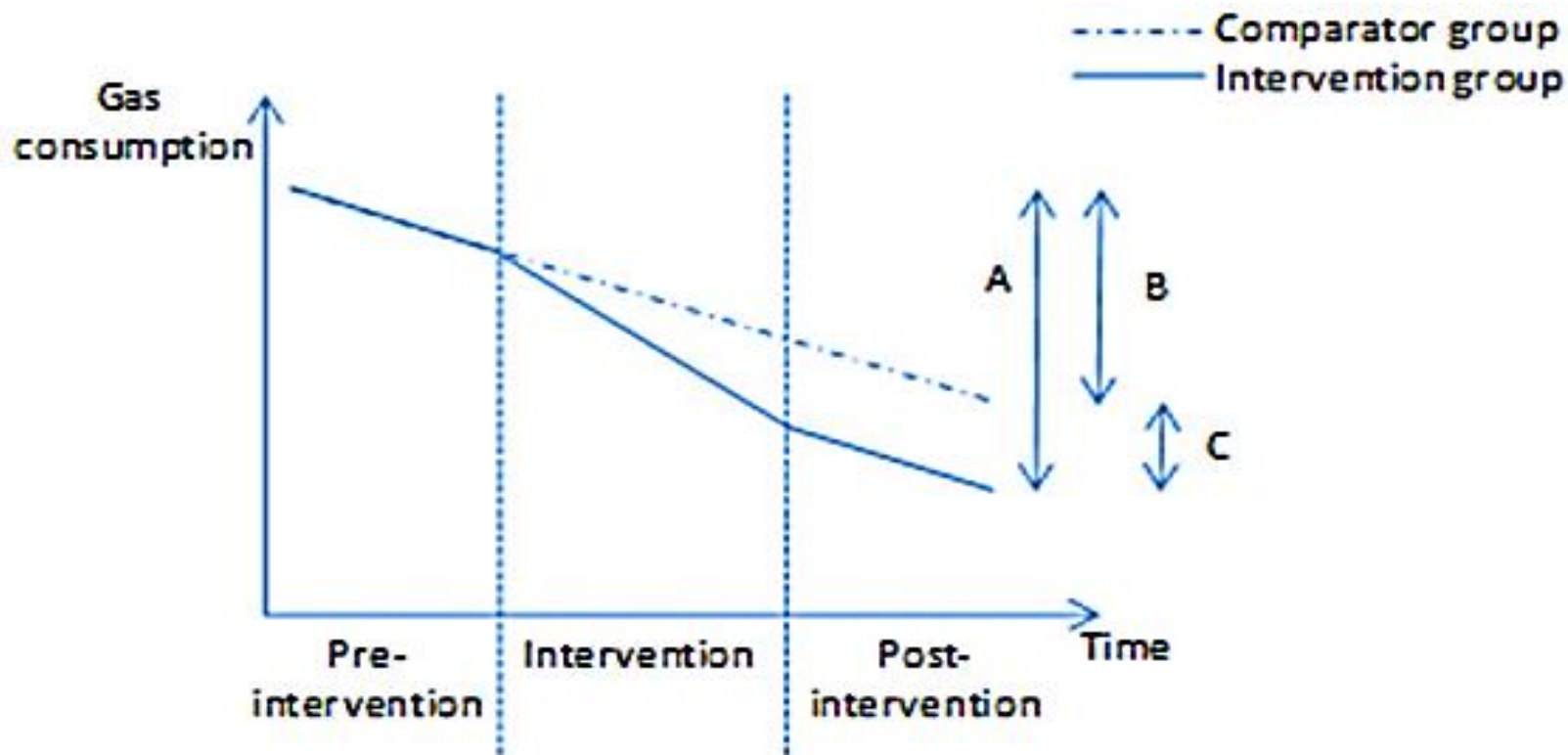
Why do we need data for policy design?

Efficiency of air conditioners - collected after MEPS were final



**In this case, without appropriate data, MEPS were set too low.
Providing an unfair advantage to benefit importers over local companies...**

How does data help in implementation?



Impacts are assessed compared to “control” group (what would have happened)

Monitoring provides headline data on policy performance

- *What happens as a result of the policy?*

Evaluation provides an *understanding* of what is happening / has happened

- *Why and what can be done about it?*

Why is monitoring and evaluation needed?

- Understand what happens as a result of the policy
- Ability to change policy during its implementation
- Learn for other policies
- Understand the energy efficiency and energy market more
 - What drives changes in the market?
 - How do energy consumers react?

Monitoring and Evaluation: When?

1. Before launch

Will the policy work?
How will it work?
Will it be worth it?

2. During delivery

Is it working?
For whom?
Why?
How?
Unforeseen events?

3. After delivery

Did it work?
How did it work?
Why did it work?
Was it worth it?
Who gained?
Were objectives met?

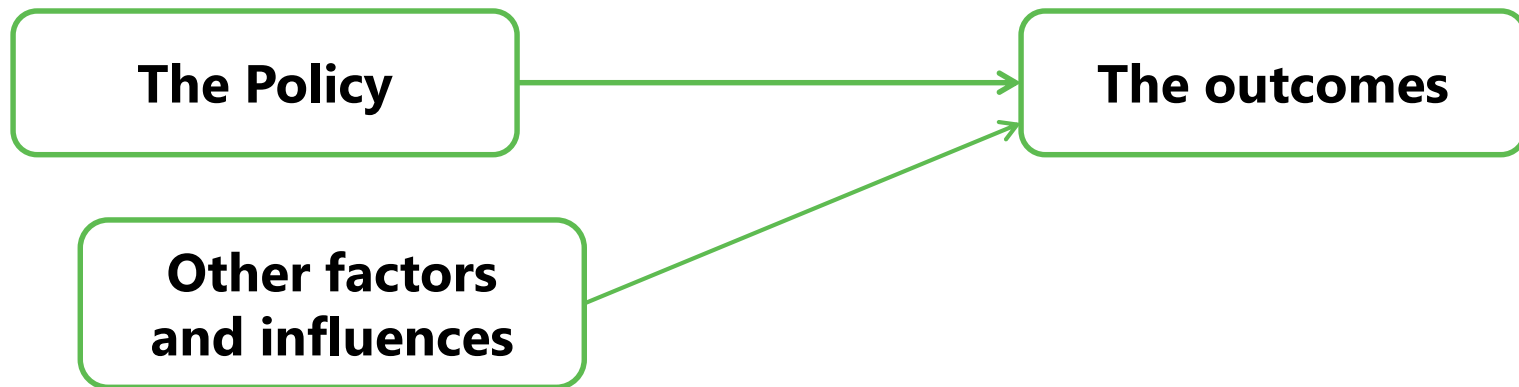
Evaluation: Did it work?

Measuring activities and outputs is straightforward, if not simple.
Outcomes / impacts are more difficult...



Why is it more difficult?

Measuring activities and outputs is straightforward, if not simple.
Outcomes / impacts are more difficult...



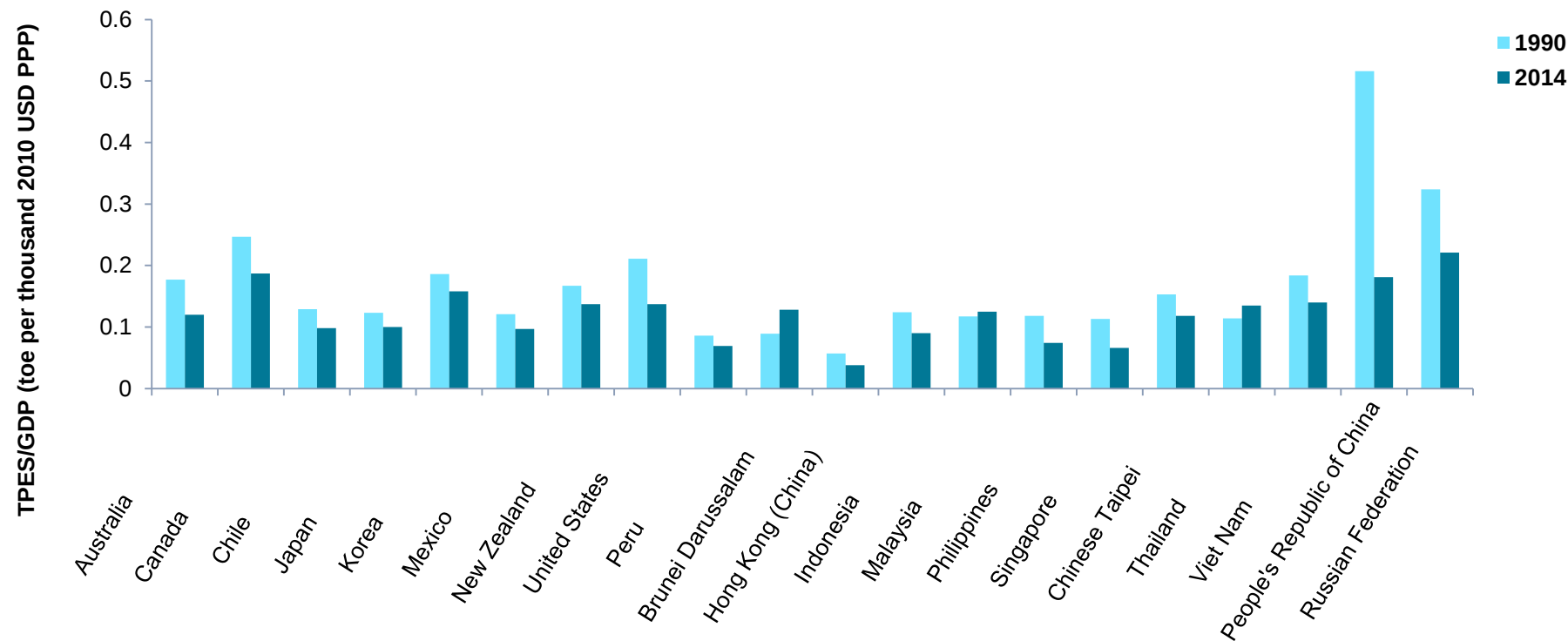
Other factors include:

- Global, national, local trends / events
- Other policies
- Something you haven't even thought of...

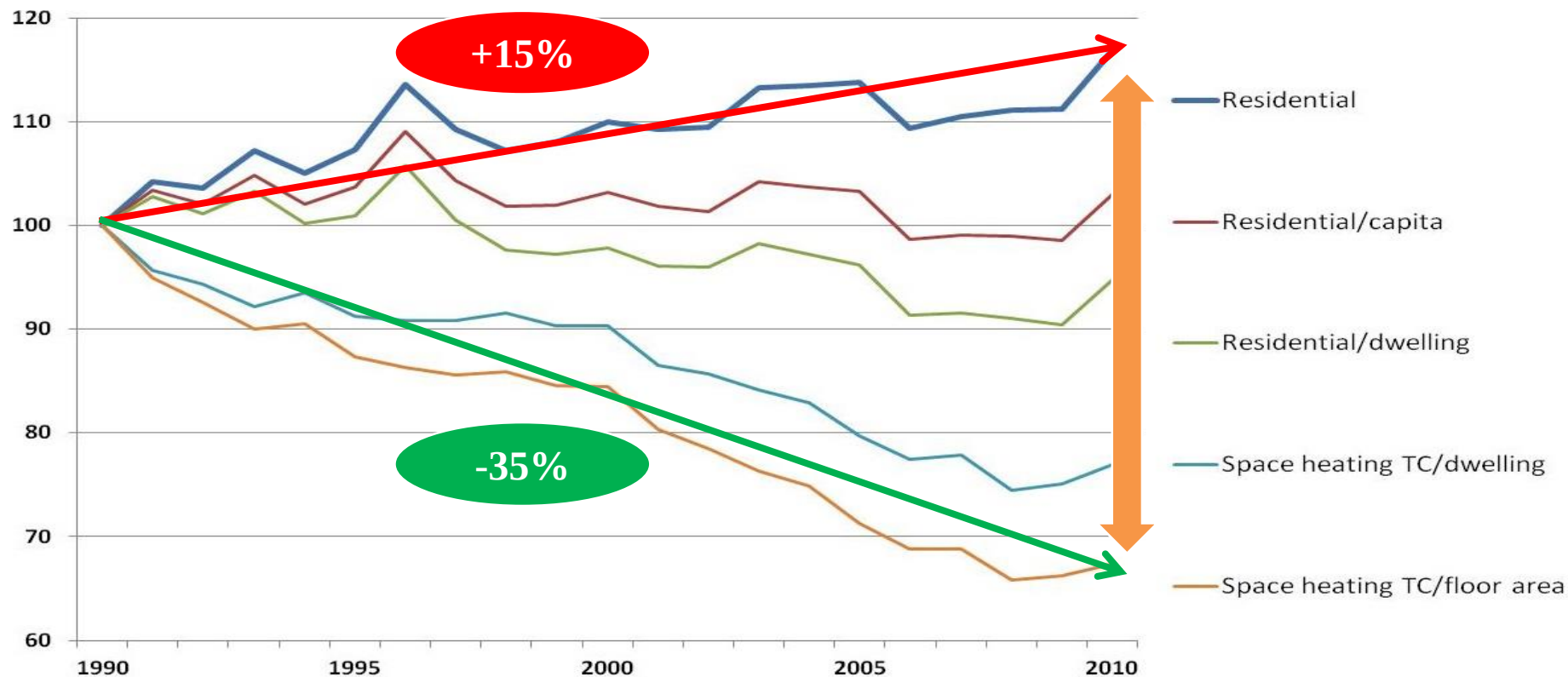
What information is needed?

Information: Is energy intensity enough?

Energy intensity for APEC members, 1990 - 2014



Information: The right metric can tell you a different story



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

What information is there?

Country energy balances have useful data...

WORLD ENERGY BALANCE

Supply

Transformation

Final consumption

Million tonnes of oil equivalent											
SUPPLY AND CONSUMPTION	Coal & peat	Crude oil	Oil products	Natural Gas	Nuclear	Hydro	Geotherm. solar etc.	Biofuels & waste	Electricity	Heat	Total
Production	3596.04	4069.38	-	2719.10	718.96	295.62	112.02	1277.08	-	1.04	12789.25
Imports	640.82	2295.06	1053.79	817.02	-	-	-	10.78	51.38	0.00	4868.77
Exports	-681.28	-2211.55	-1111.80	-826.35	-	-	-	-9.29	-50.74	-0.01	-4891.01
Stock changes	-79.80	5.49	6.16	17.84	-	-	-	-0.54	-	-	-49.86
TOTAL	3479.78	4153.97	2957.15	2600.61	718.96	295.62	112.02	1286.53	51.66	1.03	12789.25
Transfers	0.00	-156.64	179.33	-	-	-	-	-	-	-	22.69
Statistical differences	-49.50	11.30	-27.05	-1.88	-	-	0.00	-0.40	1.43	-1.24	-67.14
Electricity plants	-1974.84	-34.63	-201.57	-705.47	-715.67	-295.62	-88.61	-63.40	1671.71	-0.37	-2408.47
CHP plants	-161.19	-0.01	-22.50	-304.76	-3.13	-	-1.06	-35.21	171.56	-	-205.45
Heat plants	-103.61	-0.81	-12.92	-90.14	-0.15	-	-0.22	-10.42	-0.34	189.23	-29.38
Blast furnaces	-168.50	-	-0.79	-0.11	-	-	-	-	-	-	-169.40
Gas works	-8.80	-	-3.53	2.81	-	-	-	-0.02	-	-	-9.54
Coke/pet.fuel/B&B plants	-51.08	-	-2.40	-0.00	-	-	-	-0.01	-	-	-53.49
Oil refineries	-	-3954.42	3921.30	-0.80	-	-	-	-	-	-	-43.92
Petrochemical plants	-	30.51	-31.35	-	-	-	-	-	-	-	-0.84
Liquefaction plants	-16.20	7.85	-	-7.10	-	-	-	-	-	-	-15.45
Other transformation	0.01	0.13	-0.17	-0.12	-	-	-	-53.14	-	-0.39	-55.77
Energy industry own use	-86.22	-10.10	-210.37	-275.36	-	-	-0.13	-13.27	-156.15	-40.51	-792.10
Losses	-2.70	-8.23	-0.58	-24.63	-	-	-0.14	-0.15	-153.17	-22.67	-212.27
TOTAL	3479.78	4153.97	2957.15	2600.61	718.96	295.62	112.02	1286.53	51.66	1.03	12789.25
INDUSTRY	677.86	12.51	310.02	463.87	-	-	0.46	195.83	636.36	125.43	2422.94
Iron and steel	248.74	0.03	11.36	51.71	-	-	0.01	4.16	87.06	17.48	420.54
Chemical and petrochemical	58.37	2.18	47.73	99.18	-	-	0.00	2.30	95.52	45.11	350.39
Non-ferrous metals	14.47	0.00	6.84	16.16	-	-	0.00	0.11	68.40	2.97	108.96
Non-metallic minerals	176.70	0.07	36.98	50.61	-	-	0.00	7.08	40.97	3.01	315.43
Transport equipment	4.67	0.01	3.19	11.35	-	-	0.00	0.01	18.39	4.22	41.83
Machinery	14.34	0.05	10.04	23.24	-	-	0.00	0.17	67.77	6.78	122.39
Mining and quarrying	6.93	-	16.96	15.93	-	-	-	0.06	23.72	2.52	66.11
Food and tobacco	22.70	0.12	26.68	37.22	-	-	0.00	29.92	34.93	11.20	152.78
Paper pulp and printing	21.66	0.01	8.08	26.06	-	-	0.15	53.10	40.87	10.88	160.79
Wood and wood products	2.71	0.01	4.78	3.30	-	-	0.00	11.58	7.89	5.87	26.14
Construction	6.12	0.05	26.92	6.38	-	-	0.00	0.16	8.00	1.78	49.41
Textile and leather	11.18	0.06	5.59	7.14	-	-	0.00	0.23	23.22	7.01	54.44
Non-specified	89.28	9.93	104.85	115.59	-	-	0.30	86.95	120.21	6.60	533.72
TRANSPORT	3.36	0.04	2195.89	89.96	-	-	-	57.56	23.91	-	2369.81
World aviation bunkers	-	-	153.65	-	-	-	-	-	-	-	153.65
Domestic aviation	-	-	96.42	-	-	-	-	-	-	-	96.42
Road	-	0.03	1666.60	28.52	-	-	-	57.53	0.00	-	1752.68
Rail	3.22	-	28.37	-	-	-	-	0.02	18.04	-	49.65
Pipeline transport	-	-	0.43	59.99	-	-	-	-	2.90	-	63.31
World marine bunkers	-	-	200.72	-	-	-	-	-	-	-	200.72
Domestic navigation	0.12	-	43.98	0.05	-	-	-	-	-	-	44.16
Non-specified	0.01	0.00	5.73	0.49	-	-	-	0.01	-	-	6.21
OTHER	135.96	6.75	435.64	612.83	-	-	21.41	348.62	874.82	150.50	3086.53
Residential	78.65	0.55	210.54	421.08	-	-	9.42	820.70	426.24	105.72	2072.88
Comm. and publ. services	22.94	0.11	102.97	179.56	-	-	2.01	17.76	358.61	31.52	715.47
Agriculture/forestry	10.90	0.09	101.47	6.07	-	-	0.67	7.43	38.98	3.76	169.37
Fishing	0.01	-	6.23	0.02	-	-	0.06	0.00	0.39	0.05	6.77
Non-specified	23.47	6.00	14.43	6.10	-	-	9.25	2.73	50.60	9.45	122.04
NON-ENERGY USE	35.97	15.05	593.93	152.40	-	-	-	-	-	-	797.35
in industry/transport/energy	35.63	15.05	569.93	152.40	-	-	-	-	-	-	773.01
of which: feedstocks	2.44	14.49	362.42	749.75	-	-	-	-	-	-	529.10
in transport	-	-	6.63	0.00	-	-	-	-	-	-	6.63
in other	0.33	-	17.38	-	-	-	-	-	-	-	17.71

... and its limitations

WORLD ENERGY BALANCE

In other words...

no breakdown by end-use:

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

no breakdown by sub-sector:

- vehicle type, building type, etc.

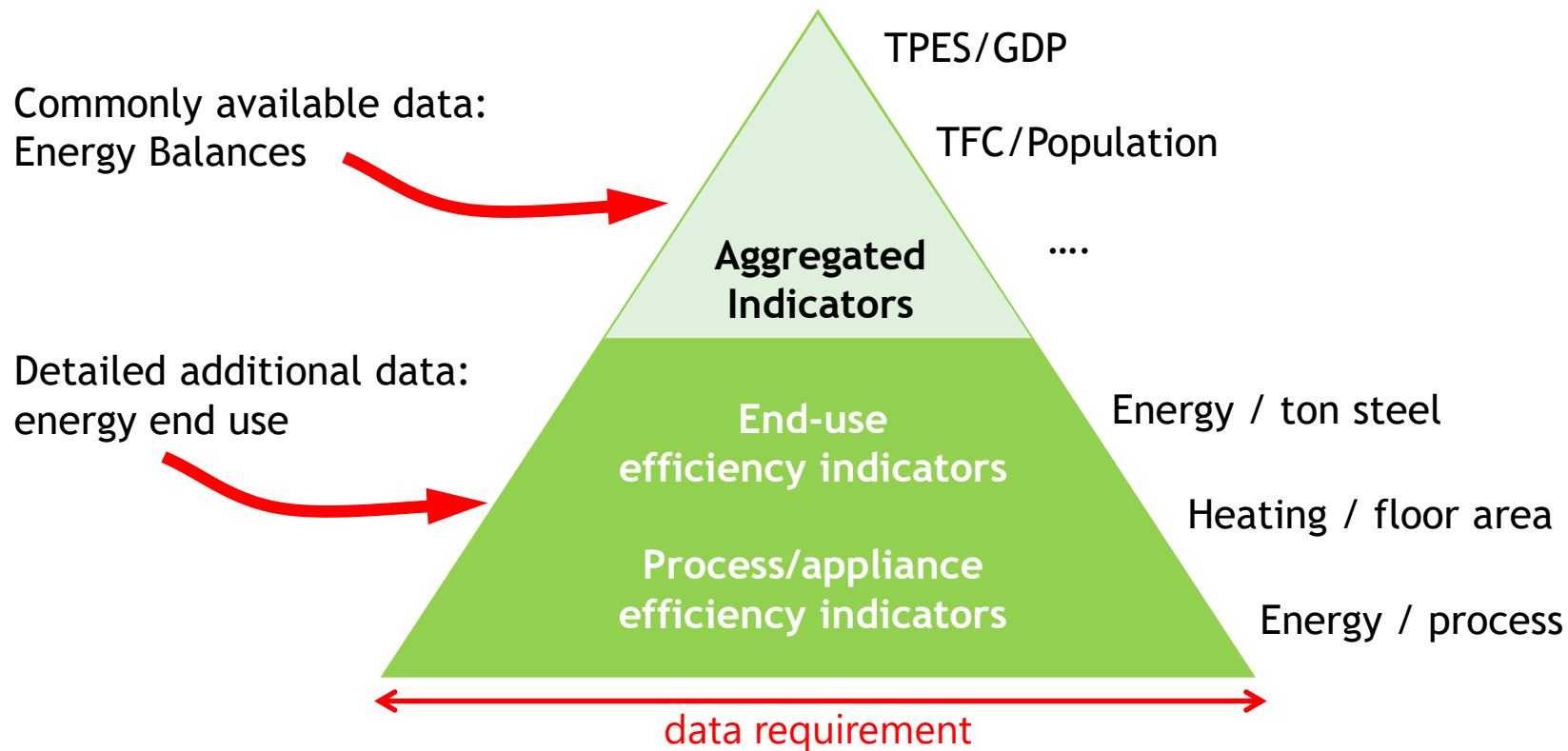
What most countries collect on a regular basis is limited to aggregated levels

Million tonnes of oil equivalent										
SUPPLY AND CONSUMPTION	Coal & peat	Crude oil	Oil products	Gas	Nuclear	Hydro	Geothermal	Solar	Renewables & waste	Total
Production	3596.04									12789.25
Imports	640.82									4868.77
Exports	-681.28									-4891.01
Stock changes	-79.80									-49.86
	3475.77									12717.16
Losses	0.00									22.69
Technical differences	-49.50									-67.14
Industry plants	-1974.84									-2408.47
Power plants	-161.19									-205.45
Furnaces	-103.61									-29.38
Works	-168.50									-169.40
Waste-to-energy plants	-8.80									-9.54
Waste-to-energy plants	-51.08									-53.49
Mineries	-									-43.92
Chemical plants	-									-0.84
Refraction plants	-16.20									-15.45
Transformation	0.01									-55.77
Industry own use	-86.22									-792.10
Losses	-2.70									-212.27
	853.14									8676.63
INDUSTRY	677.86									2422.94
Iron and steel	248.74									420.54
Chemical and petrochemical	58.37									350.39
Non-ferrous metals	14.47									108.96
Non-metallic minerals	176.70									315.43
Transport equipment	4.67									41.83
Machinery	14.34									122.39
Mining and quarrying	6.93									96.11
Food and tobacco	22.70									162.78
Paper pulp and printing	21.68									160.79

OTHER SECTORS

	Coal & Peat	Crude Oil	Oil Products	Gas	Nuclear	Hydro	Geothermal	Solar	Renewables & Waste	Electricity	Heat	Total
OTHER SECTORS	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 (Services)	23.30	-	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	36.20	3.36	164.88
Fishing	0.01	-	5.69	0.02	-	-	0.03		-	0.36	0.06	6.17
Non-specified	26.96	0.21	14.00	35.51	-	-	6.05		5.28	49.64	11.36	149.01

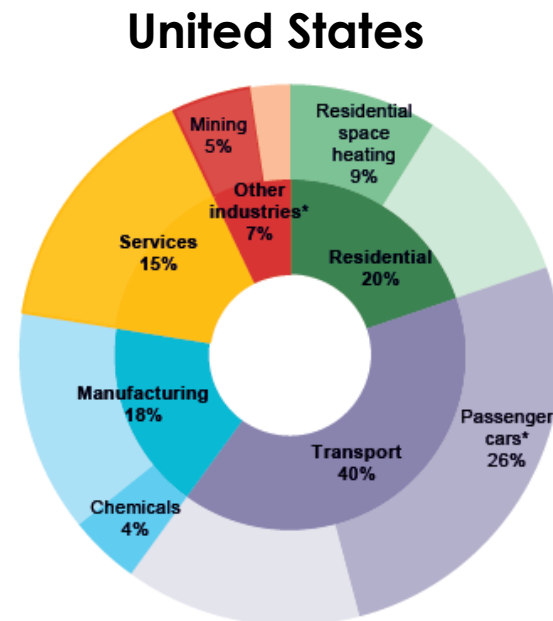
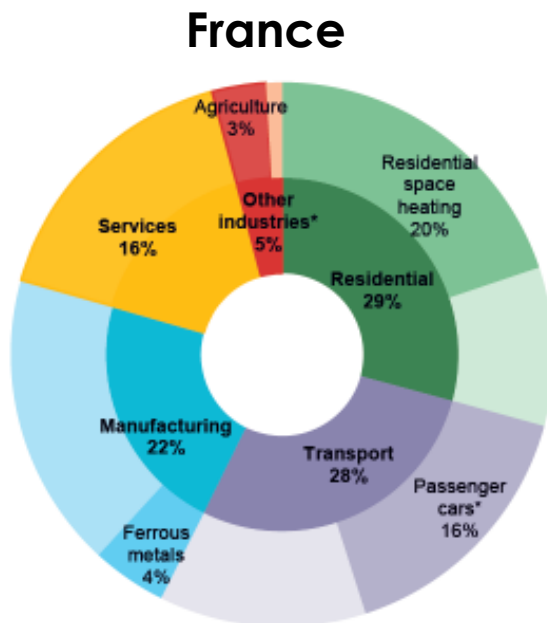
Going beyond the balances: What level of detail?



Significant new data needed to build a detailed set of efficiency indicators

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

- What are the largest end-uses within the energy consumption?
- How are they changing over time?
- What are the priority areas for policy?



Energy demand for each end-use is driven by specific “activities”
(e.g. residential: more people; more dwellings; larger dwellings; etc)

Energy efficiency indicators: Country Practices Database



International Energy Agency > EE Indicators Manual

Energy Efficiency Indicators Statistics: Country Practices Database

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

www.iea.org/eeindicatorsmanual/

A supplement to the p
from a variety of OEC

Practices are searcha
their own energy effici

veloping efficiency in

nd organisations to i

Countries

- ☐ Israel
- ☐ Italy
- ☐ Japan
- ☐ Kazakhstan
- ☐ Korea, Republic of
- ☐ Mexico

Sector

- ☐ Industry
- ☐ Residential
- ☐ Services
- ☐ Transport

Methodology

- ☐ Administrative sources
- ☐ Measuring
- ☐ Modelling
- ☐ Surveying

Available content

- ☐ methodology
- ☐ project web site
- ☐ questionnaire
- ☐ report
- ☐ results

Search by keywords

Energy efficiency indicators: Country Practices Database

- Benefit from each other's work
- Practices in surveying, administrative sources, modelling and metering
- Questionnaires and other material available
- Links to various national administrations work

Energy Efficiency Indicators Statistics: Country Practices Database

26 results found
(Tip: sort columns by clicking on the column header)
Perform another search

Filter:

PRACTICE	COUNTRIES AND TERRITORIES	SECTOR	METHODOLOGY	AVAILABLE CONTENT
R/Su/01	Albania 	Residential	Surveying	questionnaire
R/Su/02	Austria 	Residential	Surveying	methodology, questionnaire, results
R/Su/03	Belgium 	Residential	Surveying	report
R/Su/04	Portugal, Belgium, Bulgaria, Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, Norway, Romania	Residential	Surveying	methodology, project web site, questionnaire, report, results
R/Su/05	Canada 	Residential	Surveying	project web site, questionnaire
R/Su/06	China 	Residential	Surveying	
R/Su/07	China 	Residential	Surveying	
R/Su/08	Croatia 	Residential	Surveying	
R/Su/09	Croatia 	Residential	Surveying	report
R/Su/10	Bosnia and Herzegovina 	Residential	Surveying	report, questionnaire, results

Information for country practice (R/Su/05)

Background	
Country	Canada
Sector	Residential
Methodology	Surveying
Organisation	Natural Resources Canada
Name	Survey of Household Energy Use (SHEU)
Purpose	To determine total residential energy consumption To determine residential appliances energy consumption To collect residential appliances diffusion 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	The respondents for the households and the environment survey (HES) were part of community health survey (CHS) who were interviewed for the CHS. The response rate of the HES to get the SHEU.
Sample/Population size	21 690 / 12 932 350
Response rate	45%
Time to complete	60 minutes
Mandatory	No
Incentive	None
Survey respondents	Households, property managers/landlords

Natural Resources Canada
www.nrcan.gc.ca

Office of Energy Efficiency (OEE)

Energy Use Inside and Outside the Dwelling - 2007 Survey of Household Energy Use - Supplemental Report

Appendix B. Questionnaires

Energy use inside the dwelling

Energy use outside the dwelling

Section: Sport recreation vehicles / Outdoor equipment

Have you / Has anyone in your household owned any of the following recreational vehicles in the last 12 months?

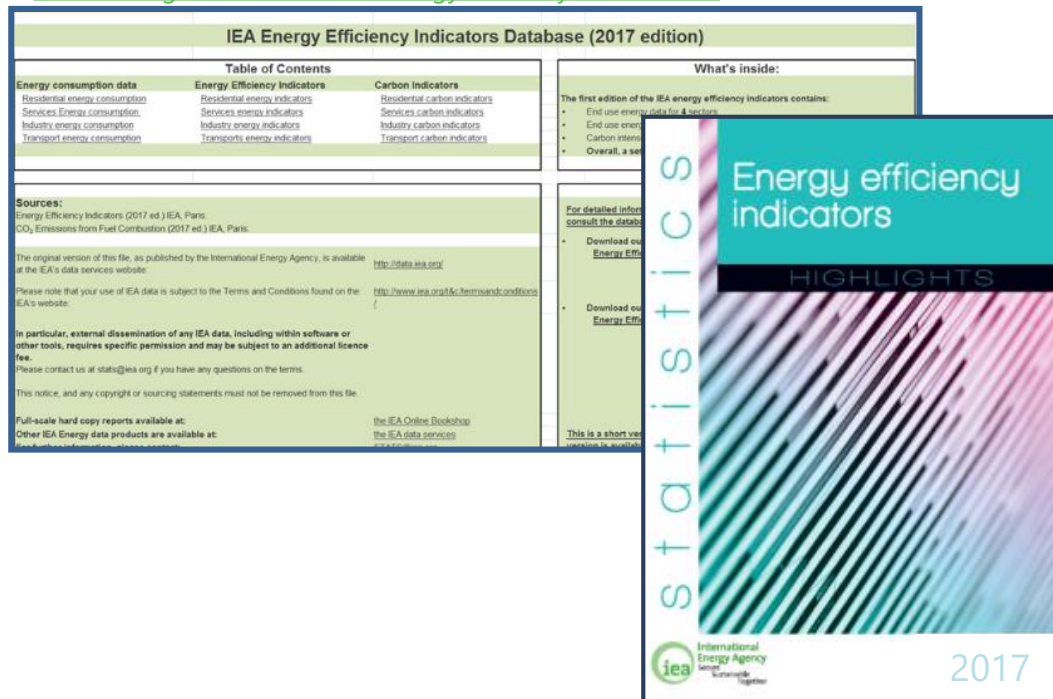
... All-terrain vehicle (ATV)
... Snowmobile
... Dirt bike or motorcross motorcycle
... Personal watercraft (e.g. a sea-doo or jet-ski)
... Motorboat (with an inboard or outboard motor)
... Household does not own any recreational vehicles

1 Yes
2 No

The IEA Efficiency statistics: publication and excel database

- Data from countries
- Annual updates
- Covers **four sectors** (*residential, services, industry and transport*)
 - ✓ End use data
 - ✓ Energy efficiency indicators
 - ✓ Carbon intensity indicators
- Available online for download

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



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

Energy efficiency indicators: an area that is quickly developing

Energy efficiency indicators: Manuals

Fundamentals on Statistics: provides guidance on how to collect the data needed for indicators

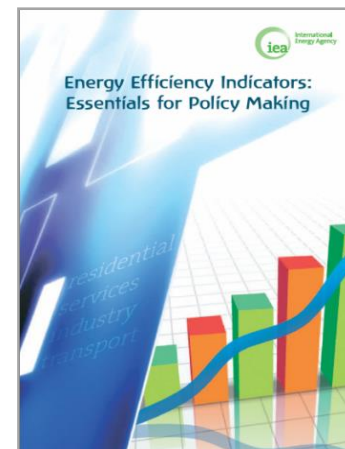
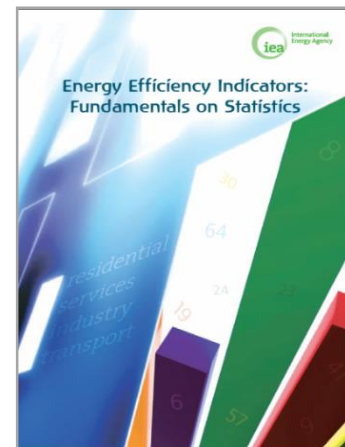
- Includes a compilation of over 170 practices from across the world
- <https://goo.gl/Y8QD1G>

Essentials for Policy Making: provides guidance to develop and interpret energy efficiency indicators

- <https://goo.gl/agcNg2>

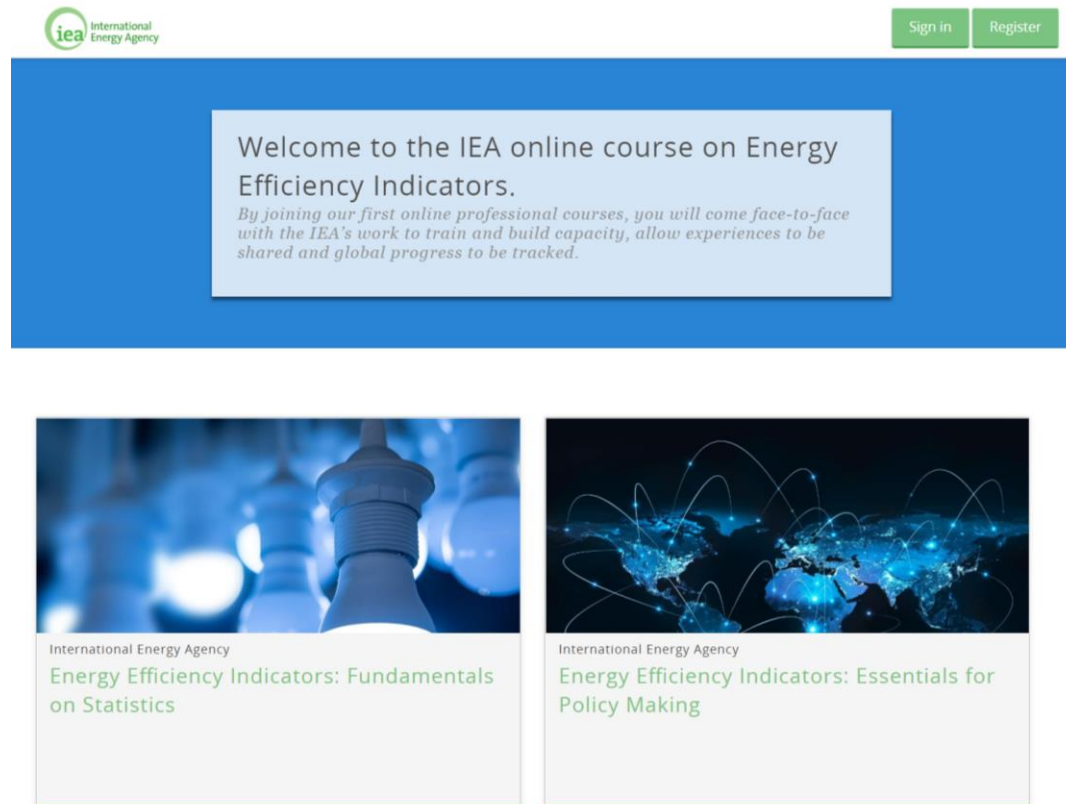
Multiple languages: both books are available in:

- English
- Spanish
- Russian
- Chinese



IEA indicators manuals: free online courses

- Global tool
- self-paced and interactive
- For policy makers
- For statisticians
- For use in any country



The screenshot shows the IEA online course landing page. At the top left is the IEA logo and the text 'International Energy Agency'. At the top right are 'Sign in' and 'Register' buttons. The main header is a blue banner with a white box containing the text: 'Welcome to the IEA online course on Energy Efficiency Indicators. By joining our first online professional courses, you will come face-to-face with the IEA's work to train and build capacity, allow experiences to be shared and global progress to be tracked.' Below the banner are two course cards. The left card has a background image of light bulbs and is titled 'Energy Efficiency Indicators: Fundamentals on Statistics'. The right card has a background image of a globe with energy lines and is titled 'Energy Efficiency Indicators: Essentials for Policy Making'. Both cards have the IEA logo and name at the top.

International Energy Agency

Sign in Register

Welcome to the IEA online course on Energy Efficiency Indicators.
By joining our first online professional courses, you will come face-to-face with the IEA's work to train and build capacity, allow experiences to be shared and global progress to be tracked.

International Energy Agency
Energy Efficiency Indicators: Fundamentals on Statistics

International Energy Agency
Energy Efficiency Indicators: Essentials for Policy Making

<https://edx.iea.org/>

“You can’t control what isn’t measured”

- End-use data shows by who, where and why energy is being used
- Creates the means to design cost effective policies
- Provides the means to monitor and evaluate and thus adapt

IEA is helping globally by:

- Developing an international energy efficiency data collection system
- Delivering manuals, sharing practice and targeted training events
- Developing comparative data sets
- Promoting the use of data in policy making
- Leading with France the G20 Energy End Use initiative



www.iea.org

 #energyefficientworld