Why data matters for Energy Efficiency and renewable policies

Duncan Millard, Chief Statistician IEA

Beijing, 23rd to 25th May 2018

Overview

- Introduction to the IEA and its Energy Data Centre
- Why is data important to policy
- What information is needed to understand energy efficiency and renewables?
- Collection of energy efficiency data - summary
- Collection of renewables data - summary

The IEA and its Energy Data Centre

The IEA

Formed in 1973 in wake of oil embargo with mission to promote member country energy security – autonomous agency of the Organisation for Economic Cooperation and Development (OECD)

30 member countries

Asia Pacific: Australia, Japan, Republic of Korea and New Zealand
Americas: United States, Canada, Mexico (since Feb 2018)
Europe: Austria, Belgium, Czech Rep, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey and United Kingdom
European Commission also participates in the work of the IEA
Chile are in the process of accession to become members of the IEA
China, Indonesia, Thailand, India, Morocco, Brazil and Singapore are countries in **Association**

Decision-making body: Governing Board - Consists of member country representatives
Under the Governing Board, several committees are focusing on each area
Secretariat: Staff of around 260, mainly energy experts and statisticians

Modernisation and Open door policy started in 2015

Role of the statistics team

From 4 year IEA statistics strategy, first produced in 2016

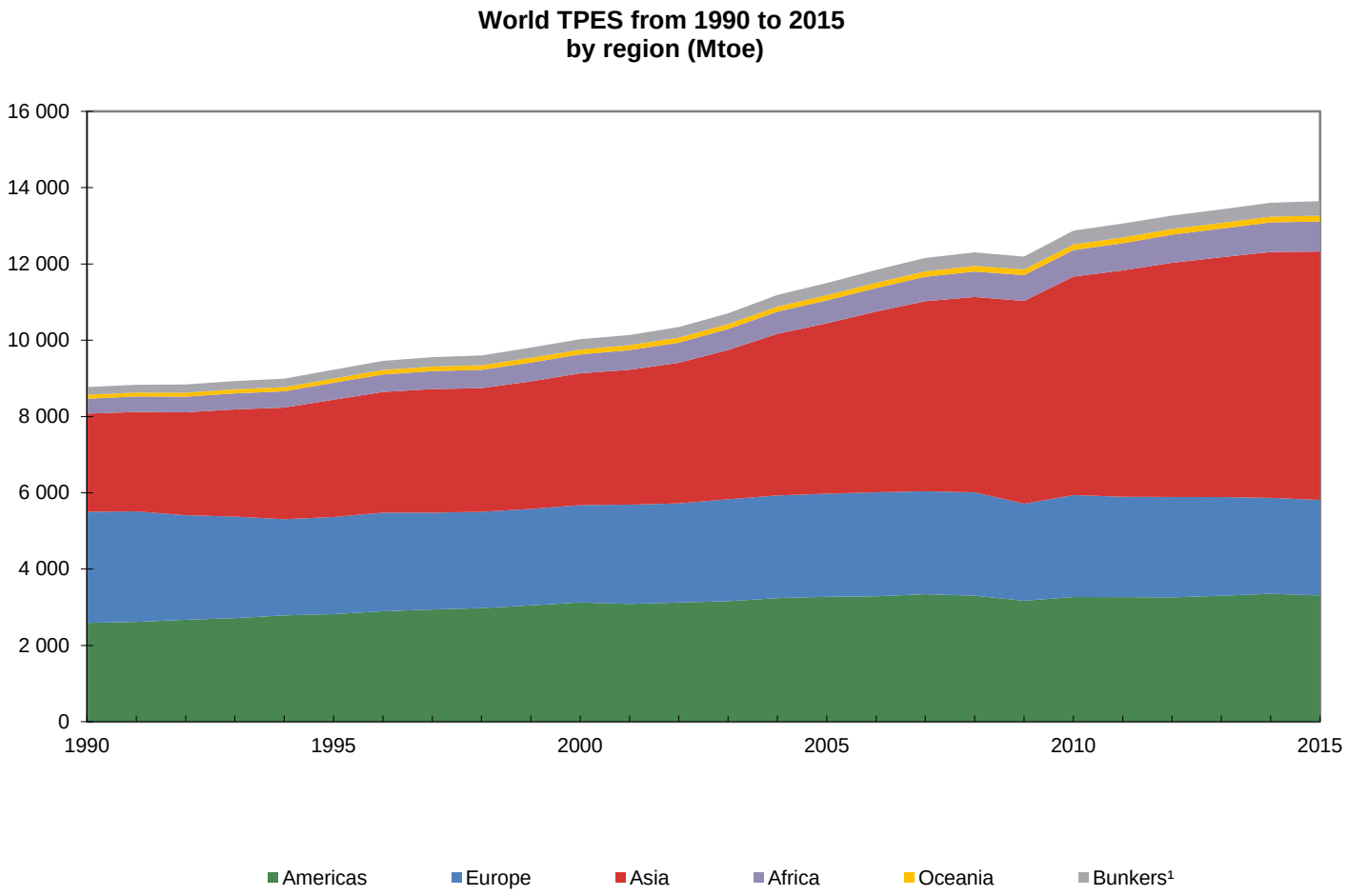
Mission

To be the premier source of worldwide energy statistics

Goals/Objectives

- To provide the statistics needed to support the mission of the Agency and all members
- To be a global reference in the methodological work on energy statistics
- To provide and further develop comprehensive global energy statistics and enhance their dissemination to inform debate and facilitate advancements in energy policy
- To improve countries ability to produce energy stats, through training and cooperation, with a particular emphasis on association countries
- Raise the profile of statistics and statisticians and highlight the relevance to policy making
- To provide opportunities for staff to develop skills and experience

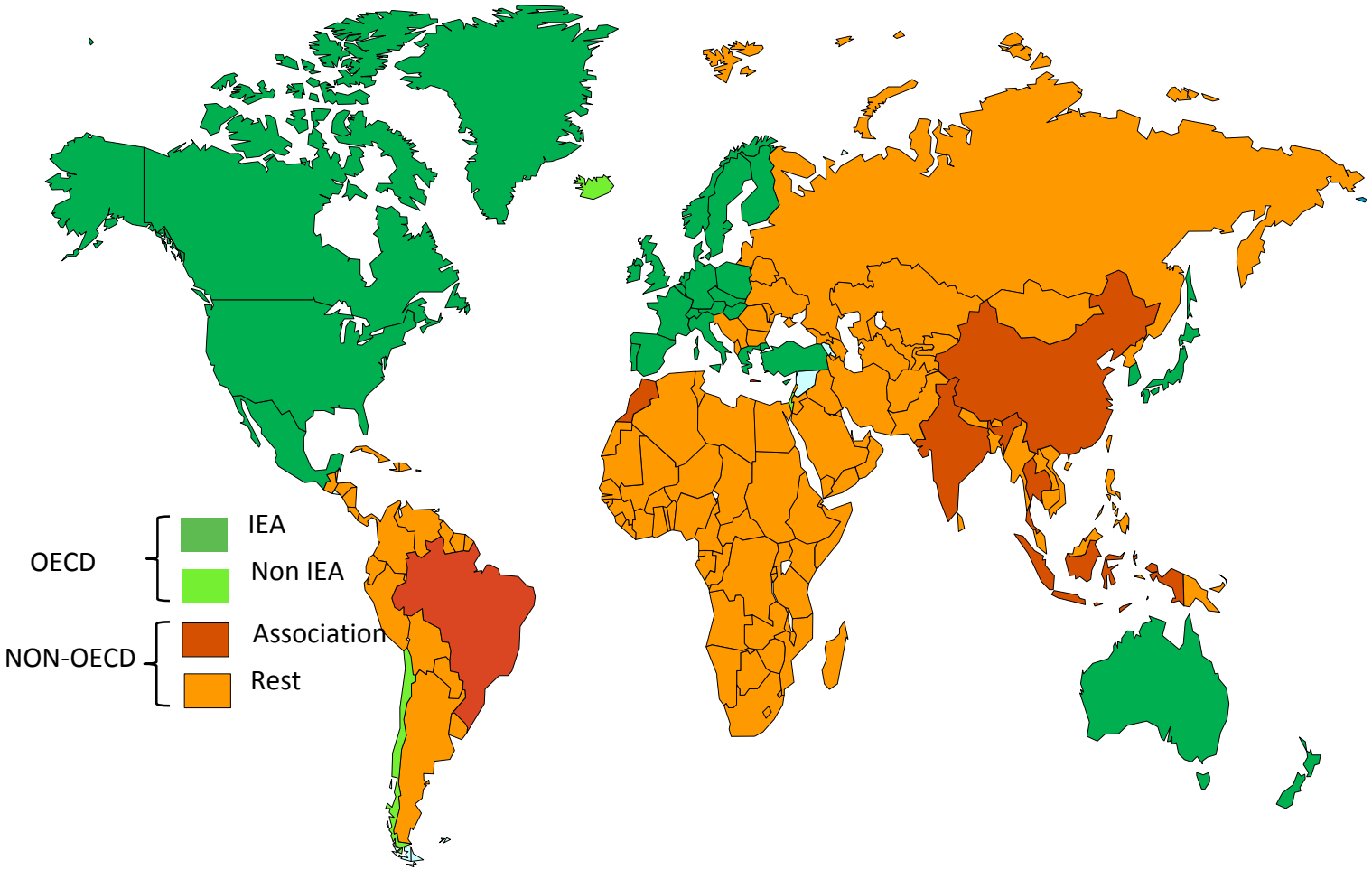
Total primary energy supply (TPES) by region



Source: IEA, Key World Energy Statistics, 2017

Data collection at the IEA: the road to global outreach

- **IEA collects data from 150 countries, on a voluntary basis for all non-OECD countries**



Data Collection by the IEA – source: direct from countries

OECD

- 5 annual Joint questionna
- Annual collection on Energy efficiency, RD&D and forecasts
- Quarterly questionnaire on prices and taxes
- Monthly questionnaire
  - Electricity
  - Oil and gas (M-2)
  - Oil and gas (JODI) (M-1
- Emergency questionnaires

Non-OECD

- Voluntary
- Joint IEA/UNECE/Eurostat questionnaires used by some and growing
- Network of statistics contacts in 120 countries
- Cooperation with international organisations

Common objective for all - to improve timeliness and detail of data sent to IEA
http://www.iea.org/statistics/resources/questionnaires/

IEA statistics dissemination

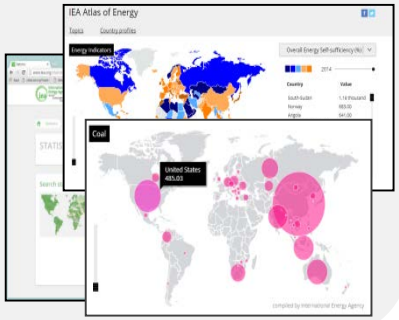
Annual and quarterly Publications

Fuel Information books, World energy statistics & balances, CO_2 emissions...

Free overviews from books saw15,000 downloads in first 3 weeks

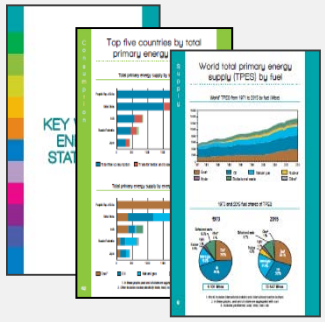
IEA website

Atlas, Sankey flows...



Booklet

Key World Energy Statistics

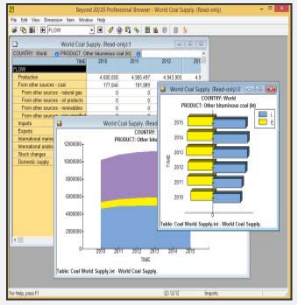


Mobile App

Android, apple and windows

Electronic data files

Data online service



What Support Does The IEA Provide?

Manuals

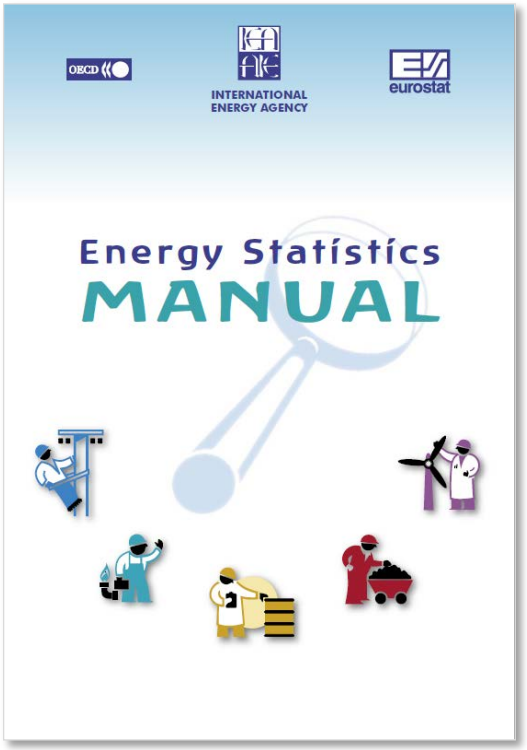
Continuous improvement in data quality

Uniformity across agencies

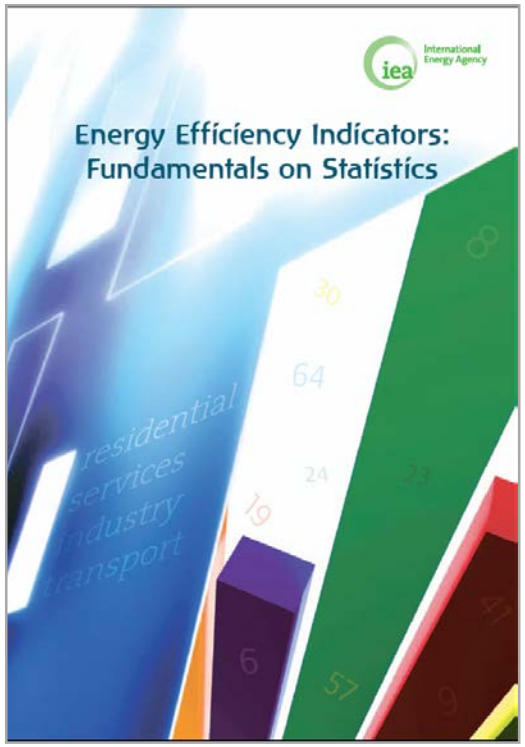
Training Capacity Building

Open communication with country sources

Energy Statistics Manuals and guidance



Available in 10 languages

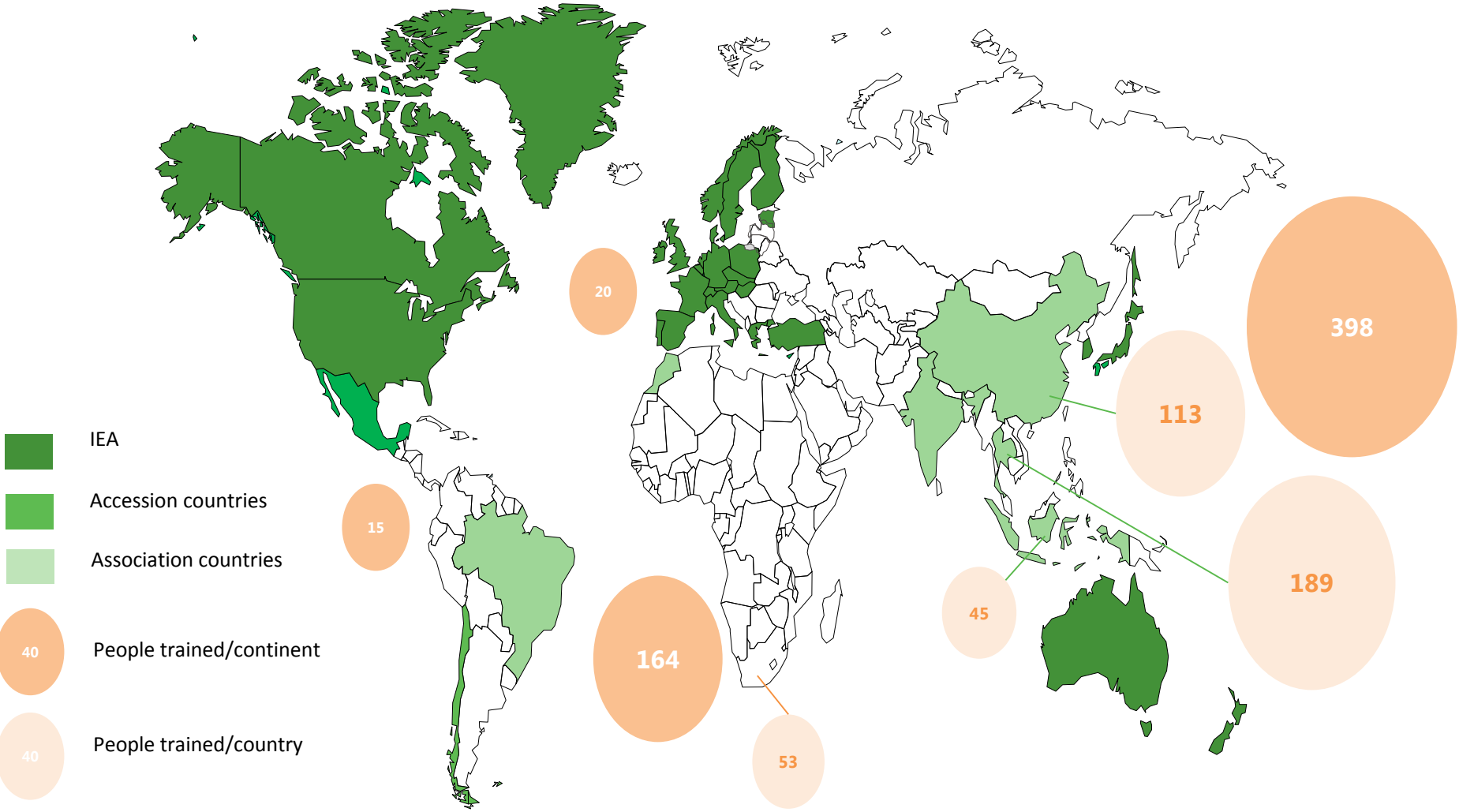


Available in 3 languages

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		

Over 170 country practices

IEA Training and Capacity Building Overview in 2017



The IEA directly trained 594 statisticians worldwide and over 4,000 online

Online Training: The IEA Online School Program 2017

Module	Online Video	Content	YouTube viewers
Data reporting	Coal	Primarily for our contacts to be trained in how to use the Joint Questionnaires.	265
	Oil		248
	Gas		267
	Electricity and heat		198
	Renewables		218
Data analysis	Energy balances	Dedicated to energy analysts.	667
	CO2		215
	Energy efficiency		859
Prices	Energy prices and taxes	Both on data collection and analysis of data.	915
Toolkit	What is the difference between primary and secondary energy?		858

9 webinars to cover the range of energy statistics,
http://www.iea.org/training/ieaonlinestatisticstrainingprogramme/ieaonlinestatisticsschool2017/
Chinese launched this week
(aiming to make available in other languages (French, Spanish, Arabic, Russian)

Why is data important to policy

Why do we need energy data?

- "There is a clear need for increasing co-operation among the IEA family to address global challenges effectively. Raising the quality of global energy data and statistics also depends heavily on international co-operation". Concept paper for the 2017 *IEA Ministerial meeting*.

- *Ministers also noted* the prominence of the IEA as the world's leading source of authoritative energy analysis, data and statistics *Summary of the Chair,* Mr. Ibrahim Baylan, Minister for Policy Coordination and Energy, Sweden *2017 IEA Ministerial Meeting*

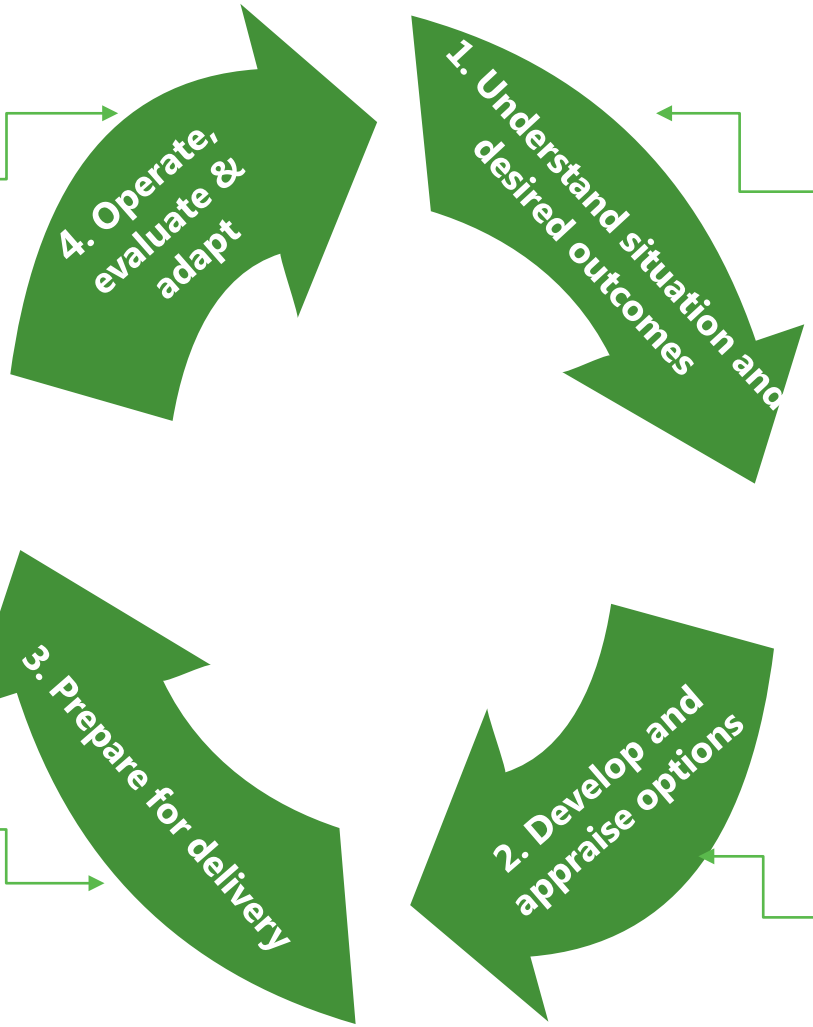
Energy security
Production
Energy access
Off grid generation
Renewables
RD&D
Prices
Investment
Energy efficiency/use

Why a country needs comprehensive energy statistics

- Energy underpins all economic activity (output and transport)
- Need to ensure adequate security and understand risk to supply – be able to understand all flows and ability to model the future
- Provides clear understanding for investors and business
- Understanding energy use allows for efficiency, greater output at lower cost
- Required to address climate change and identify cost effective steps
- Design, monitor and evaluate policies

How do energy statistics help policy-making?

- Monitoring performance indicators and expected benefits
- Evaluation and reporting

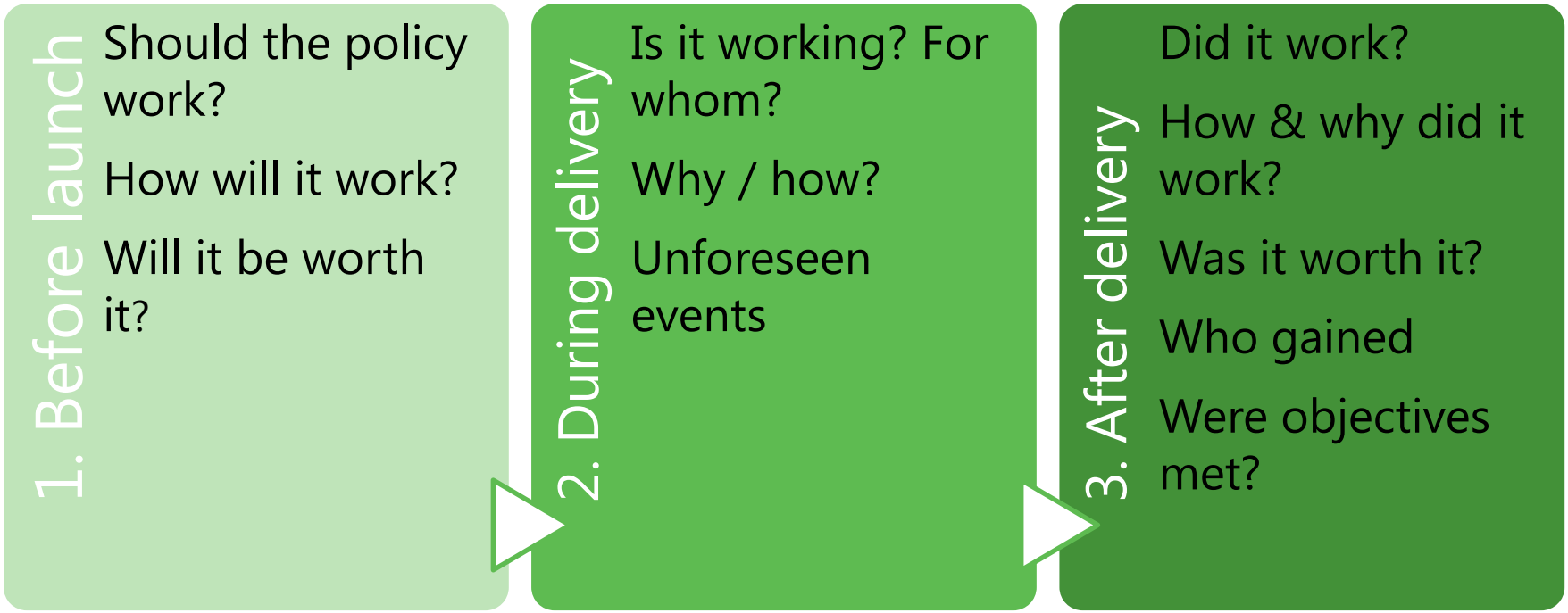


- Do we really understand what the problem or issue is?
- Are you sure there is a gap?
- What policy or evidence is already out there & what are others doing in the country broad?
- What outcome would indicate success?

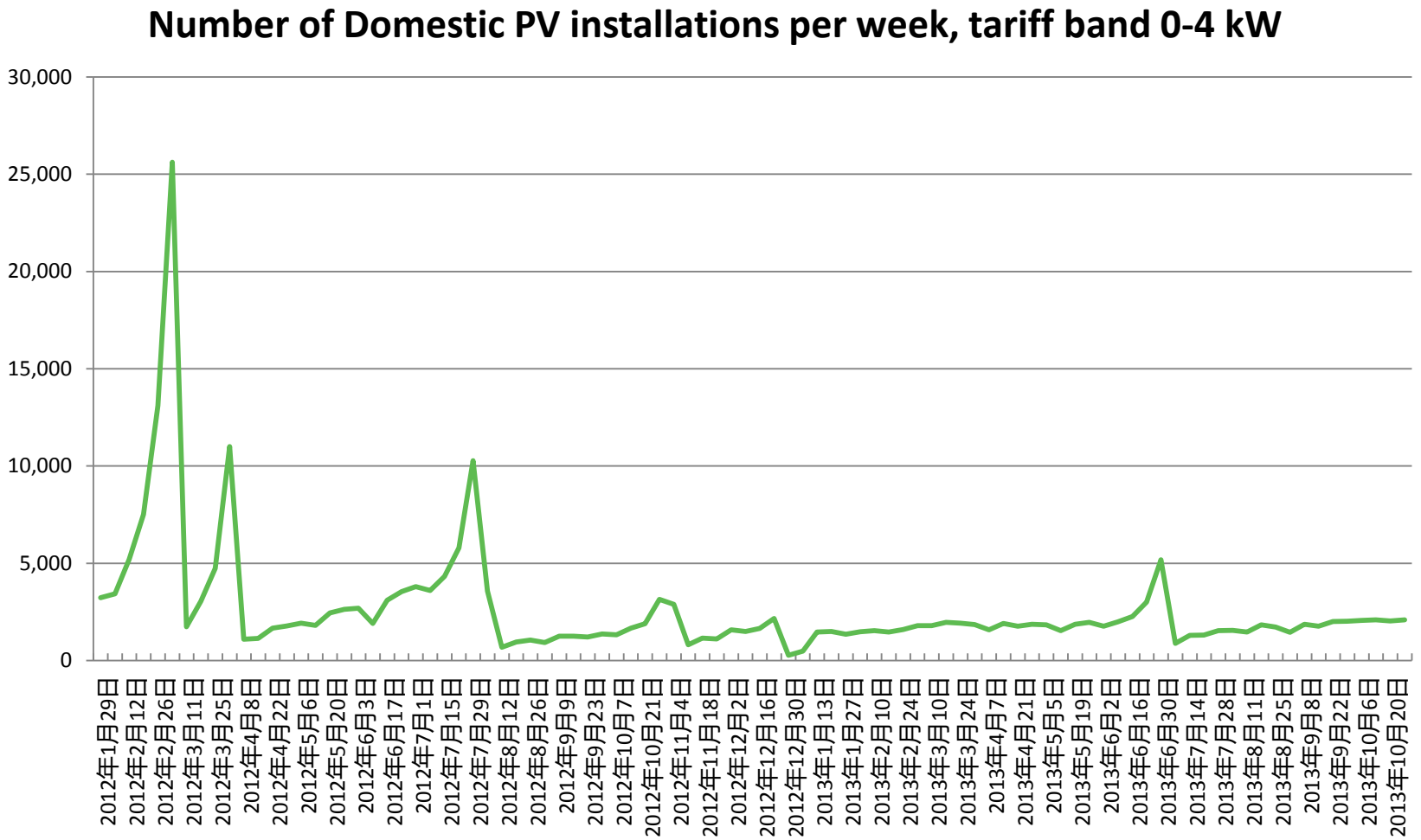
- Understand, quantify & analyse impacts, costs, risks & benefits of policy options,
- Address evidence gaps & identify research & analysis required
- Verify baseline data

- Undertake pilots & collect good practice
- Benchmark against other schemes
- Agree and put in place delivery arrangements with delivery partners and regulators
- Put in place policy monitoring, evaluation & reporting mechanisms

When to Monitor and Evaluate?



Example - UK Feed in Tariff scheme



A1 Energy Efficient Appliance

Thailand Incandescent Phase-Out Scheme (2007-2010)

- To foster the permanent use of good quality CFLs in place of GLS incandescent lamps by 2010 using Energy Conservation Fund & EGAT budget

Strategies

Supply Side

- ✓ No mandatory enforcement
- ✓ Continue voluntary endosement label NO. 5 program

Demand Side

- ✓Give away **800,000** CFLs to stimulate public recognition
- ✓Public campaigns & Market advertising
- ✓Selling low-priced CFLs with 1 year warranty throughout the country in cooperation with suppliers participating in the program

Targets in 2010:

- Average market price of CFLs < **60** Baht (50% reduction from 120 Baht)
- **60 – 70%** customer satisfaction in price & quality of CFLs

❖ Supported by Energy Conservation (ENCON) Fund, a Public Fund)

A1 ➡ Energy Efficient Appliance

Incandescent Phase-Out Scheme (2007-2010)

17

➢ Results to Date

- ✓ Average market price of CFLs lower by 20%
  (Before: 120 Baht in 2006, After: 77 Baht in 2011)
- ✓ Number of CFLs labeled no. 5 increased from average 3 millions in 2006 to 9 millions in 2007 to 13 millions in 2008 and 10 millions on average in 2009-2012.
- ✓ Energy savings of **2,502 GWh** with peak demand reduction of **386 MW** and CO_2 reduction of **1.3 million ton**
  (since labeling scheme in 2008 to April 2013)

Campaign: Together in

➢ Note:

- Market barrier of high initial cost of
- CFLs has been gradually reduced.
- Customer information and awareness has been widely raised.

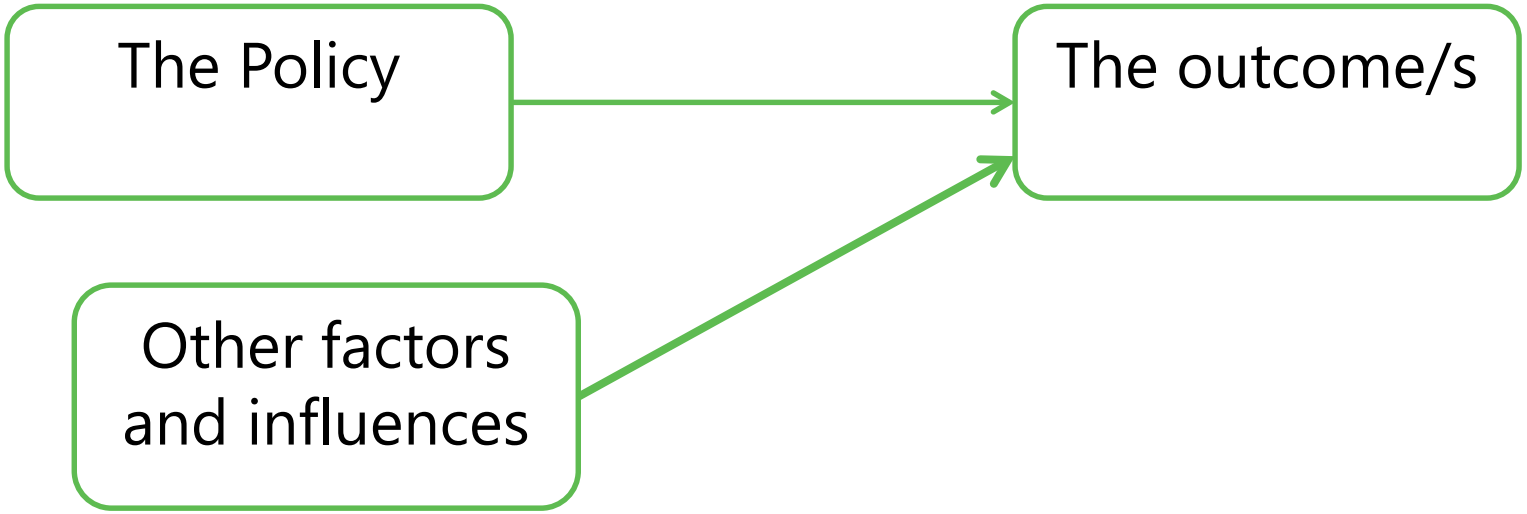
The impact evaluation problem

- Measuring outputs is straightforward, if not simple. Outcomes / impacts are more difficult…

- Why more difficult?

Did it work? Evaluating policy impacts

- Measuring outputs is straightforward, if not simple. Outcomes / impacts are more difficult…



Other factors include:

- Global, national, local trends / events
- Other policies
- Hotter/colder weather

The counterfactual (what would have happened)

- *"what would have happened if you hadn't implemented the policy"*

- Impact evaluations provide an estimate of the impact by directly measuring what has/is modelled to happen in control or comparison groups
  - measure outcomes amongst those that do (treatment) and do not receive the intervention (control or comparison groups).
  - assumes the only systematic difference between groups is the exposure to the intervention
  - Harder if the counterfactual is modelled

- It is always an estimate though – you cannot directly 'measure' the counterfactual

Policy types and challenges

- Direct implementation of one type of technology

Easier

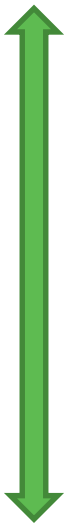
- Public information campaigns

Harder

Multiple policies make analysis of impact harder still

Designs for estimating the counterfactual

Stronger designs

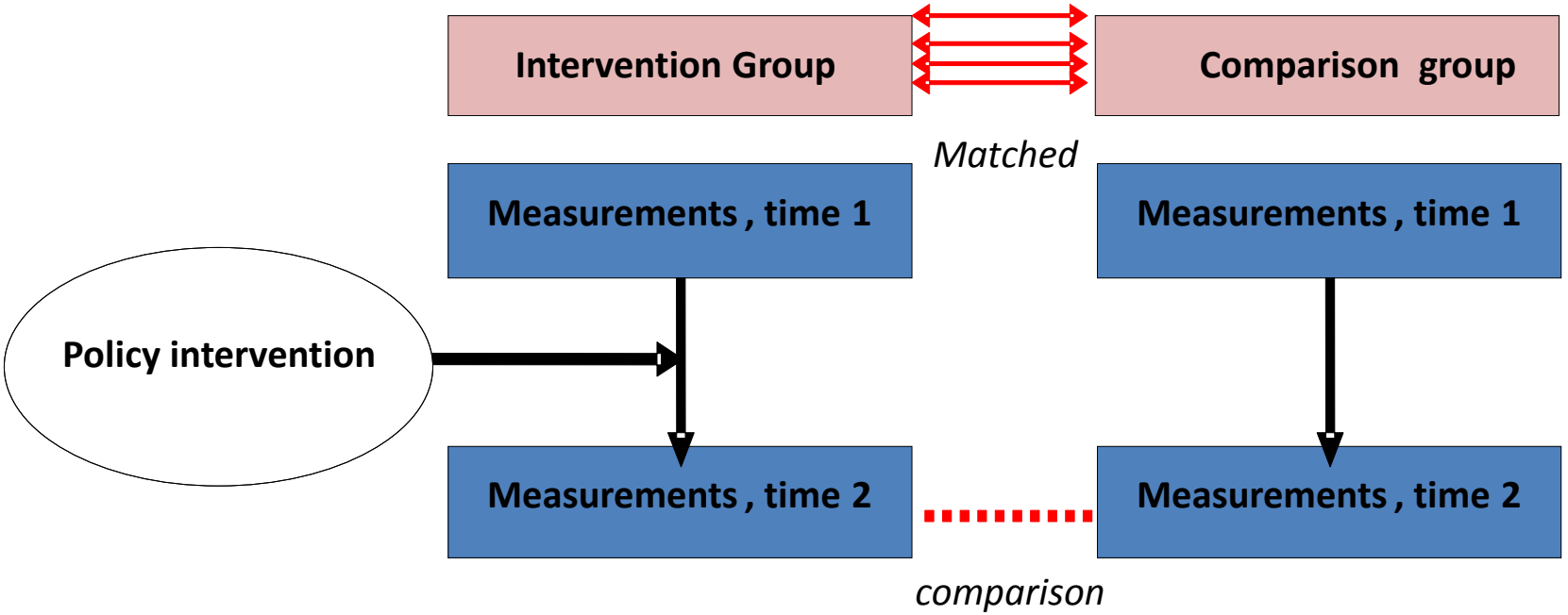


- Randomised controlled trial
- Matched comparison group designs
- Parallel trends
- Non matched groups
- Modelled counterfactual

Weaker designs

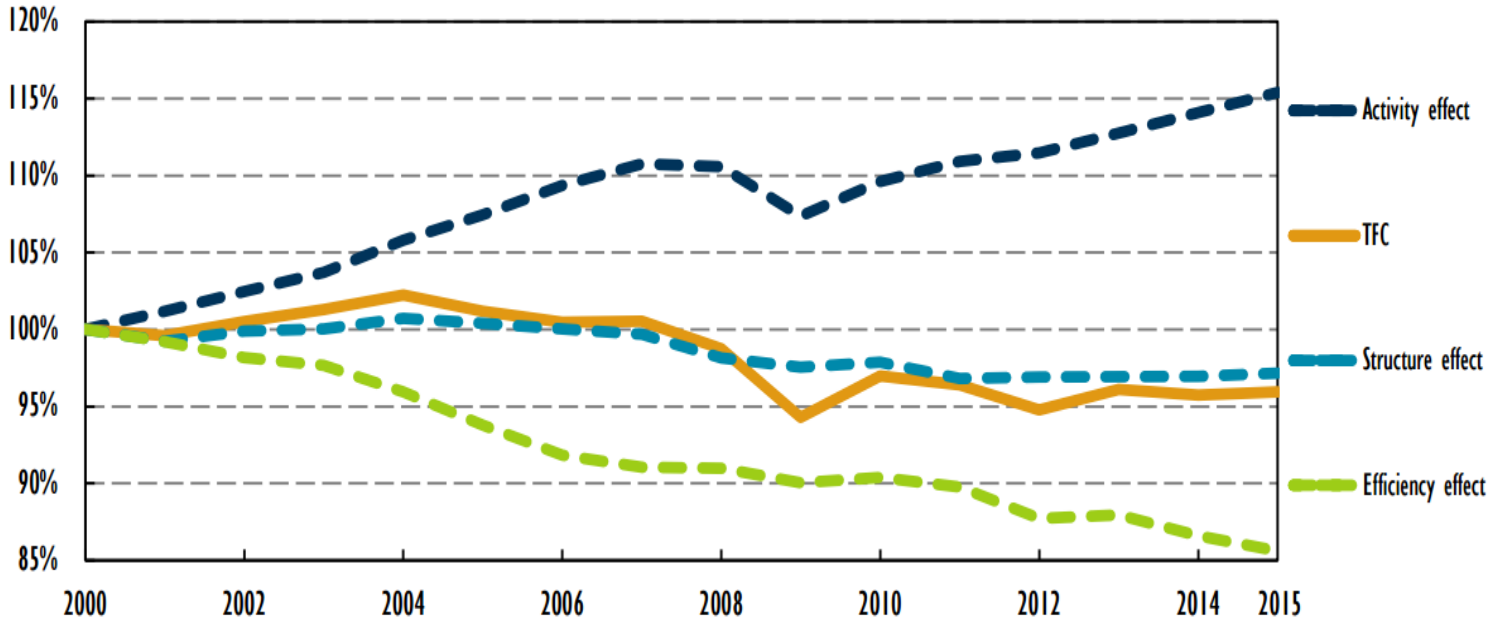
Matched groups

Groups **carefully matched** and outcomes of interest are compared between the intervention group and **matched** comparison group



What information is needed to understand energy efficiency and renewables?

Understanding energy consumption drivers - need to go beyond intensity



Note: Analysis based on the *IEA Energy Efficiency Indicators* database (2016 edition). TFC in this analysis covers the following sectors: residential, industry and services, passenger and freight transport. It does not include agriculture, non-energy, and energy supply sectors. The energy consumption decomposed in this analysis represents 90% of TFC in IEA countries in 2015.

Source: IEA ***Energy Efficiency Market Report 2016***

The importance of energy balances…

Supply

Transformation

Final consumption

World

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	1053.71	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	6.49	6.16	17.84	-	-	-	-0.54	-	-	-49.86
TPES	3475.77	4159.37	-51.93	2727.61	718.96	295.62	112.02	1278.03	0.64	1.04	12717.16
Transfers	0.00	-156.64	179.33	-	-	-	-	-	-	-	22.69
Statistical differences	-49.50	11.30	-27.05	-1.68	-	-	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	150.84	-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/pat.fuel/BKB plants	-51.08	-	-2.40	-0.00	-	-	-	-0.01	-	-	-53.49
Oil refineries	-	-3964.42	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	-2.22	-	-	-	-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
TFC	853.14	34.34	3535.48	1318.16	-	-	21.87	1102.01	1535.69	275.93	8676.63
INDUSTRY	677.86	12.51	310.02	463.87	-	-	0.46	195.83	636.96	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	162.78
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	36.14
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	89.06	-	-	-	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	-	-	-	0.01	-	-	44.16
Non-specified	0.01	0.00	5.73	0.49	-	-	-	0.00	2.97	-	9.21
OTHER	135.96	6.75	435.64	612.83	-	-	21.41	848.62	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/transf./energy	35.63	15.05	569.93	152.40	-	-	-	-	-	-	773.01
of which: feedstocks	*2.44*	*14.49*	*362.42*	*149.75*	-	-	-	-	-	-	*529.10*
in transport	-	-	6.63	0.00	-	-	-	-	-	-	6.63
in other	0.33	-	17.38	-	-	-	-	-	-	-	17.71
Electricity and Heat Output											
Electr. Generated - GWh	8697512	27881	961377	4768076	2756289	3437483	449596	331679	-	1573	21431466
Electricity plants	*8091865*	*27864*	*891872*	*3582493*	*2746188*	*3437483*	*446008*	*211248*	-	*827*	*19435848*
CHP plants	*605647*	*17*	*69505*	*1185583*	*10101*	-	*3588*	*120431*	-	*746*	*1995618*
Heat Generated - TJ	5706864	26036	751312	6597541	27357	-	346248	761894	7495	60077	14284824
CHP plants	*2058353*	*216*	*299046*	*3489955*	*20944*	-	*10389*	*434740*	*208*	*24958*	*6338809*
Heat plants	*3648511*	*25820*	*452266*	*3107586*	*6413*	-	*335859*	*327154*	*7287*	*35119*	*7946015*

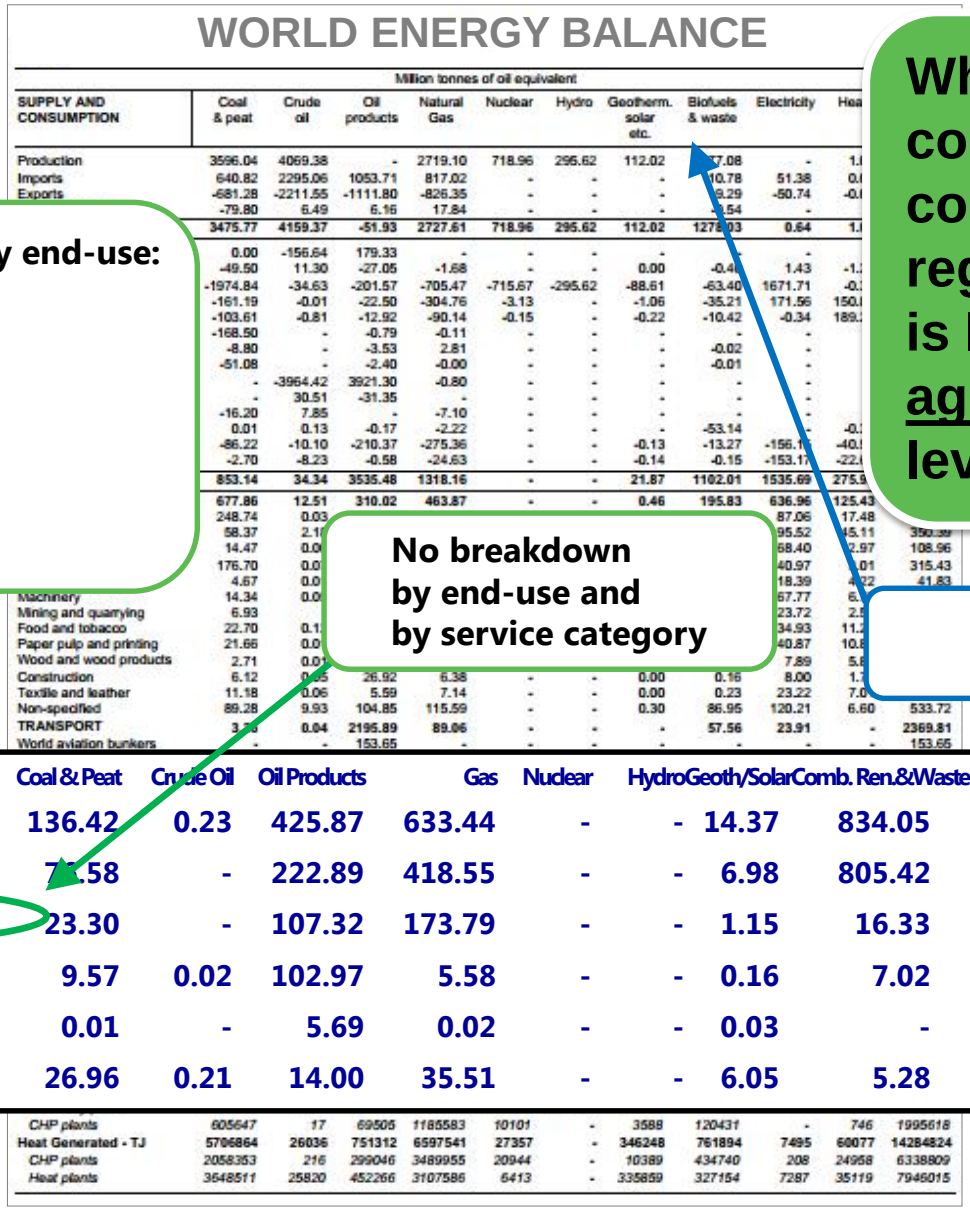
Energy intensity, Self-sufficiency …

Efficiencies of transformation sector

Shares of energy consumption by sector

Shares of electricity generation by source

… and its limitations



No breakdown by end-use:

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

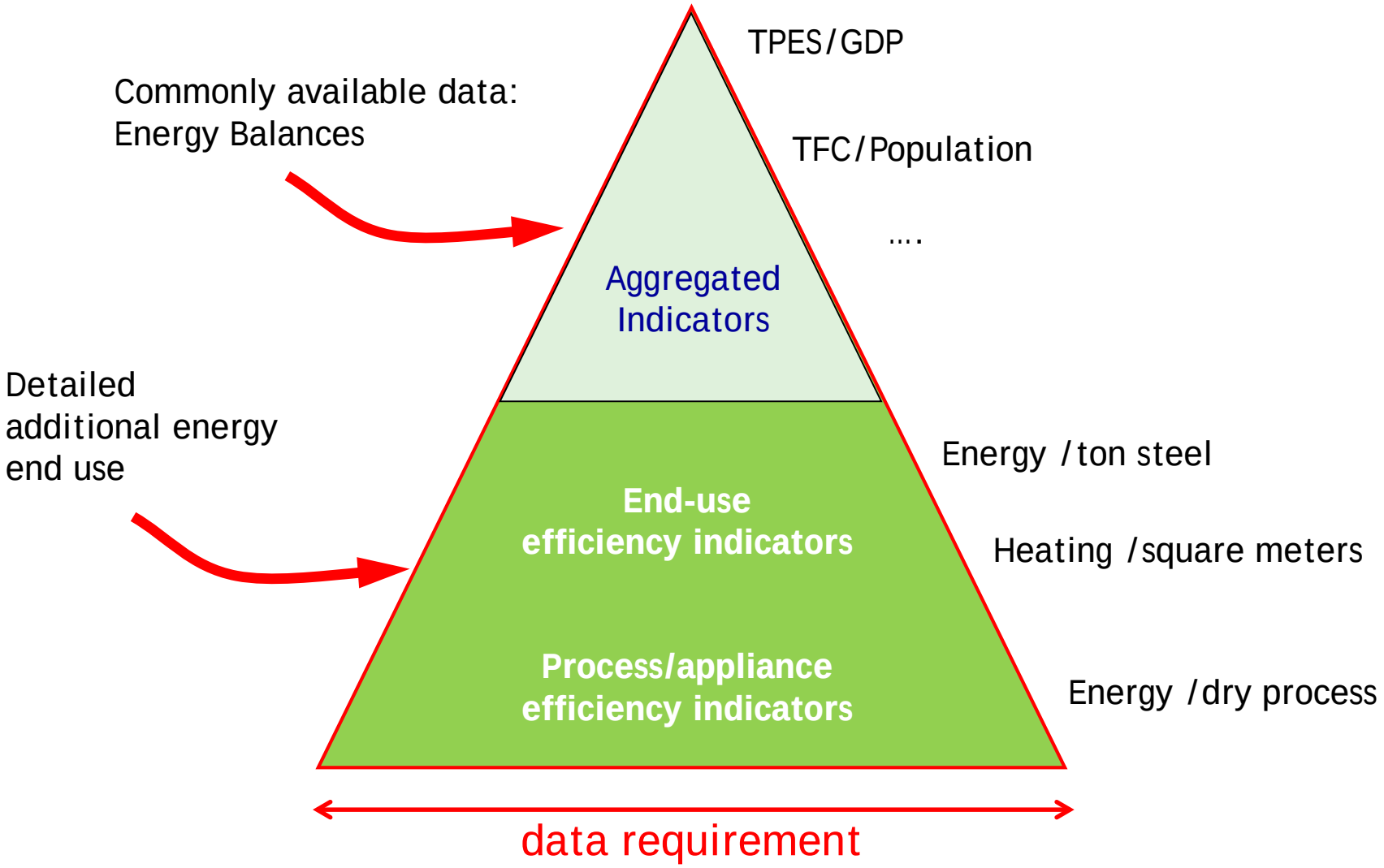
What most countries collect on a regular basis is limited to <u>aggregated</u> levels

No breakdown by end-use and by service category

No breakdown by type

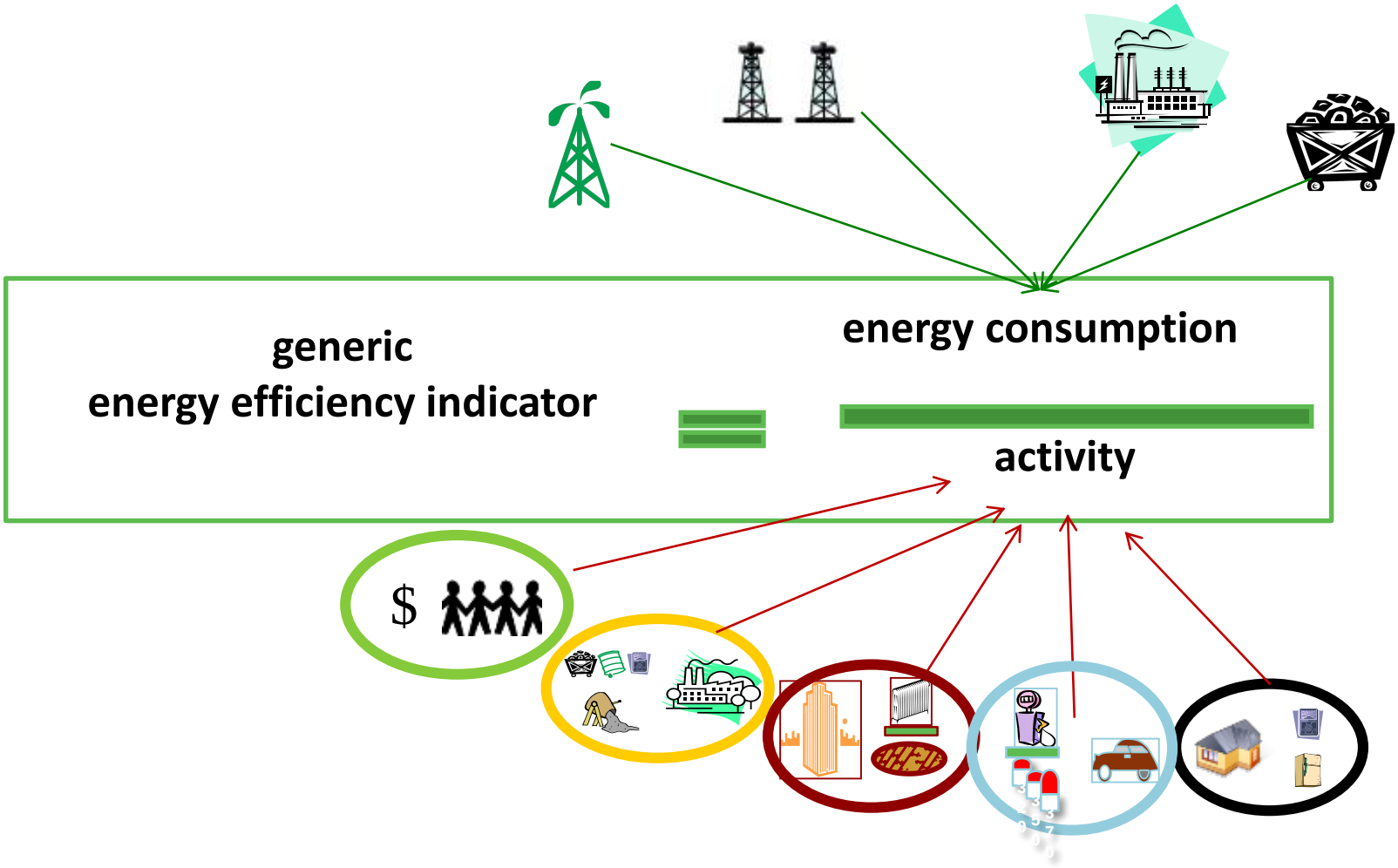
	Coal & Peat	Crude Oil	Oil Products	Gas	Nuclear	Hydro	Geoth/Solar	Comb. Ren.&Waste	Electricity	Heat	Total
OTHER SECTORS	136.42	0.23	425.87	633.44	-	-	14.37	834.05	820.32	145.22	3036.92
Residential	7[illegible]58	-	222.89	418.55	-	-	6.98	805.42	395.81	97.97	2024.19
Commercial (Services)	23.30	-	107.32	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 details for EE?



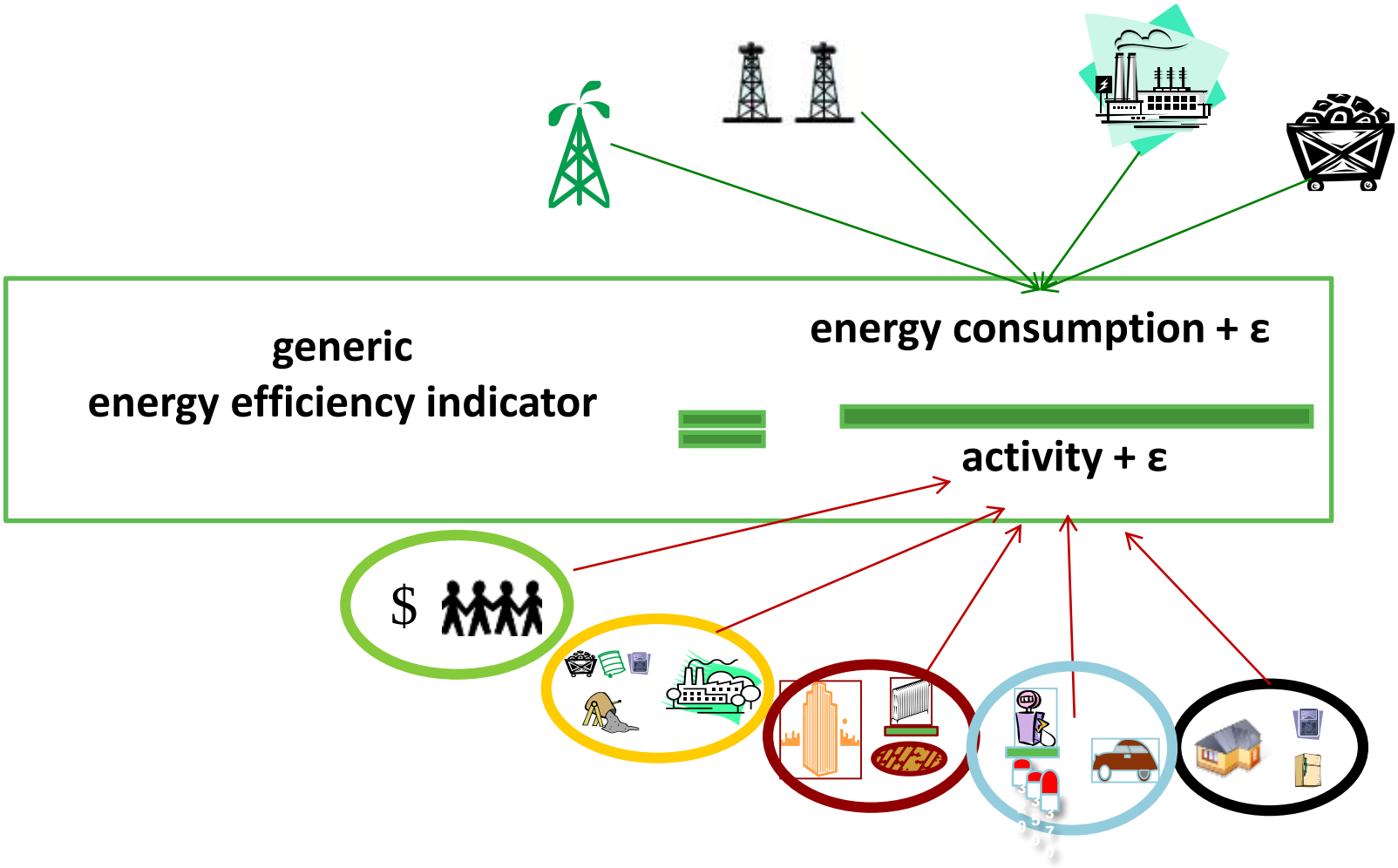
Significant new data are needed to build a minimum set of disaggregated indicators?

Indicators link activity and energy data – the reality



Linking energy use and service produced (activity)

Indicators link activity and energy data – the reality



Need to understand the accuracy of both the energy and activity data – are error terms greater than change
Think about data in indicators

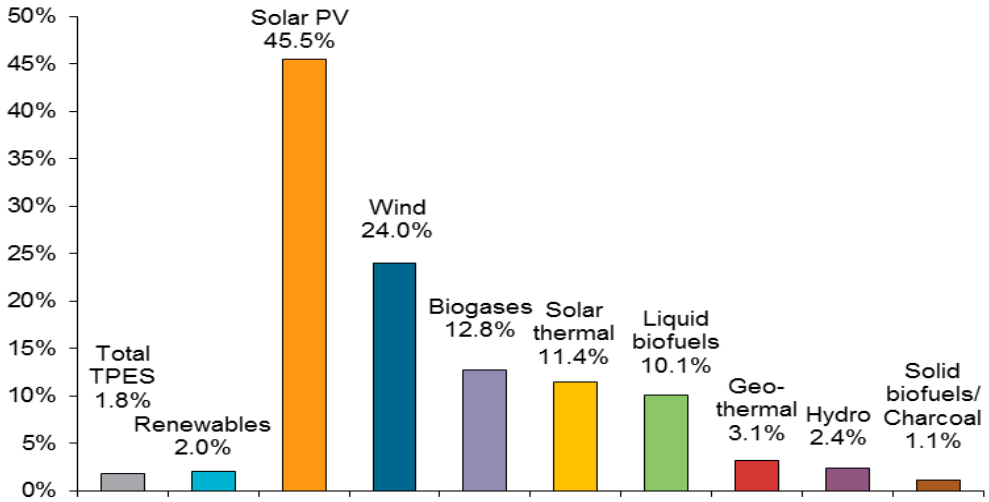
Renewables

Three main uses of renewables: elec generation, heating, transport

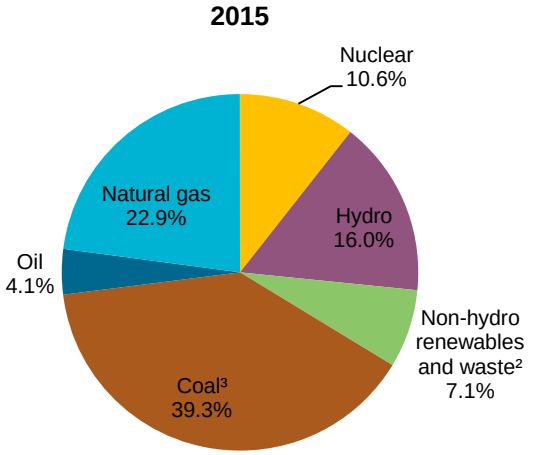
Need

- Share of renewables by type
- Level
- Growth rate

Annual growth rates of world renewables supply from 1990 to 2015



Source shares of electricity generation



How to collect energy efficiency data?

Energy Use data collection

- Maximise the use of administrative data
- Remove barriers to data sharing across gvt (survey and admin)
- Operational policy data can be really effective
- End use surveys likely to be needed covering energy consumption and activity data
- Plan cycles to cover residential, services, industry, transport (what time gap)
- Smaller survey run twice, better than one large one
- Requires funding, but having no data will cost more

Challenges faced by countries

- Cooperation across institutions
- Need for new surveys or estimations
- Ensuring quality and consistency
  - with official energy statistics
  - between energy and activity data
- Delivering timely data

The IEA Energy Efficiency Indicators (EEI) Template

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-cons
INDUSTRY	Energy consumption by ISIC categories
SERVICES	Energy consumption by end-uses in the servi
RESIDENTIAL	Household energy consumption by end-uses
TRANSPORT	Energy and activity data for passenger and fr
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

Energy consumption & **Activity** data for:

- INDUSTRY
- SERVICES
- RESIDENTIAL
- TRANSPORT

Source: http://www.iea.org/media/statistics/topics/energyefficiency/IndicatorsQuestionnaire.xls

The EEI Template – Residential (one of 4 sectors)

Energy consumption data:

- by end-use

	RESIDENTIAL	units	2013	2014	2015
Menu	Legend / Check all/none / Add remarks				
	Space Heating				
	Oil & Petroleum Products	PJ	99.83	86.05	0
	Natural Gas	PJ	951.07	819.75	0
	Coal & Coal Products	PJ	28.89	24.90	0
	Combus. Renewables & Waste	PJ	56.52	48.72	0
	Heat	PJ	2.17	2.17	0
	Electricity	PJ	90.02	77.59	0
	Other	PJ	0	0	0
☑	**Total**	PJ	1,228.51	1,059.18	0
	Total (climate corrected for 1990-2015)	PJ	1,107.83	1,108.15	#N/A
	Space Cooling				
	Oil & Petroleum Products	PJ	0	0	0
	Natural Gas	PJ	0	0	0
	Coal & Coal Products	PJ	0	0	0
	Combus. Renewables & Waste	PJ	0	0	0
	Heat	PJ	0	0	0
	Electricity	PJ	0	0	0
	Other	PJ	0	0	0
☑	**Total**	PJ	0	0	0
	Total (climate corrected for 1990-2015)	PJ	#N/A	#N/A	#N/A

- by appliance type

☑	**Total**	PJ	27.21	26.36	0
	Dish Washers				
	Electricity	PJ	11.87	11.94	0
	Other	PJ	0	0	0
☑	**Total**	PJ	11.87	11.94	0
	Clothes Washers				
	Electricity	PJ	20.63	20.82	0
	Other	PJ	0	0	0
☑	**Total**	PJ	20.63	20.82	0
	Clothes Dryers				
	Electricity	PJ	21.25	21.50	0
	Other	PJ	0	0	0
☑	**Total**	PJ	21.25	21.50	0
	Television/Home entertainment				
	Electricity	PJ	76.72	76.66	0
	Other	PJ	0	0	0
☑	**Total**	PJ	76.72	76.66	0

Activity data:

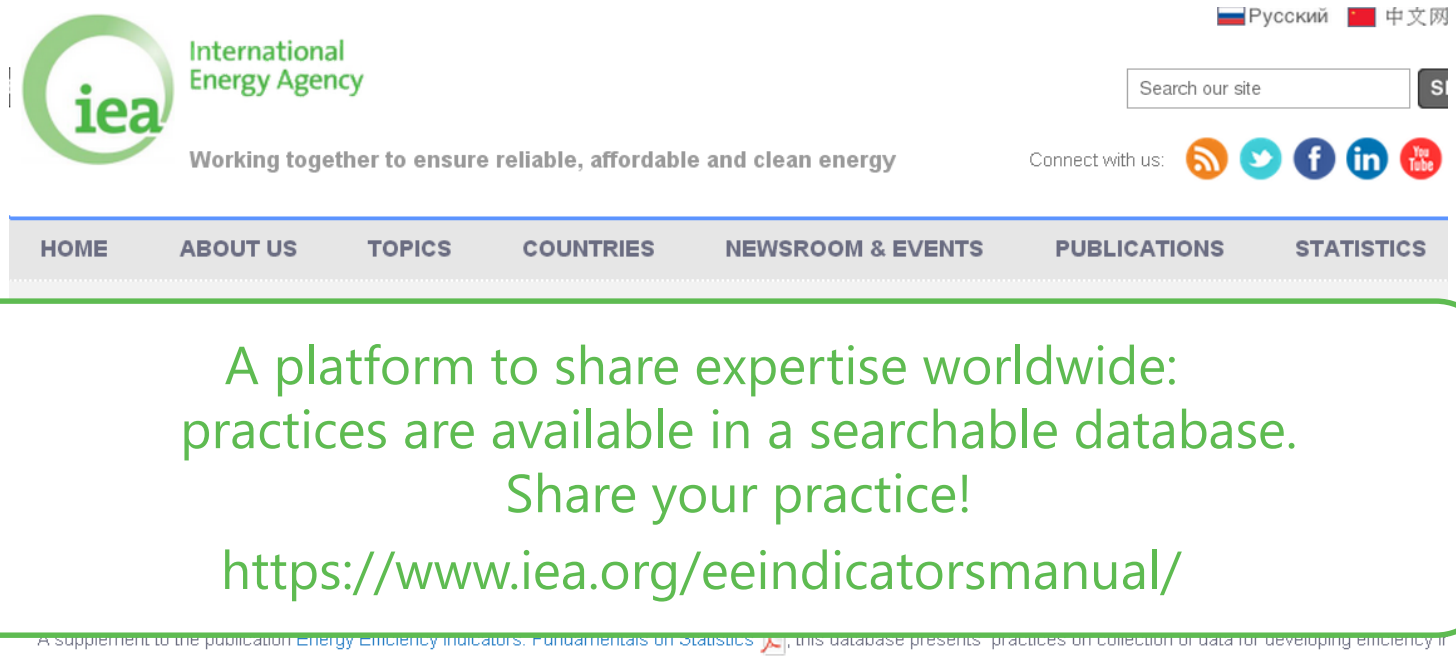
- appliances stock and diffusion

	RESIDENTIAL	units	2013	2014	2015
Menu	Legend / Check all/none / Add remarks				
	Appliances Diffusion (number of units per occupied dwelling)				
	Refrigerators	unit/dw	0.38	0.38	0
	Freezers	unit/dw	0.47	0.47	0
	Refrigerator/Freezer Combinations	unit/dw	0.69	0.69	0
	Dish Washers	unit/dw	0.38	0.39	0
	Clothes Washers	unit/dw	0.80	0.81	0
	Clothes Dryers	unit/dw	0.56	0.56	0
	Television/Home entertainment	unit/dw	2.37	2.37	0
	PC/Information & communication technology	unit/dw	1.39	1.41	0
	Appliances Stock (only within occupied dwellings)				
☑	Refrigerators	10^6	10.21	10.31	0
☑	Freezers	10^6	12.70	12.82	0
☑	Refrigerator/Freezer Combinations	10^6	18.77	18.96	0
☑	Dish Washers	10^6	10.35	10.59	0
☑	Clothes Washers	10^6	21.83	22.08	0
☑	Clothes Dryers	10^6	15.20	15.29	0
☑	Television/Home entertainment	10^6	64.24	65.42	0
☑	PC/Information & communication technology	10^6	37.87	38.47	0

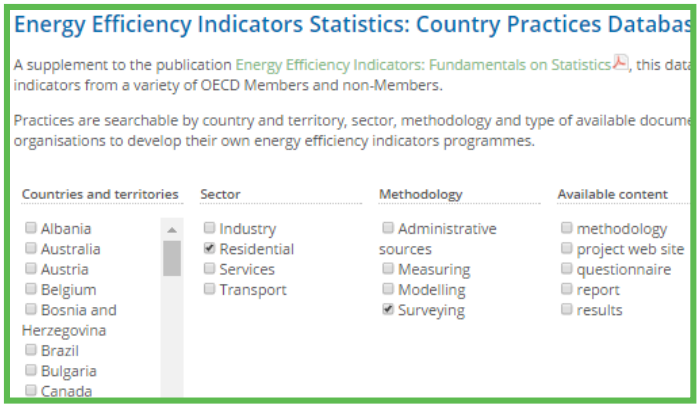
- population, number of dwellings, …

	MACRO ECONOMIC DATA	units	2013	2014	2015
Menu	Legend / Check all/none / Add remarks				
I.	**Activity & Structure Indicators**				
☑	Total Population	10^6 pers	64.11	64.60	65.03
☑	Total Employment	10^6 pers	30.04	30.75	31.29
☑					
☑	Total Dwellings	10^6 dw	27.91	0	0
☑	Occupied Dwellings	10^6 dw	27.15	27.41	0
	New Dwellings	10^6 dw	0.14	0.14	0
	Household Occupancy	pers/dw	2.36	2.36	0
☑	Total Dwelling Area (Residential Floor Area)	10^6 m^2	2,587.15	0	0
☑	Annual Heating Degree-Days	dd°C	3,179.35	2,740.35	3,017.01
☑	Annual Cooling Degree-Days	dd°C	0	0	0
☑	Total Services Floor Area	10^6 m^2	0	0	0
	New Services Floor Area	10^6 m^2	0	0	0

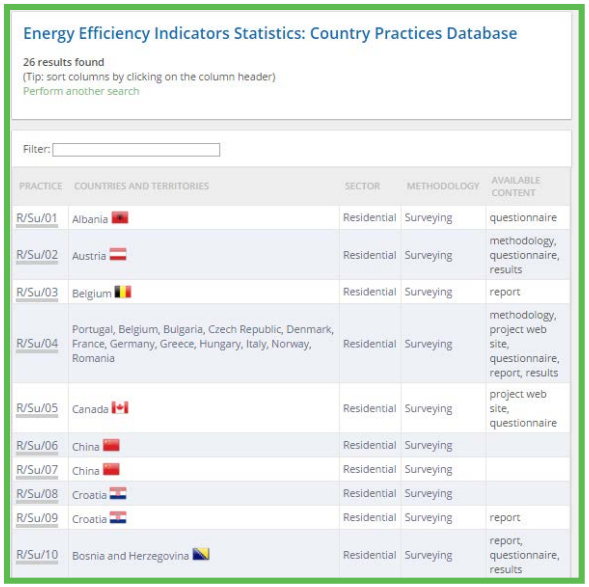
Country Practices Database

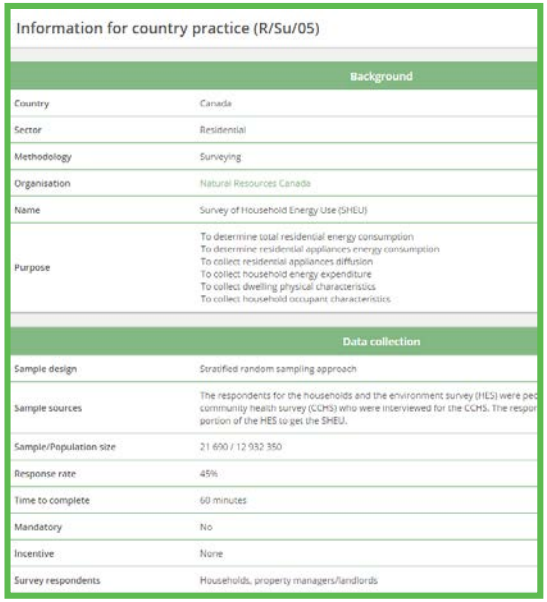


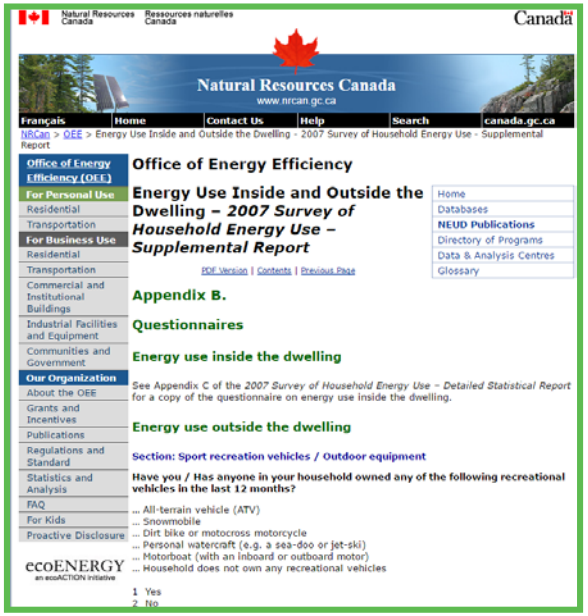
Country Practices Database



- Practices in surveying, administrative sources, modelling and metering across sectors
- Questionnaires and other material available
- Links to various national administrations work







An example of how to benefit from each other's work

How to collect renewables data?

Renewable electricity and heat data collection

- Renewable electricity (and heat)– just another form of generation, so best to collect in same way as all generation
- Sample frame – normally require licenses so known business,
- Small enough to run census for each collection (possibly above a threshold)
- Annual survey of small business or lessor fuels – have to cover all, including off-grid
- Stats need to work closely with policy to keep track of new initiatives
- Language – mapping industry phrases to statistical terms
- Feedback to business, even in mandatory survey – what's the benefit to provide accurate data
- Examples of Renewables data collection
  - UK monthly survey or all major power producers, quarterly survey of major auto generators, annual survey of small generators (all generators in the UK are IPP)
  - Supported with use of administrative data for renewables CHP and small scale renewables (mainly wind and PV) supported by policy

End-use and energy efficiency data are vital

Energy Efficiency

- 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

Renewables

- Identifies changes in generation mix and potential of any system issues
- Implications for transmission and distribution networks
- Implications for energy security and fuel demand

- IEA helping by:
  - Developing an international data collection good practice
  - Delivering manuals, sharing practice and targeted training events
  - Developing comparative data sets
  - Promote use of data in policy making
  - Leading with France the G20 Energy End Use initiative

"You cant control what isn't measured"

www.iea.org

IEA

Additional slides – for info

Services sector

Energy consumption data:

- Space heating*
- Space cooling*
- Lighting
- Other building use
- Non-building use

* Temperature corrected, using HDD & CDD

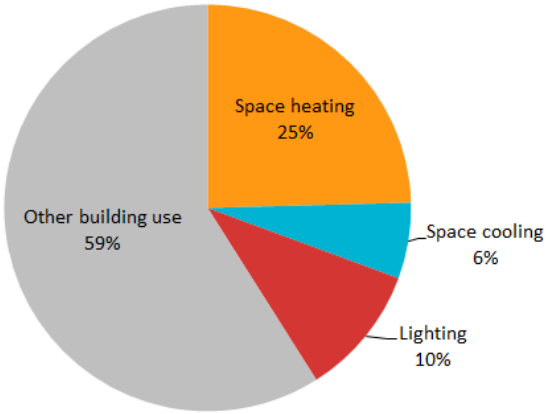
Activity data:

- Value added
- Number of employees
- Services floor area

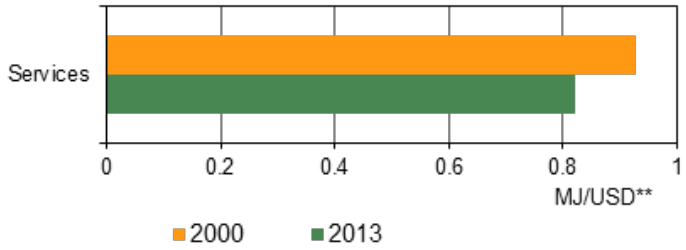
Value

# of people

Surface



Energy consumption by end-use, country C



Selected energy intensities, country C

Transport sector

Energy consumption data:

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

Activity data:

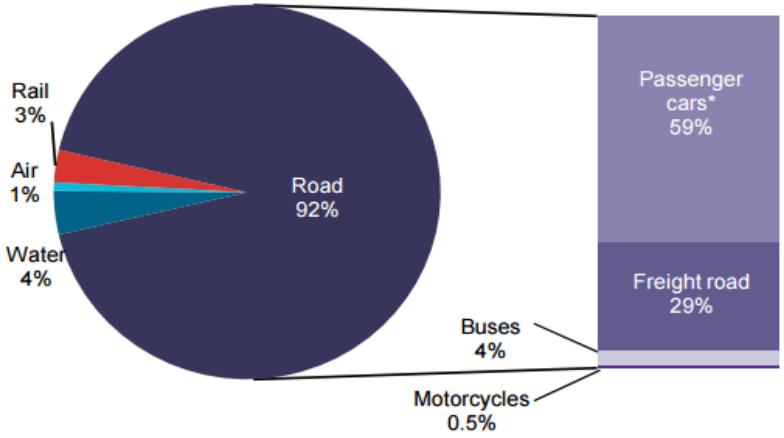
- Vehicle stocks
- Passenger-kilometers
- Tonne-kilometers

Vehicle stock

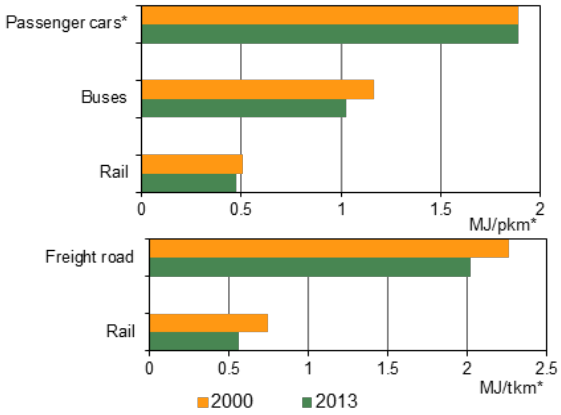
Distance travelled

Occupancy

Load



Energy consumption by mode/vehicle type, country D



Selected energy intensities, country D

The EEI Template - Transport

Energy consumption data:
- by segment and mode

TRANSPORT	units	2013	2014	2015
Menu / Legend / Check all/none / Add remarks				
Energy Use				
Cars, SUV and personal light trucks				
Motor Gasoline (including biofuels)	PJ	510.12	500.29	0
Automotive Diesel (including biofuels)	PJ	357.97	360.51	0
LPG (Liquefied Petroleum Gas)	PJ	1.26	1.18	0
Natural Gas	PJ	0	0	0
Electricity	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	**869.35**	**861.98**	•
Motorcycles (2 wheelers) & 3 wheelers				
Motor Gasoline (including biofuels)	PJ	7.12	6.75	0
LPG (Liquefied Petroleum Gas)	PJ	0	0	0
Electricity	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	**7.12**	**6.75**	•
Buses				
Motor Gasoline (including biofuels)	PJ	0	0	0
Automotive Diesel (including biofuels)	PJ	53.59	61.35	0
LPG (Liquefied Petroleum Gas)	PJ	0	0	0
Natural Gas	PJ	0	0	0
Electricity	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	**53.59**	**61.35**	•
Passenger Trains				
Diesel & Light Fuel Oil	PJ	18.13	18.18	0
Heavy Fuel Oil	PJ	0.28	0.28	0
Natural Gas	PJ	0	0	0
Electricity	PJ	21.26	21.04	0
Coal & Coal Products	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	**39.67**	**39.50**	•
Freight & Commercial road transport				
Motor Gasoline (including biofuels)	PJ	9.21	9.34	0
Automotive Diesel (including biofuels)	PJ	527.96	535.37	0
LPG (Liquefied Petroleum Gas)	PJ	0	0	0
Natural Gas	PJ	0	0	0
Electricity	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	**537.17**	**544.71**	•
Freight trains				
Diesel & Light Fuel Oil	PJ	8.41	8.43	0
Heavy Fuel Oil	PJ	0.13	0.13	0
Natural Gas	PJ	0	0	0
Electricity	PJ	10.01	9.91	0
Coal & Coal Products	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	**18.55**	**18.47**	•
Domestic freight airplanes				
Jet Fuel & Aviation Gasoline	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	•	•	•
Domestic freight ships				
Motor Gasoline (including biofuels)	PJ	0	0	0
Diesel & Light Fuel Oil	PJ	34.69	32.20	0
Heavy Fuel Oil	PJ	0	0	0
Natural Gas	PJ	0	0	0
Coal & Coal Products	PJ	0	0	0
Other	PJ	0	0	0
Total	**PJ**	**34.69**	**32.20**	•

Activity data:
- segment and mode

TRANSPORT	units	2013	2014	2015
Menu / Legend / Check all/none / Add remarks				
Activity & Structure indicators				
Passenger transport [passenger-kilometres]				
Cars, SUV and personal light trucks	10^9 pass-km	637.67	654.23	0
- gasoline (spark ignition) engine	10^9 pass-km	0	0	0
- diesel (compression ignition) engine	10^9 pass-km	0	0	0
Motorcycles (2 wheelers) & 3 wheelers	10^9 pass-km	4.91	4.64	0
Buses	10^9 pass-km	40.40	39.60	0
Passenger Trains	10^9 pass-km	72.07	75.40	0
Domestic passenger airplanes	10^9 pass-km	8.45	8.49	0
Domestic passenger ships	10^9 pass-km	0	0	0
Total Passenger Transport	**10^9 pass-km**	**763.50**	**782.36**	•
Freight transport [tonne-kilometres]				
Freight & Commercial road transport	10^9 tonne-km	151.42	153.55	0
- gasoline (spark ignition) engine	10^9 tonne-km	0	0	0
- diesel (compression ignition) engine	10^9 tonne-km	0	0	0
Freight trains	10^9 tonne-km	23.00	22.00	0
Domestic freight airplanes	10^9 tonne-km	0	0	0
Domestic freight ships	10^9 tonne-km	29.00	27.00	0
Total Freight Transport	**10^9 tonne-km**	**203.42**	**202.55**	•
Freight transport [tonnes]				
Freight & Commercial road transport	10^6 tonnes	0	0	0
- gasoline (spark ignition) engine	10^6 tonnes	0	0	0
- diesel (compression ignition) engine	10^6 tonnes	0	0	0
Freight trains	10^6 tonnes	0	0	0
Domestic freight airplanes	10^6 tonnes	0	0	0
Domestic freight ships	10^6 tonnes	0	0	0
Vehicle kilometres				
Cars, SUV and personal light trucks	10^9 vkm	386.23	387.05	0
- gasoline (spark ignition) engine	10^9 vkm	0	0	0
- diesel (compression ignition) engine	10^9 vkm	0	0	0
Motorcycles (2 wheelers) & 3 wheelers	10^9 vkm	4.35	4.51	0
Buses	10^9 vkm	3.54	3.38	0
Passenger Trains	10^9 vkm	0	0	0
Domestic passenger airplanes	10^9 vkm	0	0	0
Domestic passenger ships	10^9 vkm	0	0	0
Freight & Commercial road transport	10^9 vkm	93.81	96.88	0
- gasoline (spark ignition) engine	10^9 vkm	0	0	0
- diesel (compression ignition) engine	10^9 vkm	0	0	0
Freight trains	10^9 vkm	0	0	0
Domestic freight airplanes	10^9 vkm	0	0	0
Domestic freight ships	10^9 vkm	0	0	0
Vehicle stocks (number of vehicles in use)				
Cars, SUV and personal light trucks	10^6	29.14	29.61	0
- gasoline (spark ignition) engine	10^6	18.87	18.63	0
- diesel (compression ignition) engine	10^6	10.06	10.73	0
Motorcycles (2 wheelers) & 3 wheelers	10^6	1.22	1.22	0
Buses	10^6	0.16	0.16	0
Passenger Trains	10^6	0	0	0
Domestic passenger airplanes	10^6	0	0	0
Domestic passenger ships	10^6	0	0	0
Freight & Commercial road transport	10^6	3.82	3.95	0
- gasoline (spark ignition) engine	10^6	0.14	0.14	0
- diesel (compression ignition) engine	10^6	3.67	3.80	0
Freight trains	10^6	0	0	0
Domestic freight airplanes	10^6	0	0	0
Domestic freight ships	10^6	0	0	0

Residential Sector

Energy consumption data:

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

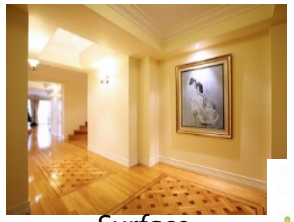
* Temperature corrected, using HDD & CDD

Activity data:

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

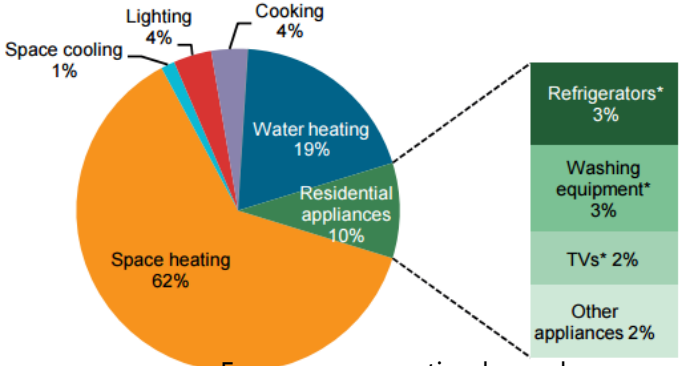
# of people

# of dwellings

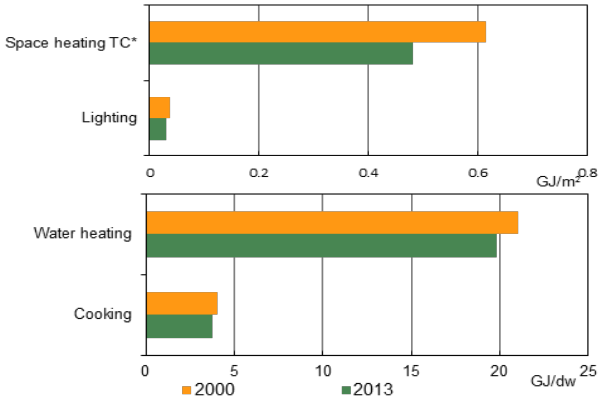


Surface

# of appliances



Energy consumption by end-use, country B



Selected energy intensities, country B

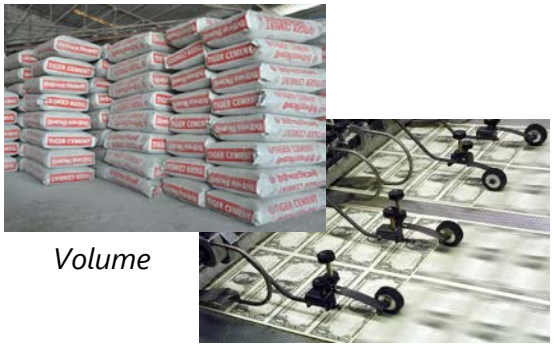
Industry Sector

Energy consumption data

- (major ISIC sub-sectors):
- Chemical
- Iron and steel
- Non-ferrous metals
  - Aluminum
- Non-metallic minerals
  - Cement
  - Clinker
- Pulp and paper
  - Pulp
  - Paper
- …. etc.

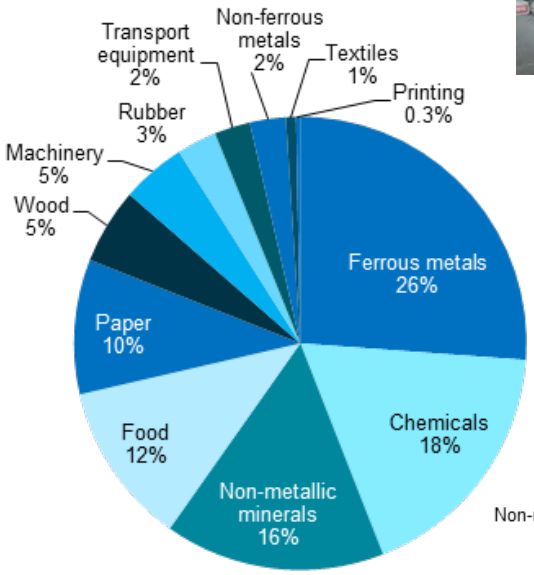
Activity data:

- Value added
- Physical production

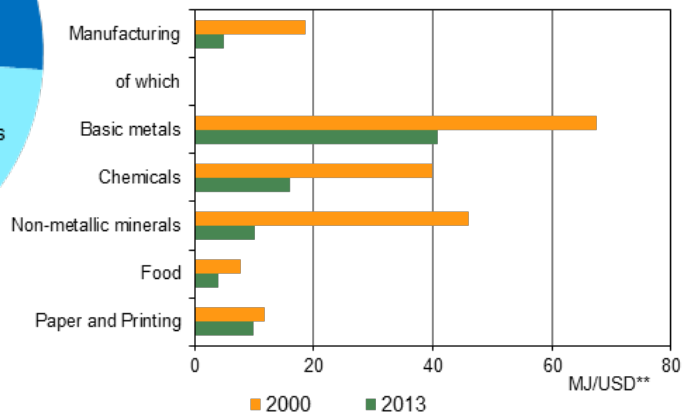


Volume

Value



Energy consumption by end-use, country A



Selected energy intensities, country A

The EEI Template - Industry

Energy consumption data (by major ISIC sub-sectors, classes and products):

INDUSTRY	units	2010	2011	2012	2013	2014	2015	sources	comments
Menu / Legend / Check all/none / Add remarks									
Total Energy Use	PJ	0	0	0	0	0	0		
24 24: Manufacture of basic metals									
Oil & Petroleum Products	PJ	0.32	0.16	0.08	0.17	0.29	0		
Natural Gas	PJ	27.93	26.31	23.47	24.69	25.34	0		
Coal & Coal Products	PJ	138.93	121.22	129.33	168.41	165.21	0		
Combus. Renewables & Waste	PJ	0	0	0	0	0	0		
Heat	PJ	0	0	0	0	0	0		
Electricity	PJ	39.12	29.88	31.59	31.23	31.48	0		
Other	PJ	0	0	0	0	0	0		
Total Energy Use	PJ	205.29	187.57	184.47	224.50	222.32	0		
Class 2410+2431: Manufacture + Casting of iron and steel									
Oil & Petroleum Products	PJ	0.32	0.16	0.08	0.17	0.29	0	IEA Energy Balances	
Natural Gas	PJ	21.91	20.35	17.35	18.47	18.99	0	IEA Energy Balances	
Coal & Coal Products	PJ	135.29	120.63	128.79	164.82	164.63	0	IEA Energy Balances	
Combus. Renewables & Waste	PJ	0	0	0	0	0	0		
Heat	PJ	0	0	0	0	0	0		
Electricity	PJ	14.90	14.78	13.48	15.28	15.22	0	IEA Energy Balances	
Other	PJ	0	0	0	0	0	0		
Total Energy Use	PJ	172.43	155.92	159.71	198.73	199.13	0		
Class 2420+2432: Manufacture + Casting of precious and non-ferrous metals									
Oil & Petroleum Products	PJ	0	0	0	0	0	0	IEA Energy Balances	
Natural Gas	PJ	6.01	5.96	6.12	6.23	6.35	0	IEA Energy Balances	
Coal & Coal Products	PJ	0.63	0.59	0.54	0.59	0.59	0	IEA Energy Balances	
Combus. Renewables & Waste	PJ	0	0	0	0	0	0		
Heat	PJ	0	0	0	0	0	0		
Electricity	PJ	24.22	25.10	18.10	15.95	16.26	0	IEA Energy Balances	
Other	PJ	0	0	0	0	0	0		
Total Energy Use	PJ	30.86	31.65	24.76	22.76	23.20	0		
Of which aluminium									
Oil & Petroleum Products	PJ	0	0	0	0	0	0		
Natural Gas	PJ	0	0	0	0	0	0		
Coal & Coal Products	PJ	0	0	0	0	0	0		
Combus. Renewables & Waste	PJ	0	0	0	0	0	0		
Heat	PJ	0	0	0	0	0	0		
Electricity	PJ	0	0	0	0	0	0		
Other	PJ	0	0	0	0	0	0		
Total Energy Use	PJ	0	0	0	0	0	0		

Activity data:

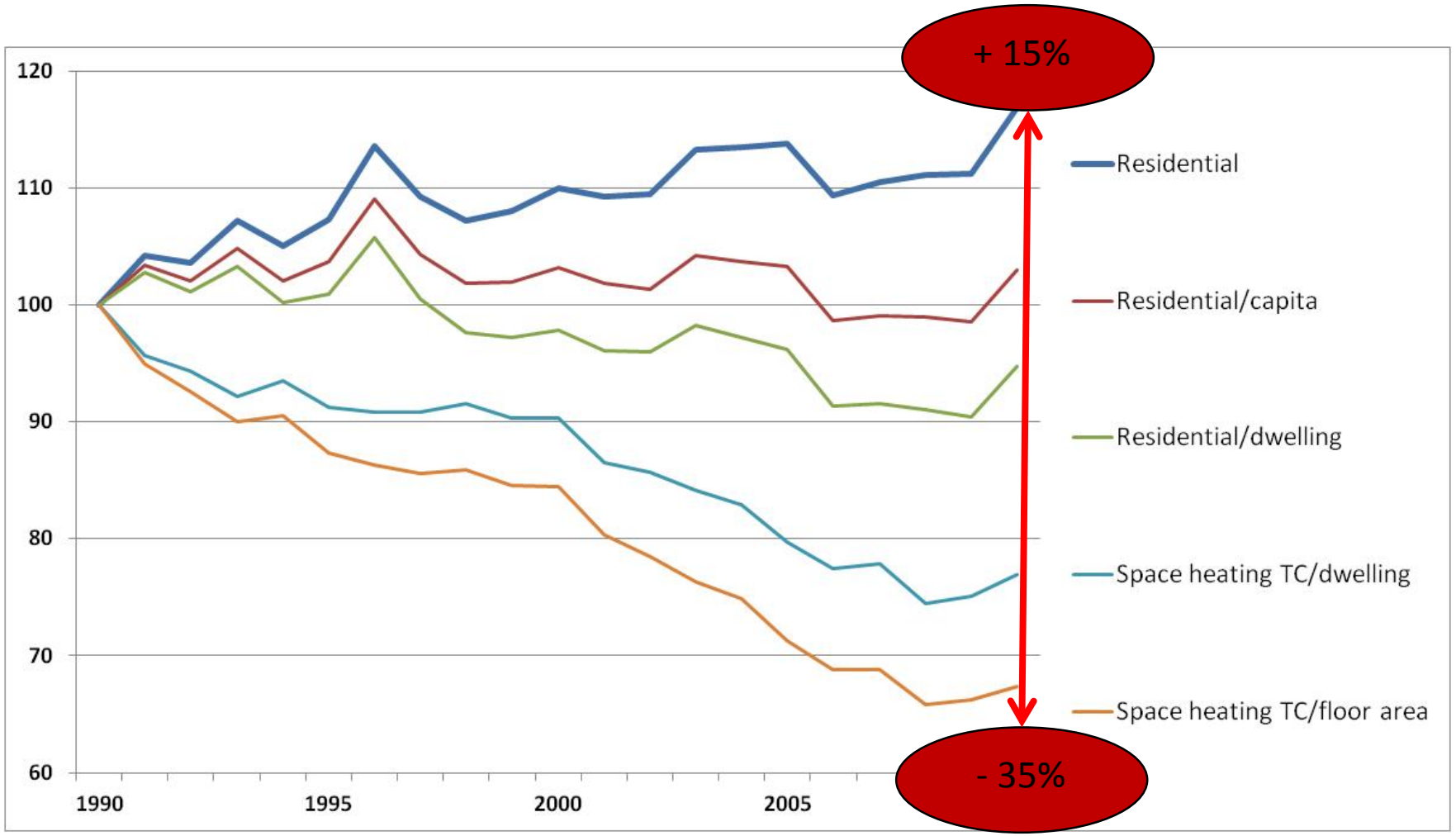
- physical production
- value added

(by major ISIC sub-sectors)

COMMODITIES	units	2010	2011	2012	2013	2014	2015	sources
Menu / Legend / Check all/none / Add remarks								
22 22: Manufacture of other non-metallic mineral products								
Cement								
Clinker production	Mt	6.60	7.10	6.56	6.71	7.20	0	
Cement production	Mt	7.68	8.53	8.50	8.20	8.96	0	USGS Minerals Yearbook
24 24: Manufacture of basic metals								
Crude Steel	Mt	9.71	9.48	9.58	11.86	12.12	0	worldsteel
Basic Oxygen Furnace production	Mt	4.95	7.53	9.92	10.17	0	worldsteel	
Electric Furnace production	Mt	1.53	2.05	1.94	1.96	0	worldsteel	
Direct Reduced Iron	Mt	0	0	0	0	0		
Pig Iron	Mt	0	0	0	0	0		
Ferro-Alloys	Mt	0	0	0	0	0		
Primary Aluminium	Mt	0	0	0	0	0	0	USGS Minerals Yearbook
Secondary Aluminium	Mt	0	0	0	0	0	0	USGS Minerals Yearbook
Primary Copper	Mt	0.21	0.06	0.04	0.04	0	USGS Minerals Yearbook	
Secondary Copper	Mt	0	0	0	0	0		

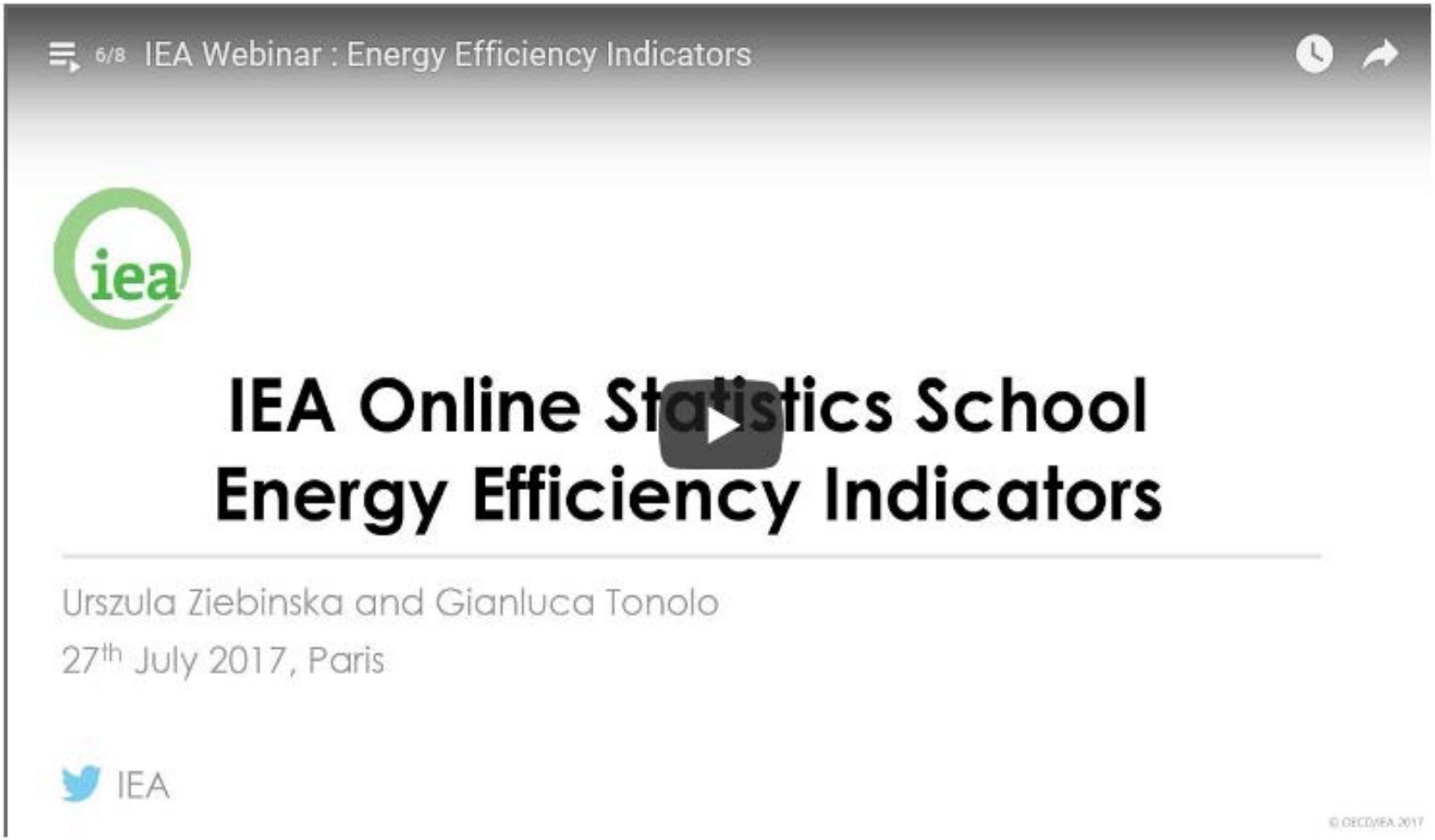
MACRO ECONOMIC DATA	units	2010	2011	2012	2013	2014	2015	sources	comments
Menu / Legend / Check all/none / Add remarks									
IV. Value-added in USD PPP 2010 $ (at the price levels and PPPs of 2010)									
ISIC Rev.4 Division									
01 - 03: Agriculture, forestry and fishing	billions of 2010$ PPP	14.96	16.60	15.39	15.49	17.65	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
05 - 09: Mining and quarrying		44.00	37.72	33.62	32.70	32.90	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
10 - 32: Manufacturing		196.40	200.33	197.60	195.03	200.52	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
10 - 12: Manufacture of food products, beverages, tobacco products		32.62	34.78	33.88	33.31	34.70	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
13 - 15: Manufacture of textiles, wearing apparel, leather and related products		6.66	6.75	6.52	6.23	6.07	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
16: Manufacture of wood and of products of wood and cork, except furniture; manufact		3.30	2.99	2.75	2.78	2.99	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
17: Manufacture of paper and paper products		5.26	4.93	4.98	4.96	5.10	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
18: Printing and reproduction of recorded media		7.07	6.83	6.24	6.54	6.30	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
17 - 18: Paper & Printing		12.33	11.76	11.22	11.50	11.43	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
19: Manufacture of coke and refined petroleum products		6.44	6.52	5.87	5.75	5.24	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
20 - 21: Manufacture of chemicals and chemical products & basic pharmaceutical pro		33.34	31.42	30.01	29.39	28.85	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
22: Manufacture of rubber and plastics products		10.27	10.19	10.35	9.95	11.17	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
23: Manufacture of other non-metallic mineral products		6.27	6.33	5.45	5.41	6.21	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
24: Manufacture of basic metals		4.22	4.58	4.70	4.67	4.58	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
Class 2410+2431: Manufacture + Casting of iron and steel		0	0	0	0	0	0		
Class 2420+2432: Manufacture + Casting of precious and non-ferrous metals		0	0	0	0	0	0		
25 - 28: Manufacture of fabricated metal products, machinery and equipment		48.34	49.70	51.15	48.24	49.46	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
29 - 30: Manufacture of motor vehicles, trailers, other transport equipment		22.18	24.43	25.51	27.46	28.44	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
31 - 32: Manufacture of furniture & Other manufacturing		10.42	10.87	9.95	10.20	10.83	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
35 -36: Electricity, gas, steam, air conditioning, and water supply		46.45	46.49	46.28	47.15	45.62	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
41 - 43: Construction		116.89	119.47	111.24	112.86	121.91	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
33 - 99: Services		1,629.34	1,654.84	1,694.06	1,724.29	1,781.32	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
Total gross value added at basic prices		2,048.04	2,075.44	2,097.16	2,126.10	2,198.20	0	OECD: Annual National Accounts, Table6A (1990-1994: IEA estimates)	
EEI statistical discrepancy		228.46	235.42	244.04	259.84	261.00	2,514.41		
GDP PPP 2010		2,276.50	2,310.85	2,341.20	2,385.94	2,459.20	2,514.41		

Energy Efficiency: A Compelling Case to Collect Detailed Data



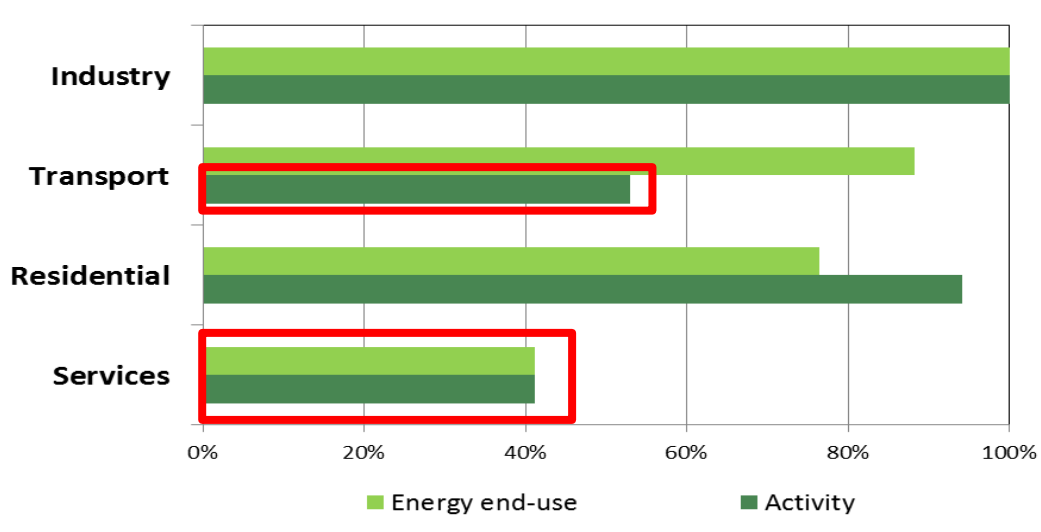
Index: 1990=1. Data for IEA18 (Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA). Source: IEA energy efficiency indicators database. TC: Temperature Corrected.

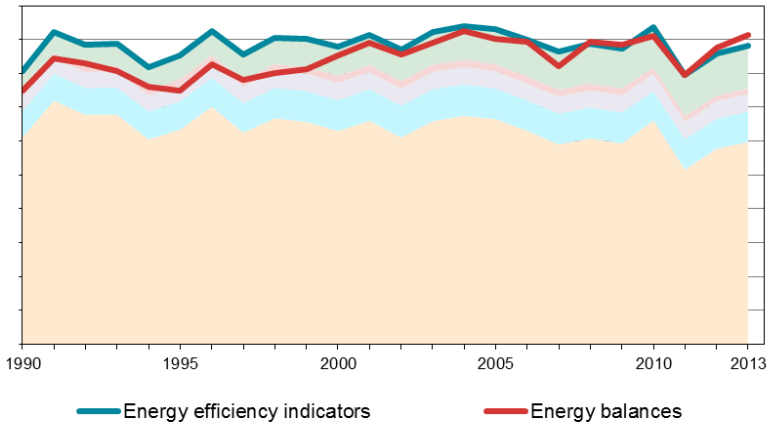
IEA Online Statistics School

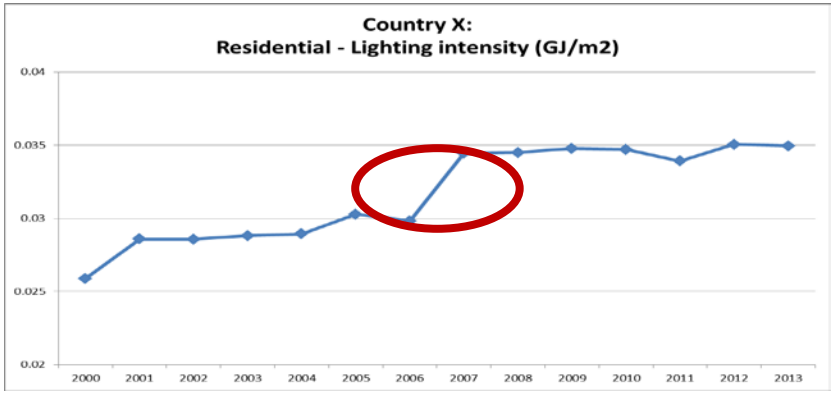


https://www.iea.org/training/ieaonlinestatisticstrainingprogramme/ieaonlinestatisticsschool2017/
https://youtu.be/CEsuvf651vE

Completeness, Consistency, Continuity



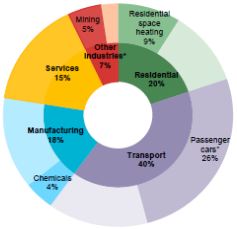




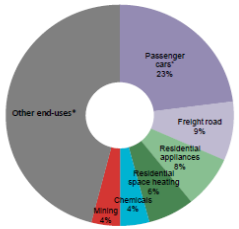
Energy efficiency indicators highlights

Cross-sectoral overview

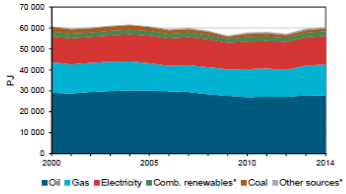
Largest end-uses by sector, 2014



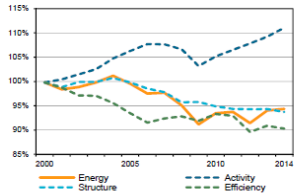
Top-6 CO_2 emitting end-uses, 2014**



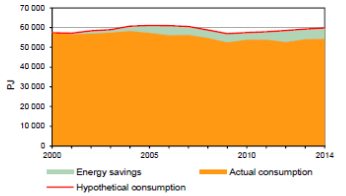
Final energy consumption by source



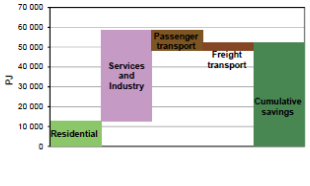
Drivers of final energy consumption***



Estimated energy savings from efficiency***



Estimated cumulative energy savings by sector, 2000-14***

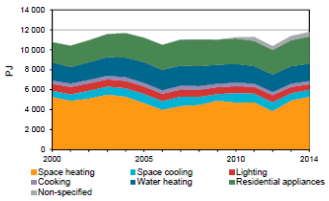


*Other industries includes agriculture, mining and construction; passenger cars includes cars, sport utility vehicles and personal trucks; other end-uses includes the remaining part of emissions beyond the top-6; comb. renewables includes combustible renewables and wastes; other sources includes heat and other energy sources.

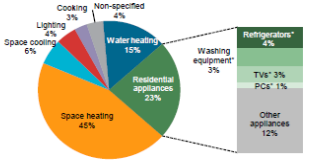
Residential sector

	Residential consumption (PJ)	Share of fossil fuels* in space heating (%)	Population (million)	Consumption per capita (GJ/pers)	Average dwelling surface (m²)	Average dwelling occupancy (pers/dw)
2000	10 772	84	282	38	196	2.8
2014	11 792	79	319	37	181	2.8

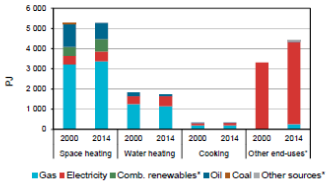
Residential energy consumption by end-use



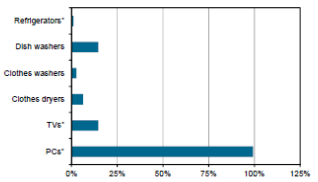
Residential energy consumption by end-use, 2014



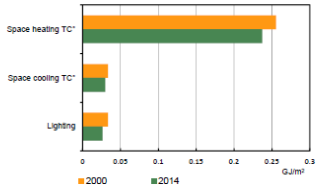
Residential energy consumption by source



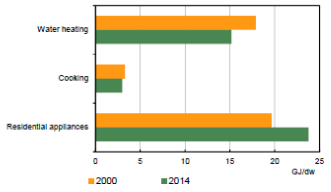
Appliances per dwelling, 2000-14 % change



Energy intensities by end-use per floor area



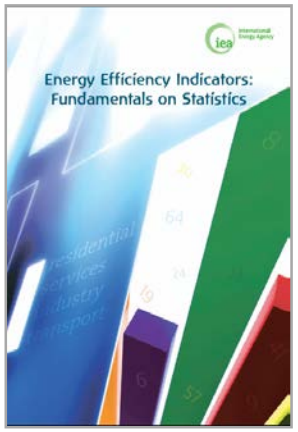
Energy intensities by end-use per dwelling

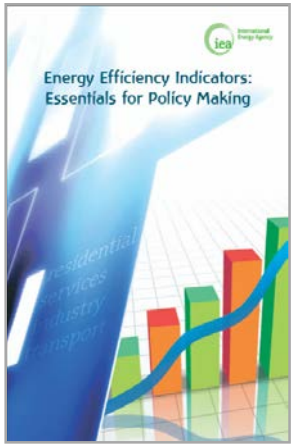


https://www.iea.org/publications/freepublications/publication/energy-efficiency-indicators-highlights-2016.html

Tools to develop indicators

- Fundamentals on statistics:
  provides guidance on how to collect the data needed for indicators
  - Includes a compilation of over 170 existing practices from across the world
  - https://goo.gl/Y8QD1G
- Essentials for policy makers:
  provides guidance to develop and interpret energy efficiency indicators
  - https://goo.gl/agcNg2





Both available also in Russian and other languages

A translation to Azeri has been done by the Ministry of energy of the Republic of Azerbaijan.

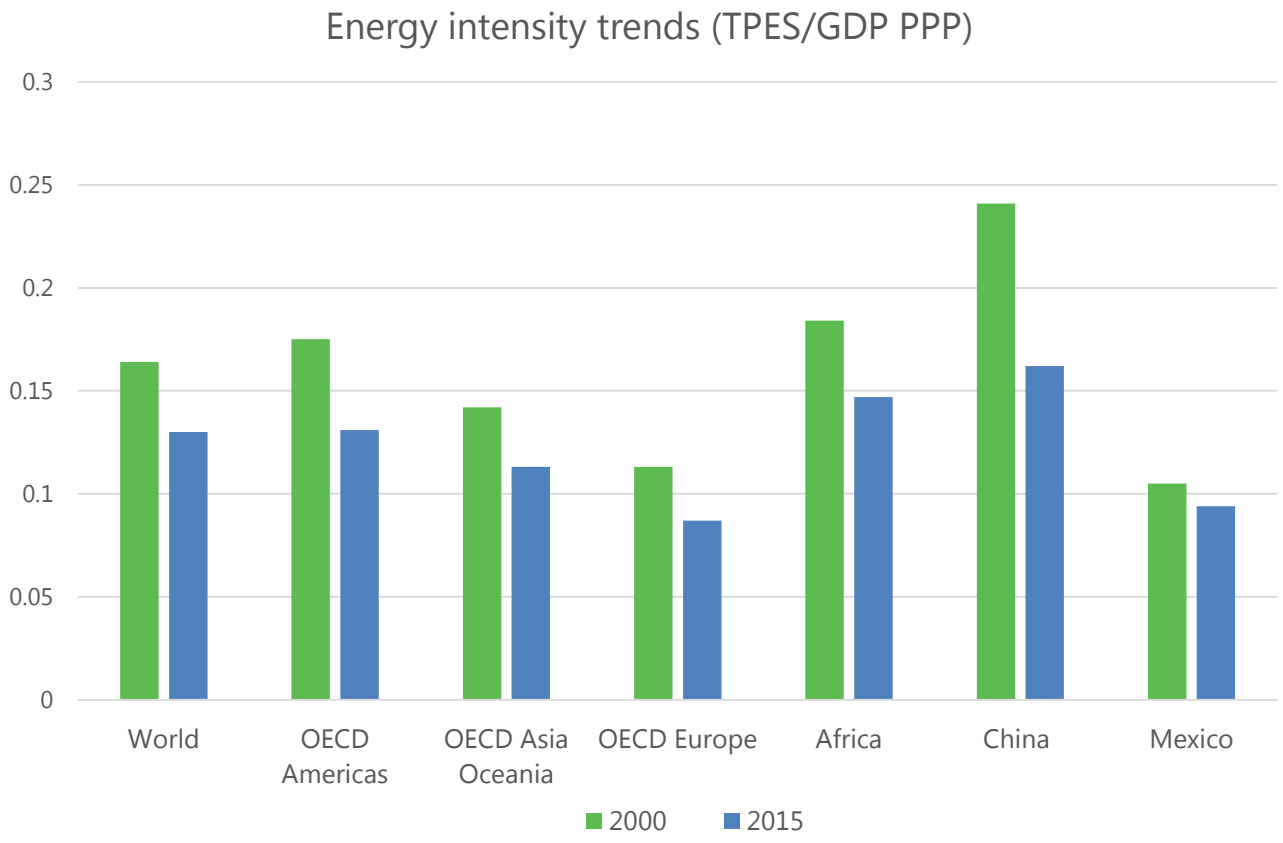
Being developed as on-line tools to complement the existing training on stats

Activity data

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

Need to consider what data are available

What drives energy intensity trends?



Source: IEA World energy balances, 2017

Efficiency progress and also other factors (mainly structural changes)