Africa Energy Efficiency Policy in Emerging Economies Training Week

Indicators and Evaluation

Nairobi
18-21 March 2024

International Energy Agency

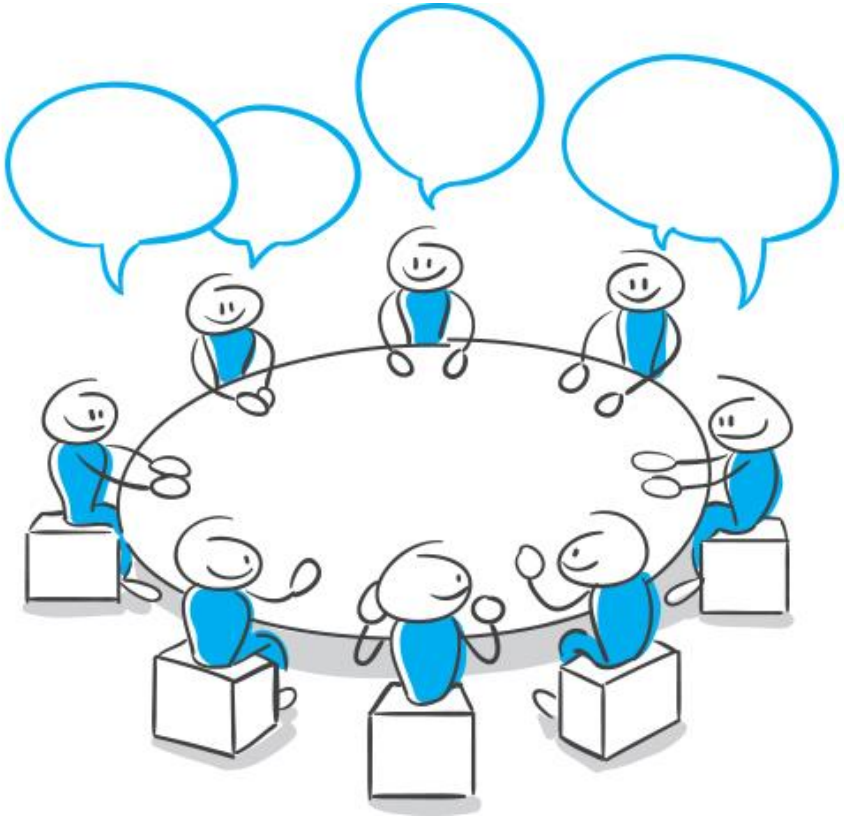
Introductory Round Table

Charles Michaelis and Mafalda Silva

March 18 2024

Nairobi

Roundtable: meeting each other

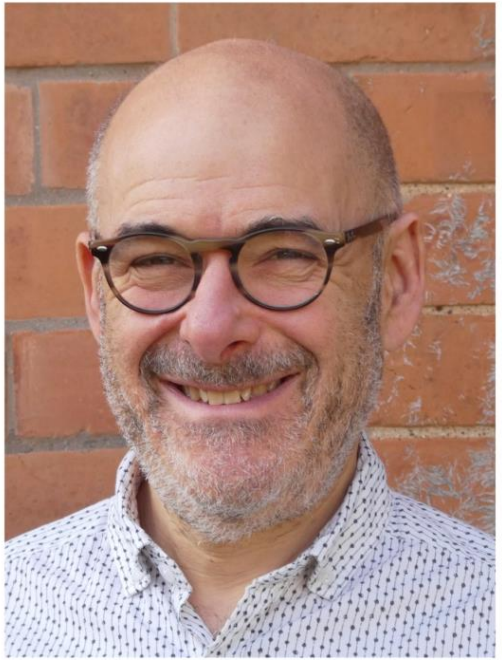


Introductions

- What is your name?
- Where are you from?
- Who do you work for?
- What do you do?

Introductions

- Charles Michaelis
  - From the UK with experience in SE Asia, Africa, China, and Australia
  - Monitoring and evaluation of energy efficiency policies for 30 years
  - Indicators and evaluation helps to deliver better policies with better results for people and the environment
  - Hoping to build understanding of indicators and evaluation to help you in your work in future



Introductions

- Mafalda Silva
  - From Portugal with experience in methodologies for efficiency indicators and indicators analysis
  - Former IEA official – Statistics manager at the IEA leading the efficiency indicators work stream (2017 – 2021)
  - Coordinator researcher in projects around sustainable energy systems and energy efficiency /EDSM
  - Good policies need evidence. Hoping to provide useful takeaways on indicators and evaluation for your daily work and to learn from your experience

Key Learning Points

- Monday
  - Monitoring and evaluation concepts
  - Energy balances and energy efficiency indicators
  - The role of indicators and evaluation

- Tuesday
  - Theories of change
  - Multiple impacts of energy efficiency
  - Policy and programme indicators

- Wednesday
  - Understanding the impact of policies and programmes
  - Evaluation questions
  - Developing a MEL Framework
  - Next steps

Working in groups

Case study based

Evaluation Concepts Exercise

Charles Michaelis

March 18 2024

Nairobi

International Energy Agency

What are indicators

Indicators are clues, signs or markers that describe observable changes or events which relate to a programme or policy and show how close a programme or policy is to its desired path and outcomes.

Indicators provide the evidence that something has happened – e.g. an output delivered, an immediate effect occurred or a long-term change observed.

What is evaluation?

Evaluation is an objective process of understanding how a policy or programme was implemented, what effects it had, for whom and why.

Leads to more effective policies and programmes

In groups

- 5 minutes
- Taking it in turns, remove a brick and place it on the top
- Tallest tower or last to collapse wins

Reflection

- What did you achieve?
- What about your approach worked and what didn’t, why?
- What would you do differently next time?
- What indicators could you use to measure performance?

What are indicators and evaluation?

- Repeat exercise
- Was that more effective?
- What have you learned about indicators and evaluation?
  - What did you do?
  - How did you do it?
  - What difference did it make?

International Energy Agency

Energy balances as a first tool for informing policies: *Introduction to the energy balances*

Mafalda Silva

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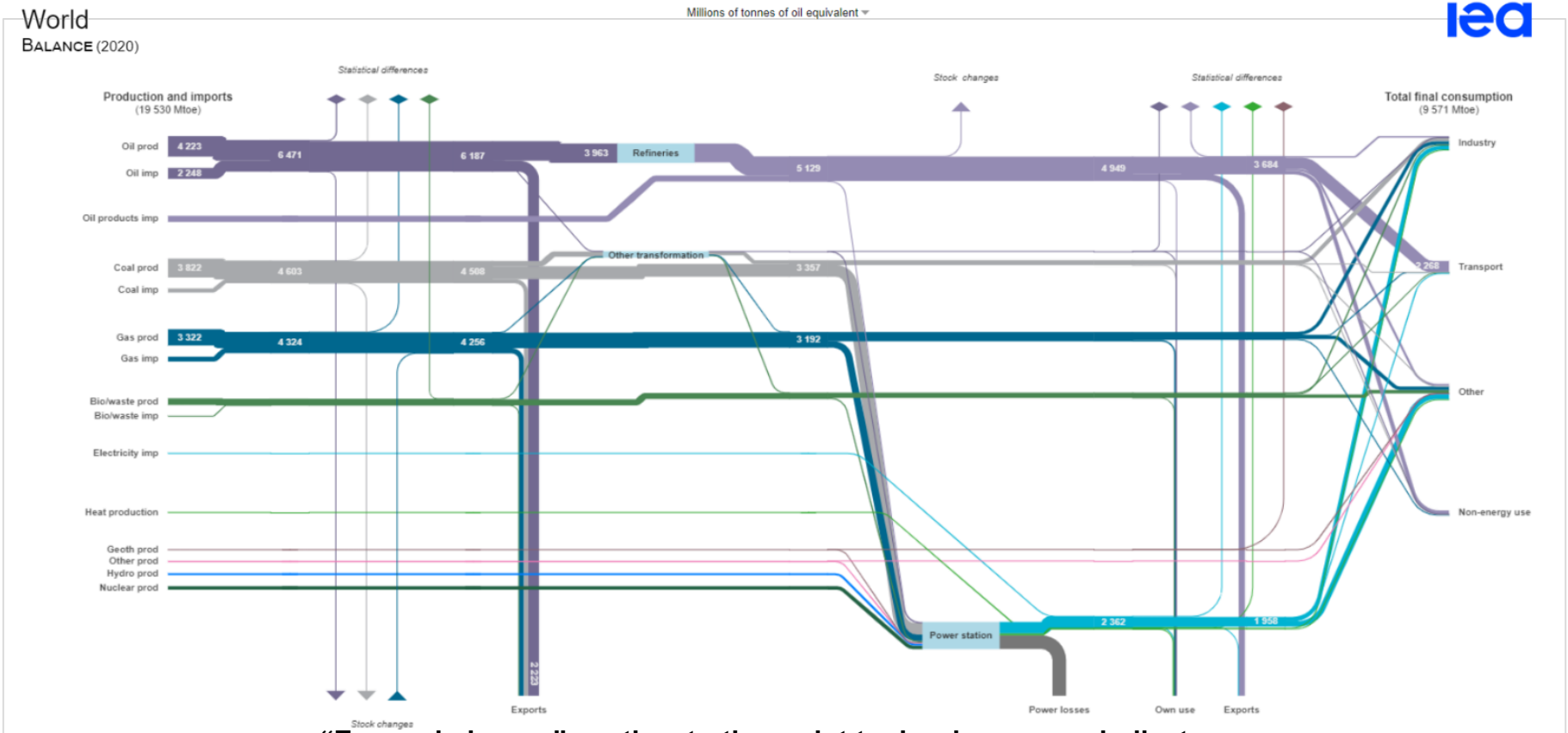
Overview

The importance of energy balances

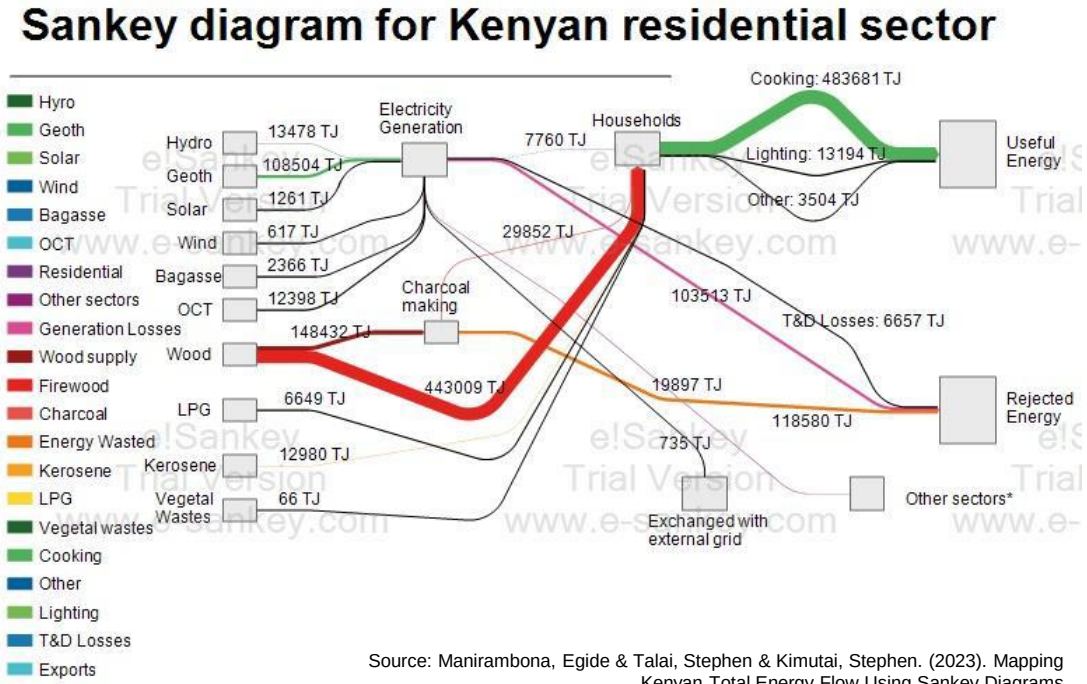
- How to read an energy balance?
- Aggregated indicators from the energy balances
- Why aggregated indicators are useful?

The “big picture” – Sankey diagram



“Energy balances” are the starting point to develop energy indicators

Kenya's Sankey



Source: Manirambona, Egide & Talai, Stephen & Kimutai, Stephen. (2023). Mapping Kenyan Total Energy Flow Using Sankey Diagrams

The importance of energy balances: bringing all information together

"…An accounting framework for compilation of data on all energy products entering, exiting, and used within the national territory of a given country during a reference period."

Why do we develop energy balances?

- **To understand overall energy use in country,** from supply, to transformation and final consumption sectors.
- **To estimate high-level indicators** and **CO_2 emissions** from the energy sector
- **To assess data completeness and check quality** of the various energy commodity balances

How to read an energy balance?

The energy balance table

SUPPLY AND CONSUMPTION	Coal	Crude oil	Oil products	Natural Gas	Nuclear	Hydro	Geotherm. solar etc.	Biofuels & waste	Electricity	Heat	Total
Production	288774	40021	-	26872	9853	12995	9946	185098	-	-	573658
Imports	123528	231480	33154						400	-	414117
Exports	-564	-	-65208						-730	-	-66521
Intl. marine bunkers	-	-	-1657						-	-	-1657
Intl. aviation bunkers	-	-	-4398						-	-	-4398
Stock changes	2476	-495	2355						-	-	4342
TES	414214	271006	-35754						-330	-	919441
Transfers	-	2826	-2656						-	-	171
Statistical differences	-135	-3078	-1118						-	-	-2131
Electricity plants	-284969	-	-4178						136132	-	-225908
CHP plants	-	-	-	-	-	-	-	-	-	-	-
Heat plants	-	-	-	-	-	-	-	-	-	-	-
Blast furnaces	-15468	-	-	-	-	-	-	-	-	-	-15468
Gas works	-22	-	-								-22
Coke/pat. fuel/BKB plants	-5235	-	-								-5235
Oil refineries	-	270754	267620								-3134
Petrochemical plants	-	-	-								-
Liquefaction plants	-	-	-								-
Other transformation	-	-	-								-3806
Energy industry own use	-1772	-	-16218	-6							-34115
Losses	-	-	-								-23211
TFC	106612	-	207696	32							606580
INDUSTRY	94212	-	31043	6							206087
Iron and steel	55050	-	639								63054
Chemical and petrochemica	1192	-	6037								8837
Non-ferrous metals	524	-	117	-	-	-	-	-	1061	-	1702
Non-metallic minerals	13423	-	7431	-	-	-	-	-	146	-	21000
Transport equipment	-	-	-	-	-	-	-	-	858	-	858
Machinery	-	-	379	-	-	-	-	-	598	-	977
Mining and quarrying	-	-	1669	-	-	-	-	-	1282	-	2951
Food and tobacco	-	-	4	-	-	-	-	-	719	-	723
Paper, pulp and printing	855	-	-	-	-	-	-	-	918	-	1773
Wood and wood products	-	-	-	-	-	-	-	-	345	-	345
Construction	145	-	540	-	-	-	-	-	44	-	728
Textile and leather	685	-	391	-	-	-	-	-	143	-	1219
Non-specified	22338	-	13835	5698	-	-	60	32170	27818	-	101918
TRANSPORT	-	-	98067	3258	-	-	-	878	1564	-	103767
Domestic aviation	-	-	4443	-	-	-	-	-	-	-	4443
Road	-	-	89329	2791	-	-	-	878	-	-	92999
Rail	-	-	2810	-	-	-	-	-	1564	-	4374
Pipeline transport	-	-	-	466	-	-	-	-	-	-	466
Domestic navigation	-	-	1444	-	-	-	-	-	-	-	1444
Non-specified	-	-	40	-	-	-	-	-	-	-	40
OTHER	12401	-	46964	3306	-	-	942	122511	59795	-	245919
Residential	2698	-	27927	1178	-	-	801	115438	26484	-	174527
Comm. and public services	4635	-	2773	1963	-	-	90	7072	9494	-	26027
Agriculture/forestry	-	-	10950	166	-	-	-	-	18195	-	29311
Fishing	-	-	-	-	-	-	-	-	-	-	-
Non-specified	5067	-	5314	-	-	-	50	-	5622	-	16054
NON-ENERGY USE	-	-	31622	19186	-	-	-	-	-	-	50808
in industry/transf./energy	-	-	31622	19186	-	-	-	-	-	-	50808
of which: feedstocks	-	-	14136	19186	-	-	-	-	-	-	33322
in transport	-	-	-	-	-	-	-	-	-	-	-
in other	-	-	-	-	-	-	-	-	-	-	-

Supply

Refined products and electricity are secondary energy; production equals zero to avoid double counting.

Transformation

Negative value represents an input, positive value represents an output.

Transformation **losses** appear in the **Total** column as negative figures.

TES

Total energy supply

- Columns present the “commodity balances” for all products
- All data are comparable thanks to a common energy unit
- Total energy can be defined – Balances out!

Understanding the main energy flows

Supply

Transformation & own use

Final consumption

Million tonnes of oil equivalent

SUPPLY AND CONSUMPTION	Coal[1]	Crude oil[2]	Oil products	Natural gas	Nuclear	Hydro	Geotherm./ Solar/ etc.	Biofuels/ Waste	Electricity	Heat	Total
Production	3657.19	4473.27	-	3032.41	679.65	349.22	225.63	1344.87	-	1.76	13763.99
Imports	795.23	2379.32	1329.40	915.52	-	-	-	23.92	62.11	0.01	5505.50
Exports	-833.43	-2354.63	-1414.63	-932.53	-	-	-	-19.44	-62.25	-0.01	-5616.91
Stock changes											108.86
TPES											761.45
Transfers											27.73
Statistical differences											42.41
Electricity plants											268.88
CHP plants											451.86
Heat plants											-9.39
Blast furnaces	-207.69	-	-0.05	-0.01	-	-	-	-0.04	-	-	-207.78
Gas works	-13.32	-	-2.17	5.42	-	-	-	-0.27	-	-	-10.34
Coke/pat.fuel/BKB/PB plants	-89.82	-	-2.32	-0.03	-	-	-	-0.12	-	-	-92.29
Oil refineries	-	-4246.76	4165.65	-	-	-	-	-	-	-	-81.11
Petrochemical plants	-	35.90	-35.37	-	-	-	-	-	-	-	0.53
Liquefaction plants	-12.08	15.16	-	-16.47	-	-	-	-	-	-	-13.40
Other transformation	-0.30	10.75	-0.54	-13.01	-	-	-	-90.54	-	-0.68	-94.32
Energy industry own use											822.61
Losses											224.84
TFC											555.32
Industry											2752.60
Transport	0.07	0.01	2533.20	101.89	-	-	-	81.97	30.73	-	2747.87
Residential	72.73	-	209.30	431.24	-	-	31.64	728.60	488.44	99.20	2061.15
Services	33.90	-	85.72	187.45	-	-	7.88	28.28	395.52	36.99	775.73
Agriculture/Forestry	16.08	0.01	104.20	9.66	-	-	2.07	9.84	52.79	3.21	197.87
Fishing	0.00	-	5.68	0.06	-	-	0.05	0.01	0.55	0.05	6.41
Non-specified other	30.08	0.01	18.27	3.42	-	-	1.06	3.84	79.21	8.16	144.05
Non-energy use	55.70	8.00	637.17	168.78	-	-	-	-	-	-	869.64

Rows present energy flows across energy products

Three main "blocks" of flows

Quiz

How to convert mass to energy units?

A. **Density**

B. **Calorific Value**

C. **Carbon Content**

Quiz

How to convert mass to energy units?

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B. **Calorific Value**

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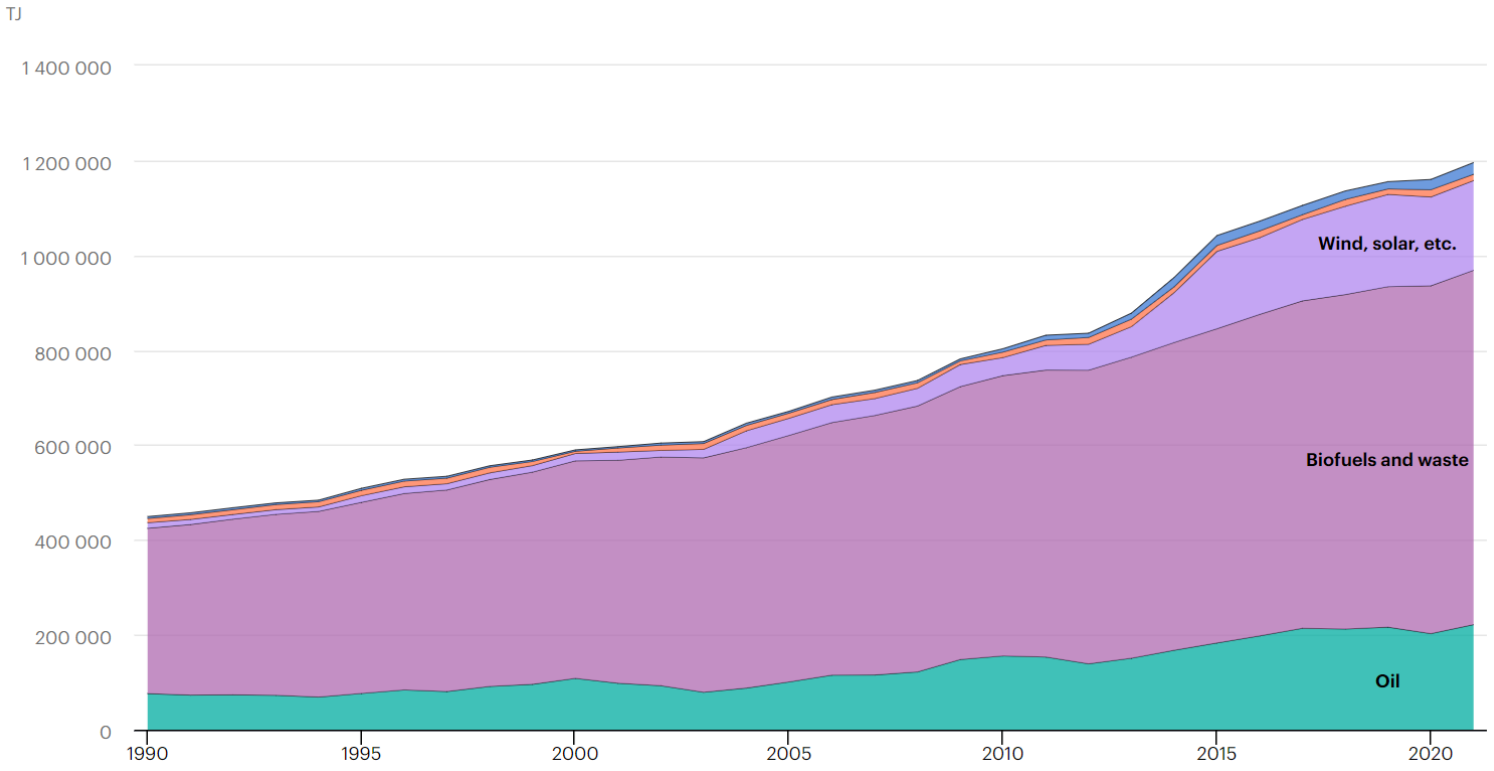
Typically, in units of energy per mass **(kJ/kg)**

Energy supply (Kenya's)

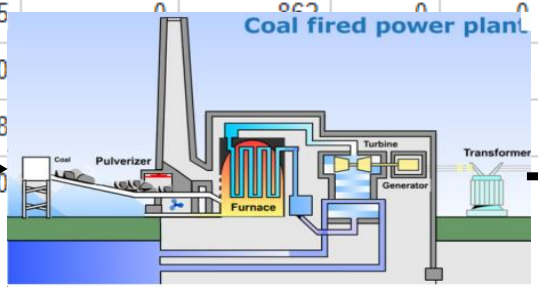


Balances give us "High-level" information: **TPES, Totals, etc…**

Transformation and own use

	Coal and peat	Crude oil	Oil products	Natural gas	Nuclear	Hydro	Geothermal, solar, etc.	Biofuels and waste	Electricity	Heat	Total*
Electricity plants	-355445	0	-31163	-119138	-20839	-27438	-31647	-21908	231911	0	-375667
CHP plants	-9940	0	-360	-178	0	0	0	0	3536	1068	-5875
Heat plants	0	0	0	0	0	0	0	0	0	0	0
Gas works	-30	0	0	0	0	0	0	0	0	0	-30
Oil refineries	0	-508585	501625	0	0	0	0	0	0	0	-6960
Coal transformation	-18358	0	0	0	0	0	0	0	0	0	-18358
Liquefication plants	0	465	0	862	0	0	0	0	0	0	-397
Other transformation	0	0	0	0	0	0	0	-16141	0	0	-16190
Energy industry		-628								-65	-62651
Losses		-200								-33	-36890

Input (coal)



Output (electricity)

The concept of transformation efficiency = output / input

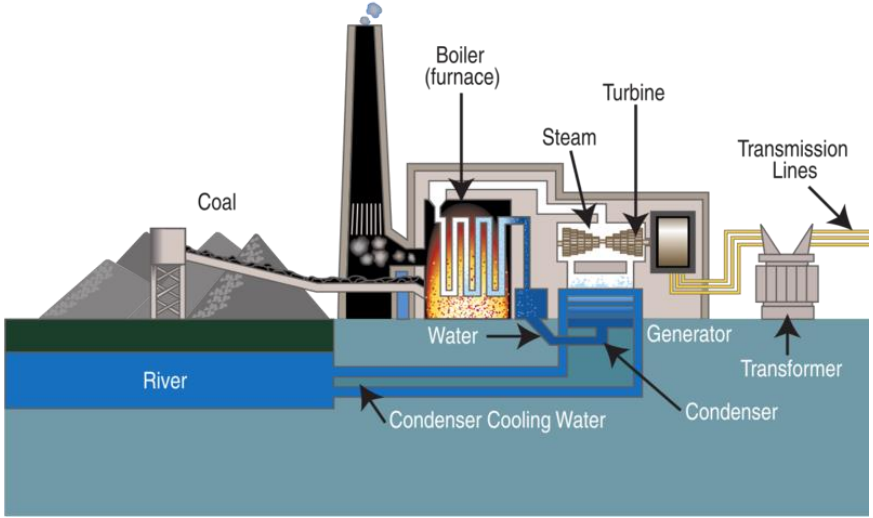
Quiz

What is the average efficiency for a coal electricity-only power plant?

A. **37%**

B. **52%**

C. **65%**



Source: Energy Education
https://energyeducation.ca/encyclopedia/Coal_fired_power_plant#cite_note-8

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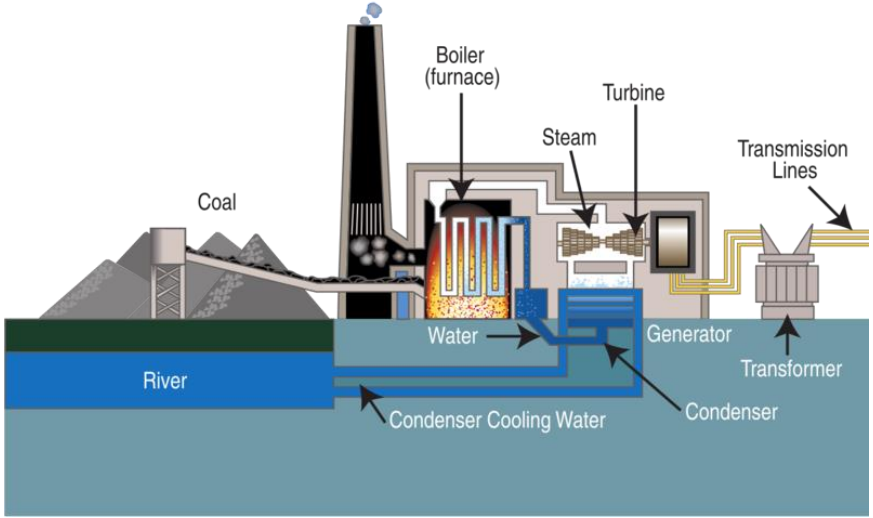

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Final consumption

World

Million tonnes of oil equivalent

FINAL CONSUMPTION	Coal	Crude oil	Oil products	Natural gas	Nuclear	Hydro	Geothermal/ Solar/ etc.	Biofuels/ Waste	Electricity	Heat	Total
TFC	**1035.50**	**14.68**	**3893.25**	**1440.26**	**-**	**-**	**43.63**	**1050.88**	**1793.94**	**283.18**	**9555.32**
Industry	826.95	6.66	299.71	537.77	-	-	0.92	198.33	746.69	135.57	2752.60
Transport	0.07	0.01	2533.20	101.89	-	-	-	81.97	30.73	-	2747.87
Residential	72.73	-	209.30	431.24	-	-	31.64	728.60	488.44	99.20	2061.15
Services	33.90	-	85.72	187.45	-	-	7.88	28.28	395.52	36.99	775.73
Agriculture/Forestry	16.08	0.01	104.20	9.66	-	-	2.07	9.84	52.79	3.21	197.87
Fishing	0.00	-	5.68	0.06	-	-	0.05	0.01	0.55	0.05	6.41
Non-specified other	30.08	0.01	18.27	3.42	-	-	1.06	3.84	79.21	8.16	144.05
Non-energy use	55.70	8.00	637.17	168.78	-	-	-	-	-	-	869.64

Delivery of energy products to all final consumers (sectors)

Quiz

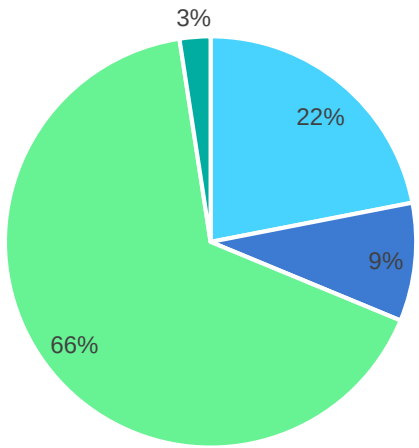
What is the largest energy-consuming sector in Kenya?

A. **Buildings**

B. **Transport**

C. **Industry**

Kenya's total final energy consumption



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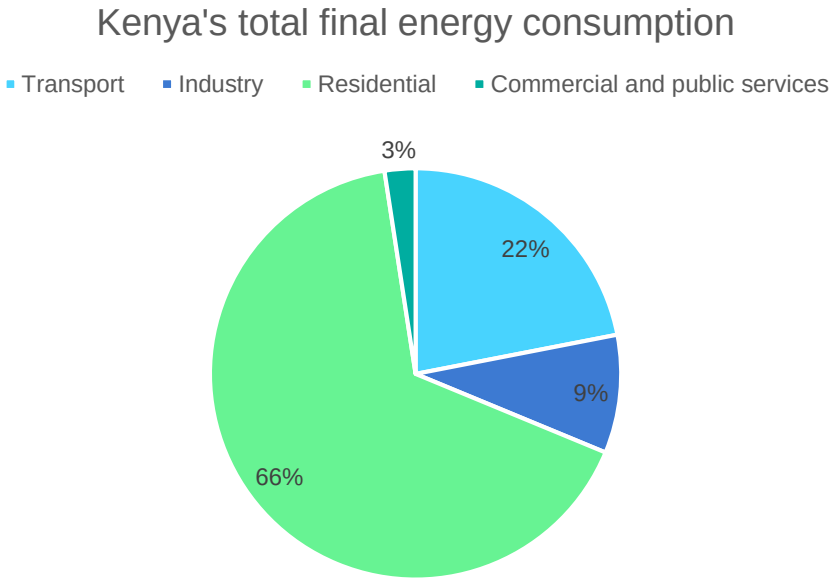

From energy balances we derive high-level indicators

World

Million tonnes of oil equivalent

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Production	3657.19	4473.27	-	3032.41	679.65	349.22	225.63	13			
Imports	795.23	2379.32	1329.40	915.52	-	-	-				
Exports	-833.43	-2354.63	-1414.63	-932.53	-	-	-				
Stock changes	111.90	-15.32	-7.21	19.55	-	-	-				
TPES	**3730.89**	**4482.63**	**-92.43**	**3034.95**	**679.65**	**349.22**	**225.63**	13			
Transfers	-1.36	-233.00	262.09	-	-	-	-	-	-	-	27.73
Statistical differences	28.63	11.25	14.35	-11.26	-	-	0.09	0.84	-1.14	-0.35	42.41
Electricity plants	-1672.04	-40.48	-178.55	-868.18	-672.06	-349.22	-177.96	-120.97	1811.30	-0.72	-2268.88
CHP plants	-623.84	-0.01	-17.99	-314.57	-7.59	-	-2.56	-60.58	335.99	239.30	-451.86
Heat plants	-23.38	-0.83	-10.95	-61.70	-	-	-1.56	-1			
Blast furnaces	-207.69	-	-0.05	-0.01	-	-	-				
Gas works	-13.32	-	-2.17	5.42	-	-	-				
Coke/pat.fuel/BKB/PB plants	-89.82	-	-2.32	-0.03	-	-	-				
Oil refineries	-	-4246.76	4165.65	-	-	-	-				
Petrochemical plants	-	35.90	-35.37	-	-	-	-	-	-	-	0.53
Liquefaction plants	-12.08	15.16	-	-16.47	-	-	-	-	-	-	-13.40
Other transformation	-0.30	10.75	-0.54	-13.01	-	-	-	-90.54	-	-0.68	-94.32
Energy industry own use	-75.28	-11.24	-208.00	-296.17	-	-	-0.00	-13.46	-181.96	-36.50	-822.61
Losses	-4.91	-8.69	-0.47	-18.71	-	-	-0.01	-0.14	-169.65	-22.26	-224.84
TFC	**1035.50**	**14.68**	**3893.25**	**1440.26**	**-**	**-**	**43.63**	**1050.88**	**1793.94**	**283.18**	**9555.32**
Industry	826.95	6.66	299.71	537.77	-	-	0.92	198.33	746.69	135.57	2752.60
Transport	0.07	0.01	2533.20	101.89	-	-	-	81			
Residential	72.73	-	209.30	431.24	-	-	31.64	72			
Services	33.90	-	85.72	187.45	-	-	7.88	28			
Agriculture/Forestry	16.08	0.01	104.20	9.66	-	-	2.07	9			
Fishing	0.00	-	5.68	0.06	-	-	0.05	0			
Non-specified other	30.08	0.01	18.27	3.42	-	-	1.06	3			
Non-energy use	55.70	8.00	637.17	168.78	-	-	-	-	-	-	869.64

Supply →

Transformation →

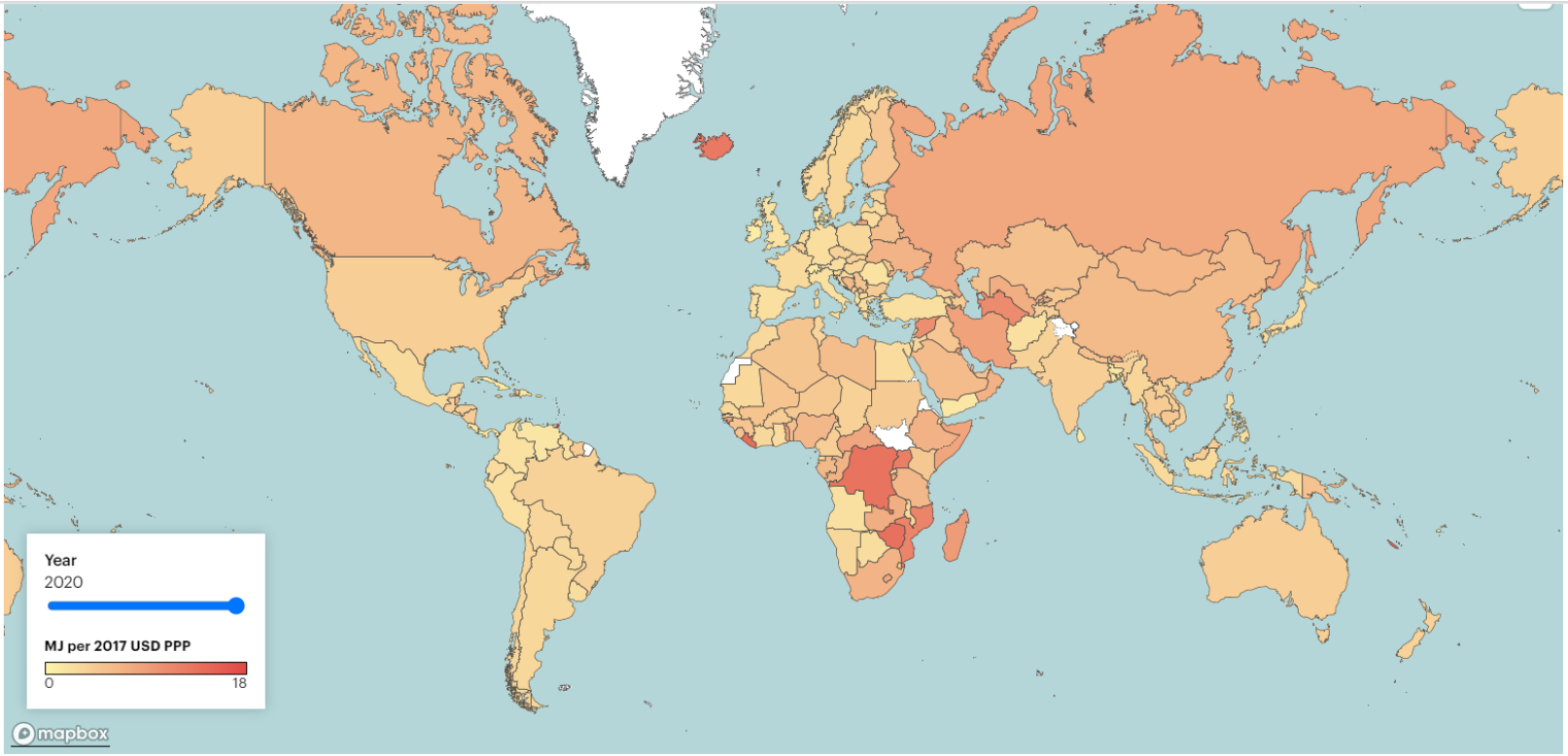
Final consumption →

Energy intensity, Self-sufficiency…

Efficiencies of transformation sector

Shares of energy consumption by sector

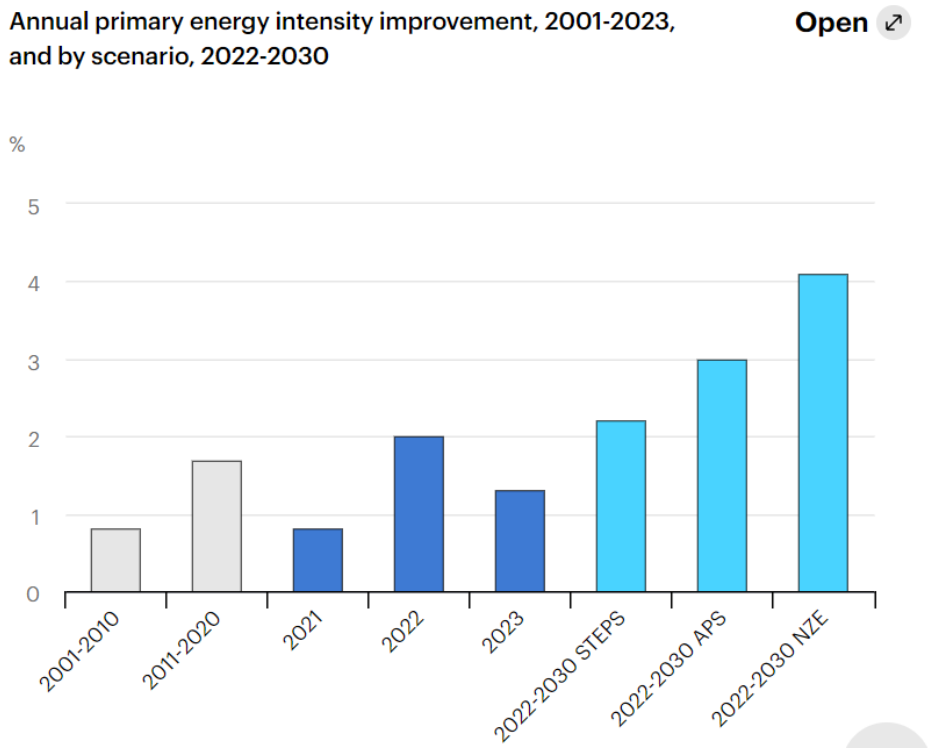
…calculate aggregated energy intensities (TES/GDP)



This indicator is derived from energy data sourced on a joint dataset built by the International Energy Agency and the United Nations Statistics Division. GDP data is sourced from the World Bank's World Development Indicators database.

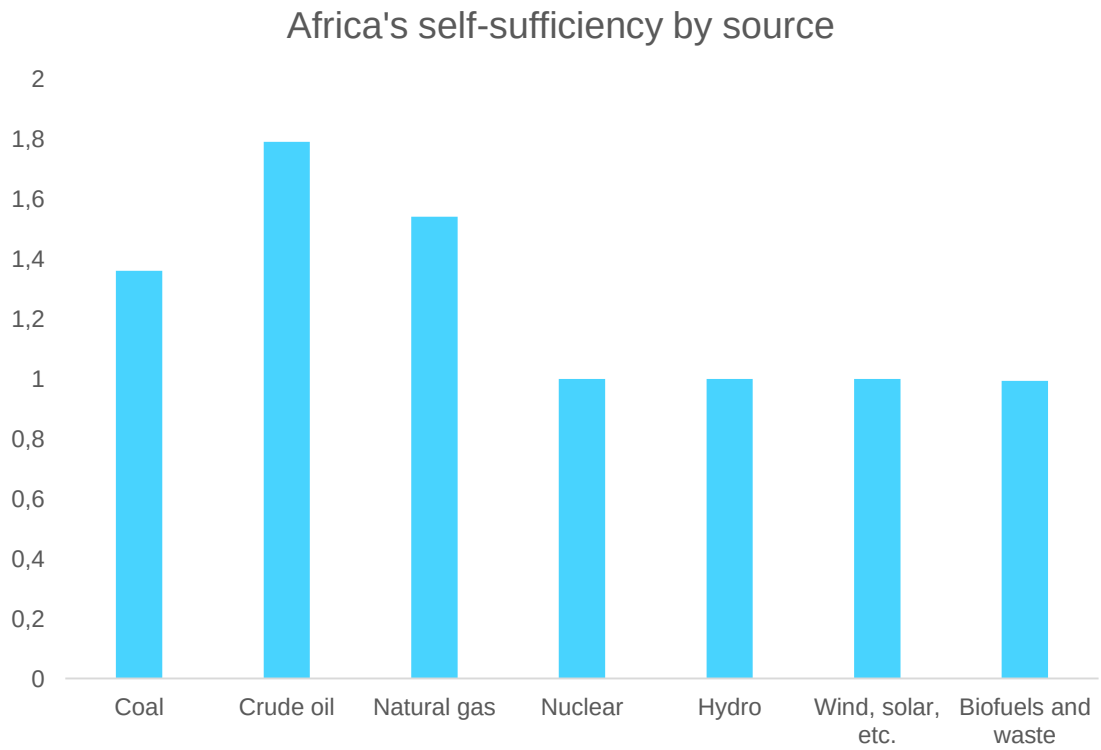
Tracking SDG 7.3

Doubling anual rate of progress until 2030



Progress in energy intensity in 2023 – the main metric used for the energy efficiency of the global economy – is set to fall back to below longer-term trends, to 1.3% from a stronger 2% in 2022

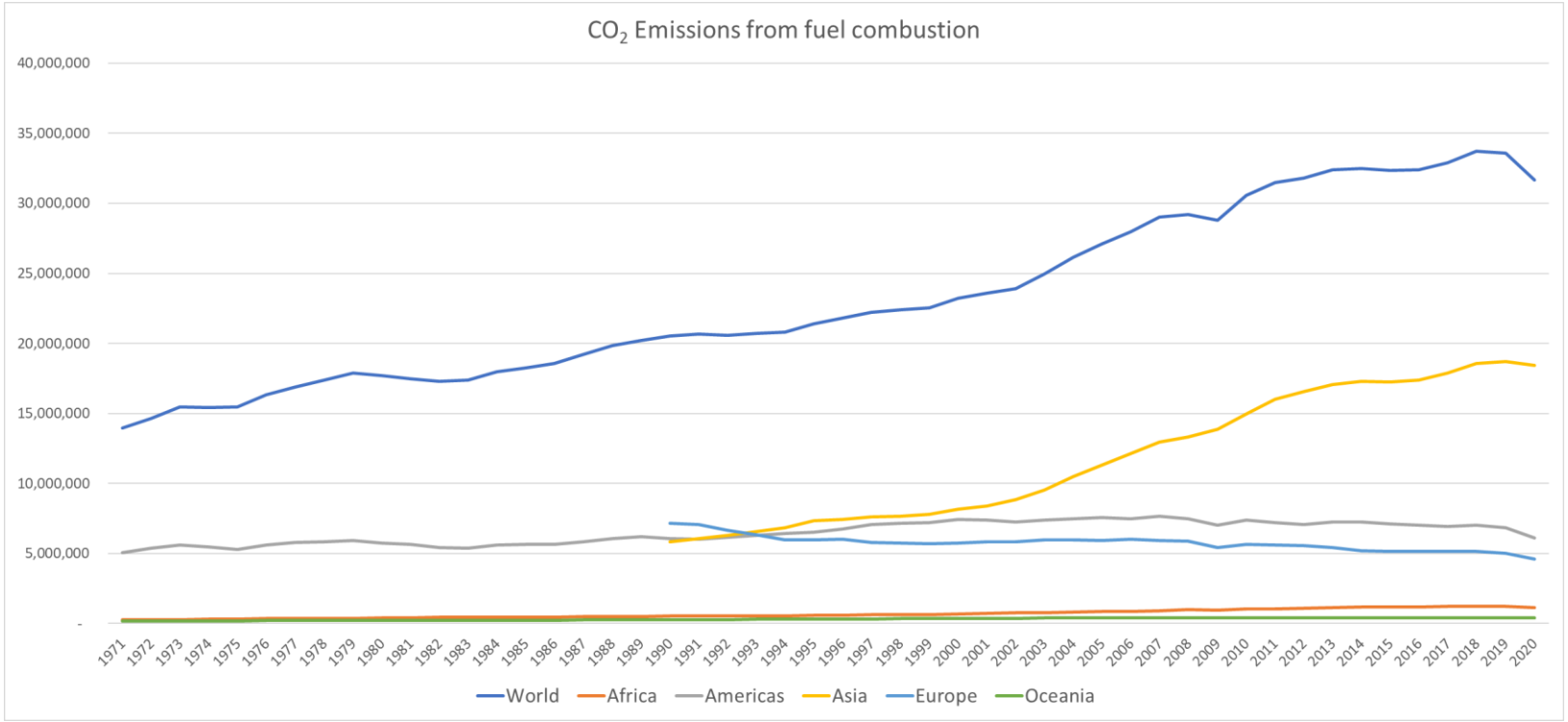
Calculate self-sufficiency



Source: IEA

Self-sufficiency: Production/Total primary energy supply

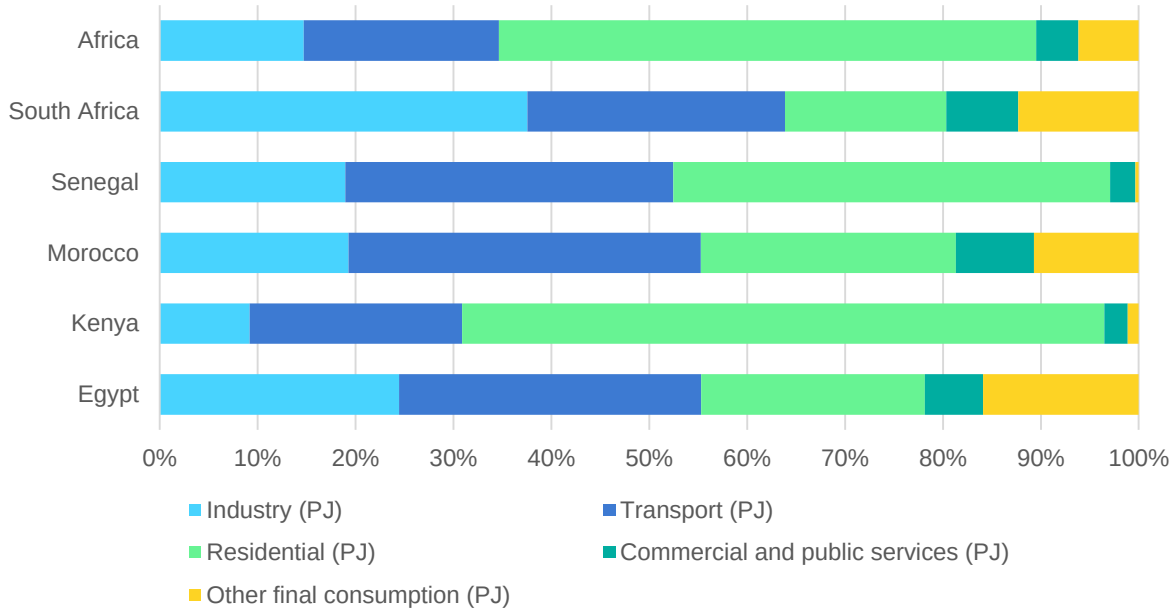
… estimate CO_2 emissions from fuel combustion



Source: IEA, World CO_2 Emissions from Fuel Combustion, 2022

Based on energy balances and IPCC methodologies

…understand the shares of sectors in total final consumption



** Total Final Consumption excluding non-energy uses*

Source: IEA World Energy Balances, 2023

Key to understand where energy is used and to define policy priorities

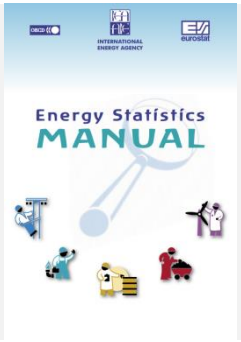
Manuals and supporting documentation

Resources on Energy Statistics

The IEA produced a comprehensive Energy Statistics Manual covering most of our data collection methodologies, consistently with the IRES framework.

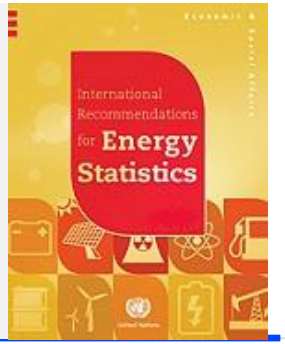
A comprehensive Energy Statistics Manual available in 10 languages.

Click on the manual to download it free of charge!



*Visit the **IEA's Statistics website** to access additional resources, including our questionnaires, glossary and documentation related to our data collection methodologies.*

To learn more about the international framework for energy statistics, please refer to the United Nations' International Recommendations for Energy Statistics (IRES).



STATISTICS

International Energy Agency

Developing and using energy efficiency indicators

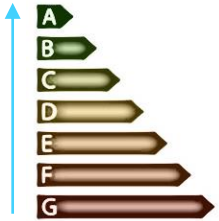
Mafalda Silva

March 18 2024

Nairobi

Energy efficiency is…

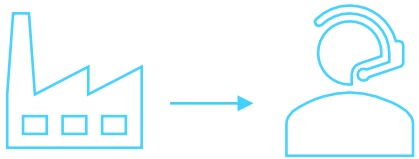
- Using less energy to deliver the same service



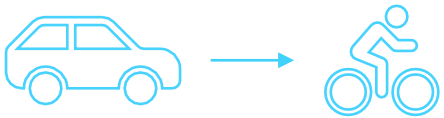
- Using the same energy to deliver more service

Energy efficiency is NOT…

- Using less energy delivering a different service



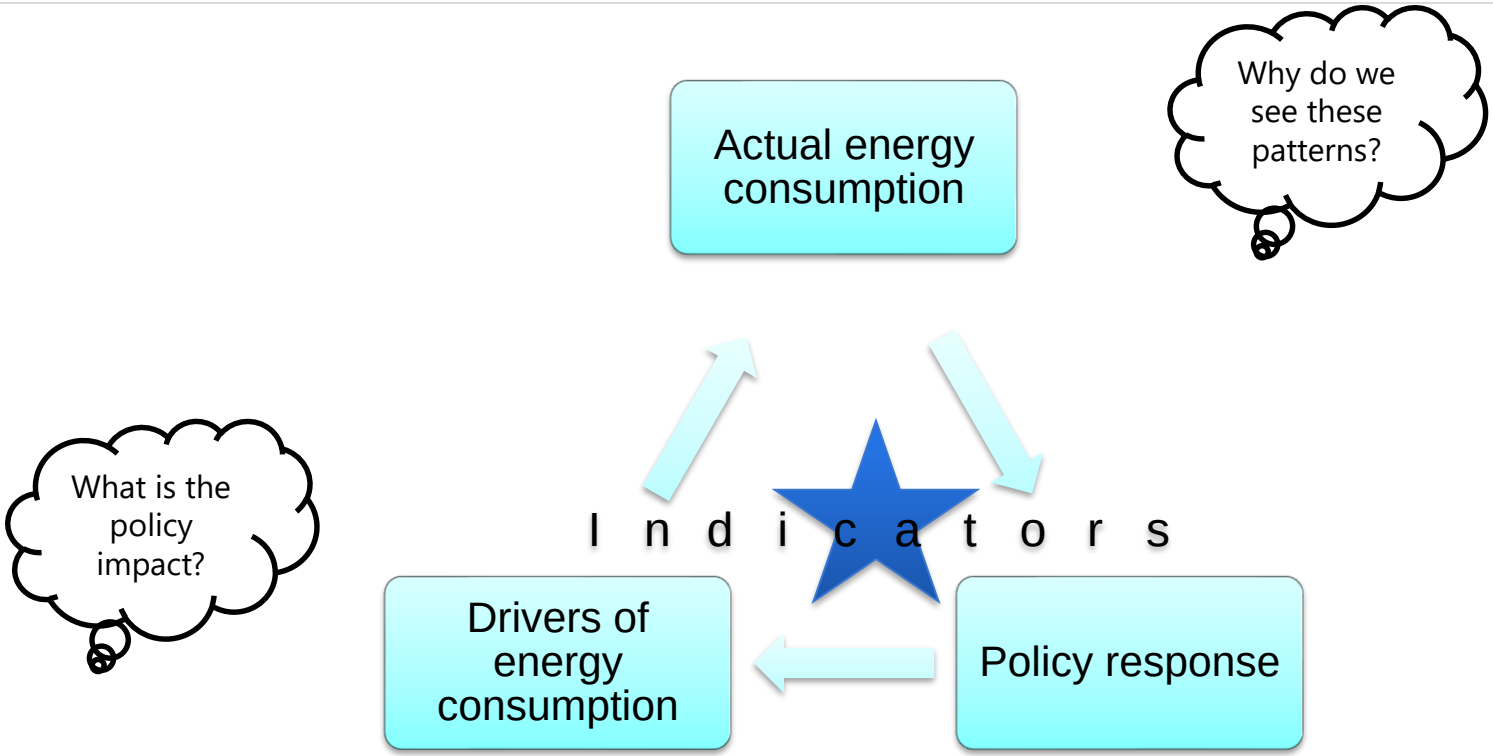
- Using less energy delivering less service



The need for detailed data and indicators

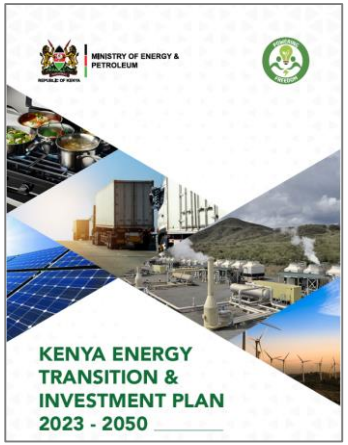
Energy efficiency indicators

The role of efficiency indicators



Source: adapted from IEA elearning courses (course 1)

The role of efficiency indicators



A set of technology interventions will be needed to achieve energy transition for a Net Zero

Sector		2020	2030	2040	2050
Industry	Steel	Improve energy and materials efficiency		Decarbonise future steel production through hydrogen DRI	
	Cement	Improve energy and materials efficiency		Decarbonise future cement production, starting 2040, through coal with CCS and minor biomass with CCS	
	Chemicals and other industries	Improve the efficiency of industrial processes		Decarbonise low - and medium - temp heat through industrial heat pumps Decarbonise high - temp heat through gas CCS	
Transport	Cars and motorcycles	Improve new cars efficiency standards and encourage public transport usage	Shift the market of new cars and 2 wheelers to electric with ~30% CAGR	Shift the whole fleet to electric as old cars and motorcycles retire	
	Freight trucks and buses	Improve new efficiency standards on freight trucks and buses		Shift trucks and buses to electric and hydrogen	
	Aviation and shipping	Implement new efficiency improvements and biofuels when available			
Buildings	Cooking	Replace traditional biomass cookstoves by oil - derived and improved biomass ones by 2030	Roll -out greater volumes of electric and improved biomass cookstoves to fully replace oil - derived ones sometime after 2050		
Power and Hydrogen	Power	Deployment of solar PV, onshore wind and geothermal starting 2020 to reach 8 GW, 14 GW and 3 GW respectively by 2040		Fast deployment of solar PV at 6GW/yr on average to reach 140 GW Deployment of nuclear units starting 2045	
	Hydrogen			Production of green hydrogen ramping up significantly starting 2040	

1 Through re-use, Vapor Recovery Unit (VRU) or Leak detection and repair for fugitives (LDAR)

Segment and vehicle types

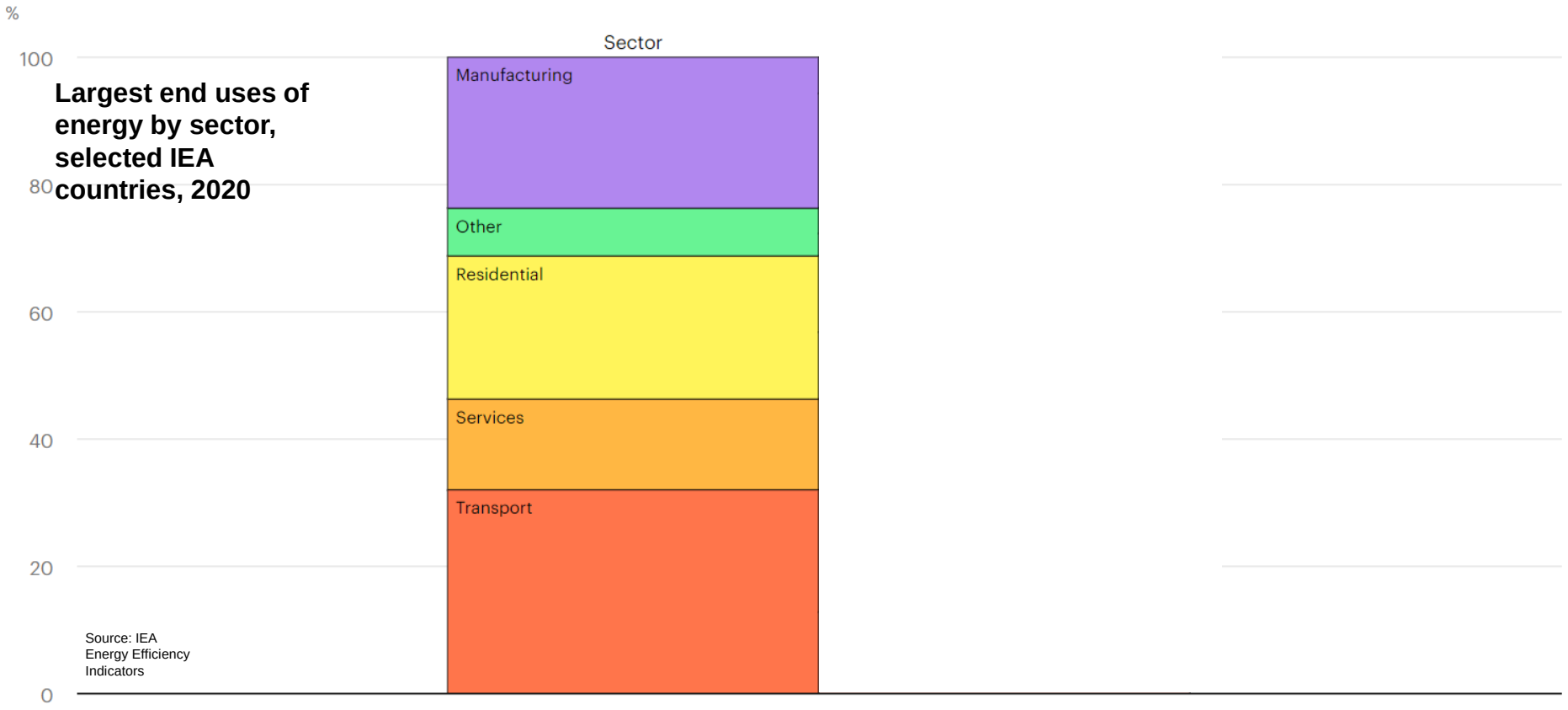
End use (e.g. cooking)

Indicators help understand if a country is on track to meet their targets

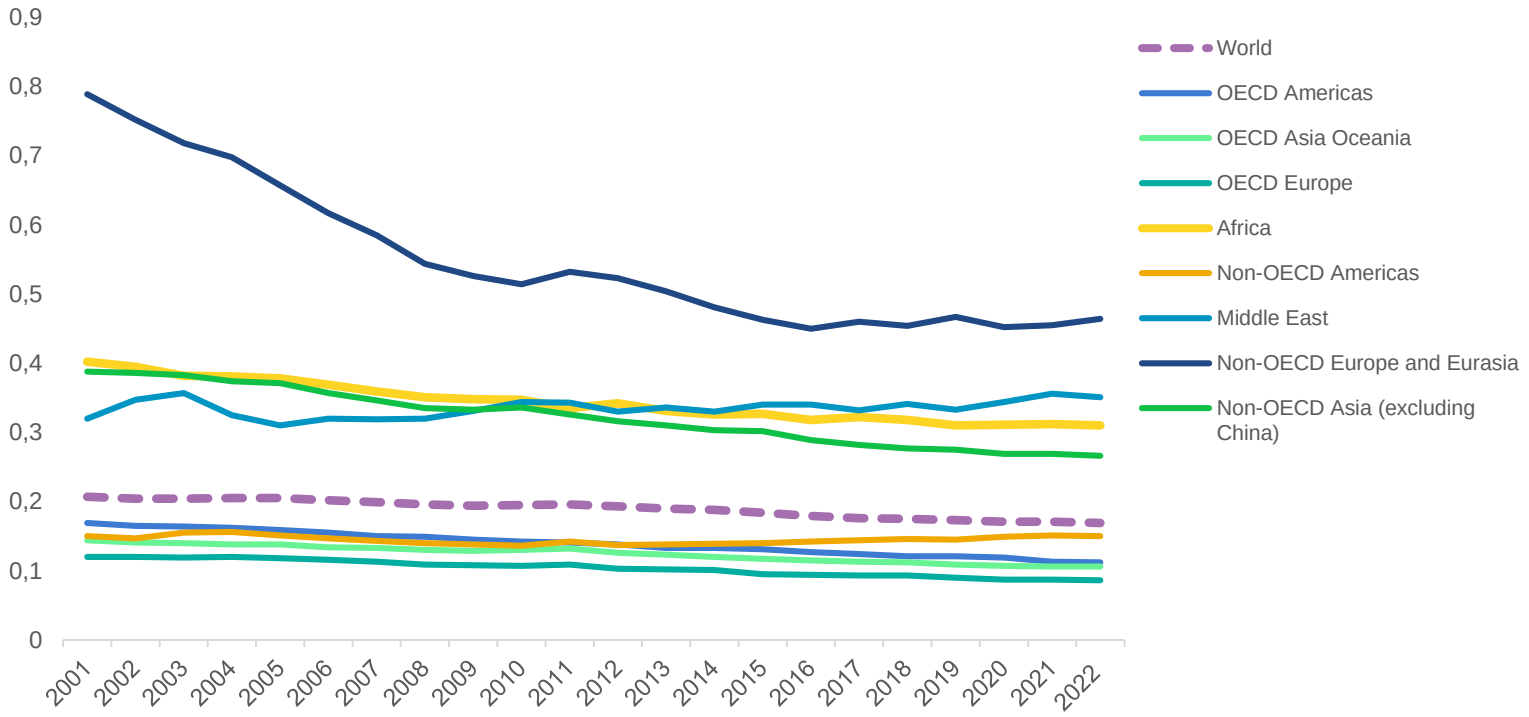
Why are efficiency indicators important?

- ✓ Support evidence-based policy design and evaluation
- ✓ Monitoring progress in relation to targets (international, national, regional…)
- ✓ Energy planning: energy projections, scenario design, etc…
- ✓ Benchmarking
- ✓ …

What is it that balances don’t tell us?



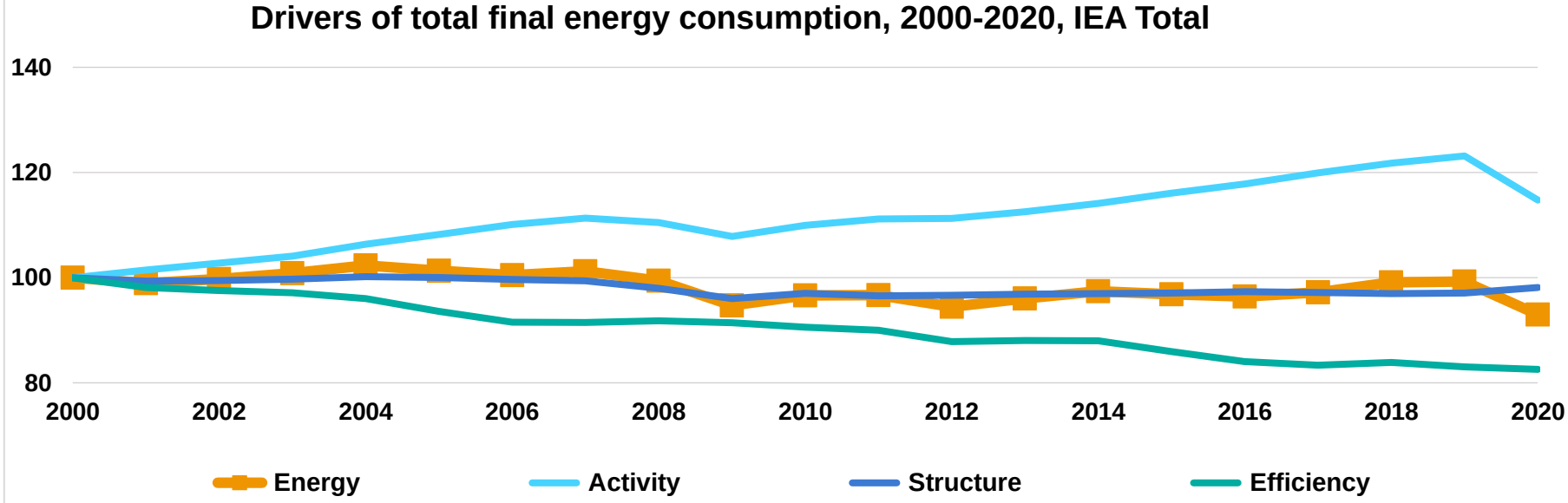
What drives energy intensity trends?



Source: IEA World energy balances and UNSD

Efficiency progress but also other factors (mainly activity /structural changes)

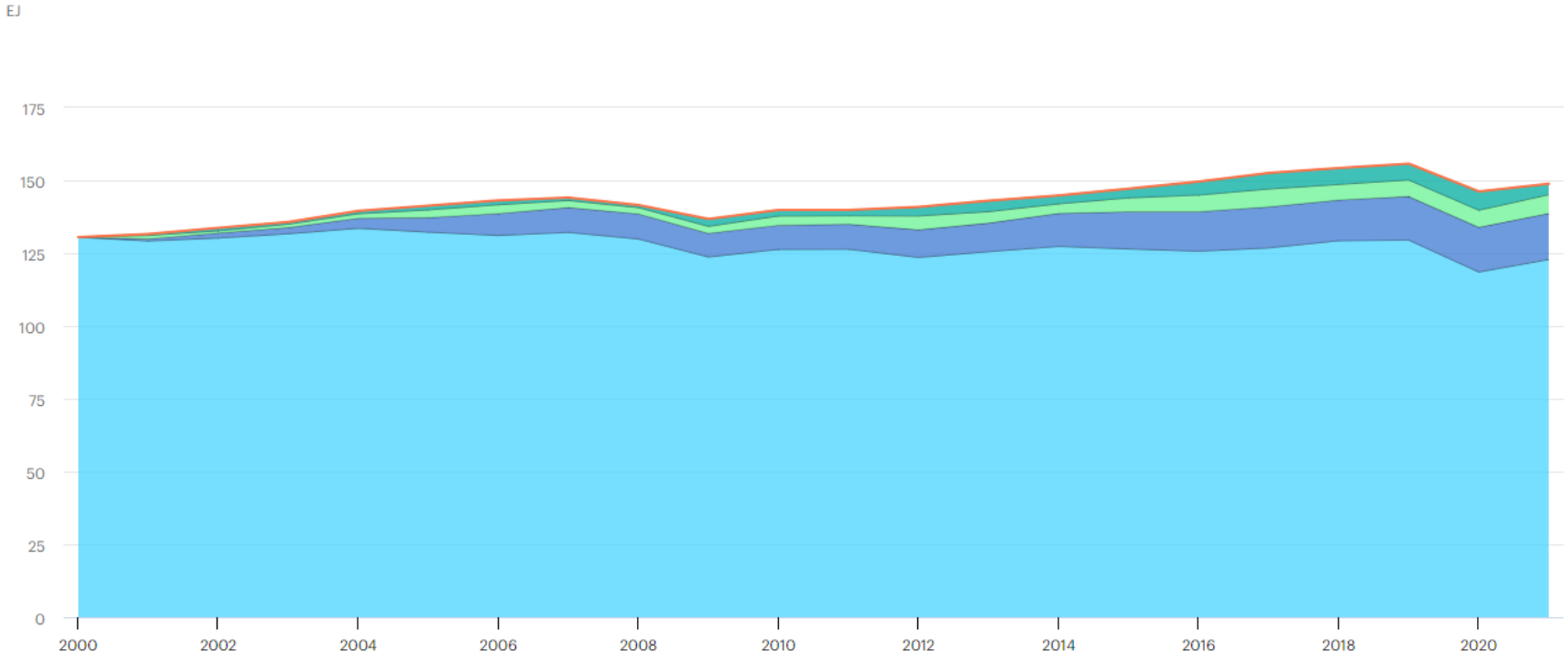
Disentangling efficiency from other drivers



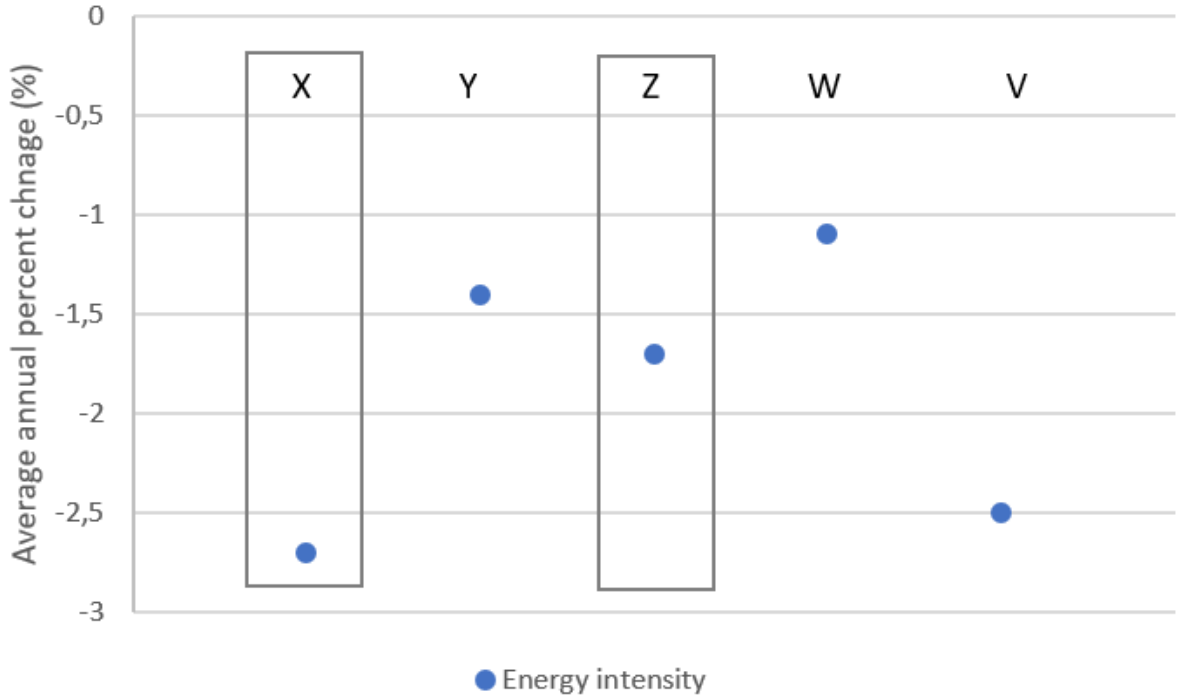
Source: IEA (2022), *Energy Efficiency Indicators Highlights* , OECD/IEA, Paris.

Estimating actual savings from efficiency

Estimated savings of final energy use in IEA countries, 2000-2021



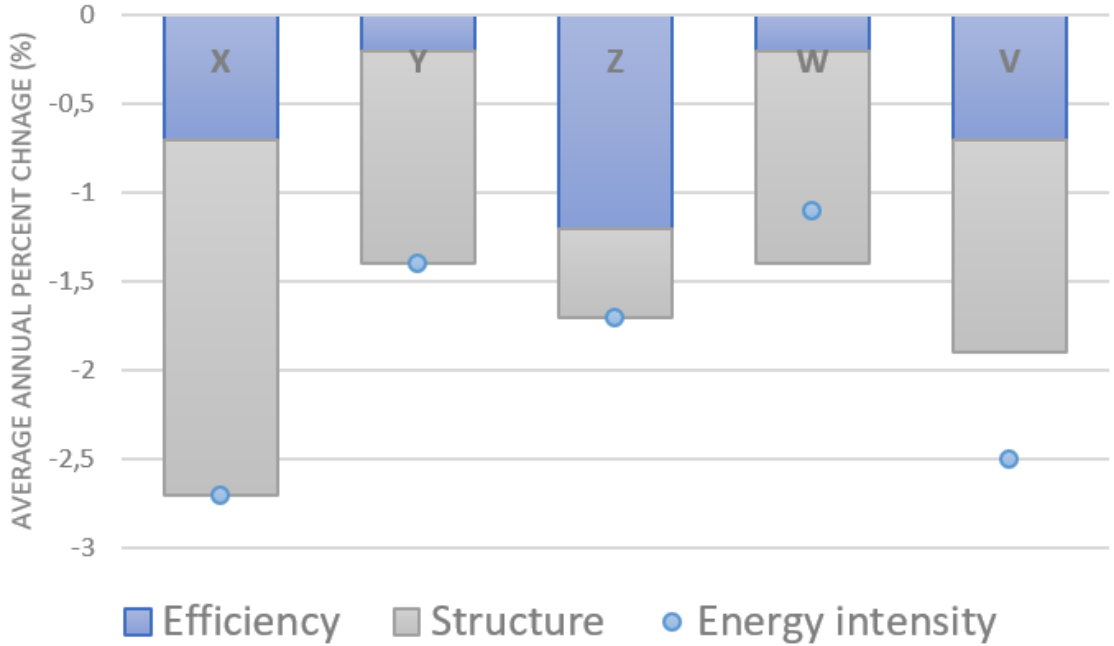
Aggregated Indicators may be misleading



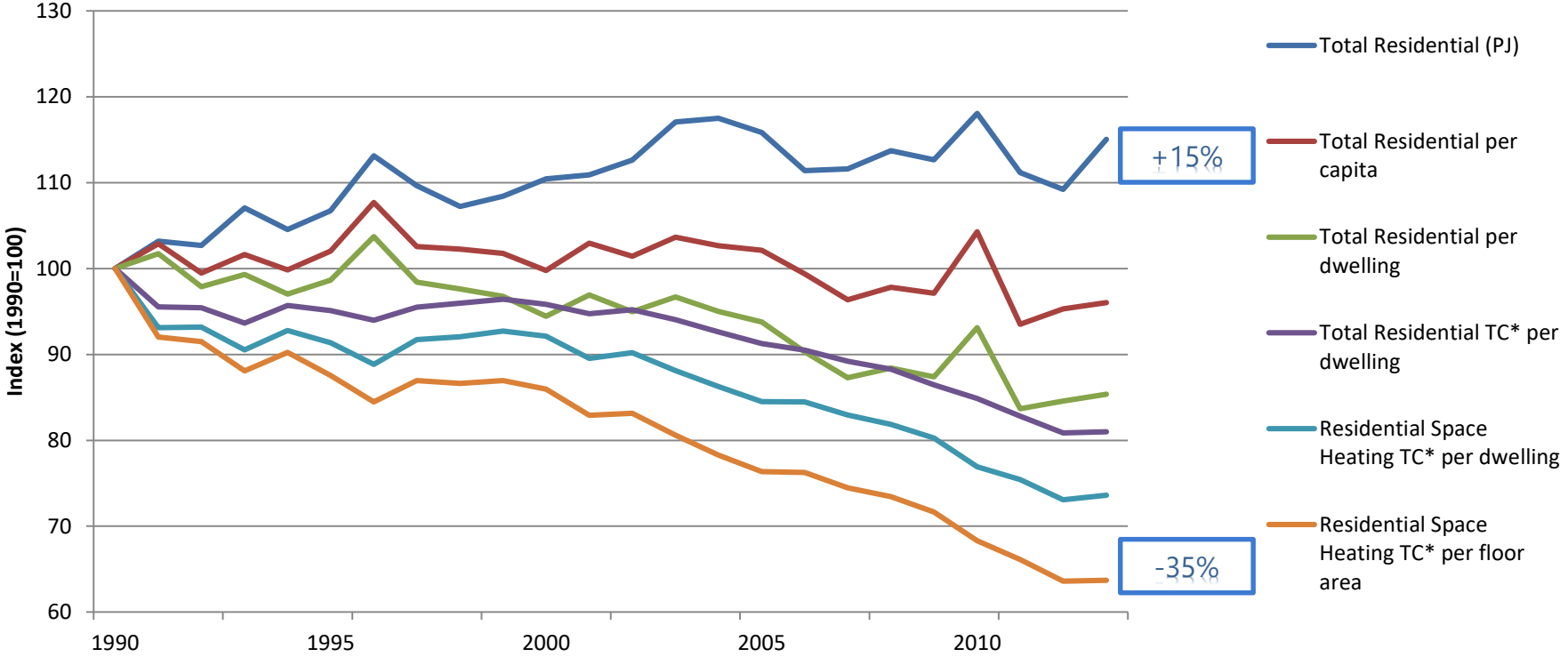
Intensity decreased more in country X. Is country X more efficient?

Aggregated Indicators may be misleading

Country X intensity reduction was mostly due to structural changes,
while country Y had larger energy efficiency improvements.



Discuss this chart in your groups – what do you think is going on?



Data for IEA 20
* Temperature correction using heating degree days
Data source: IEA, *Energy efficiency indicators, All rights reserved.*

How to develop energy efficiency indicators?

$$Energy\ efficiency\ indicator\ =$$

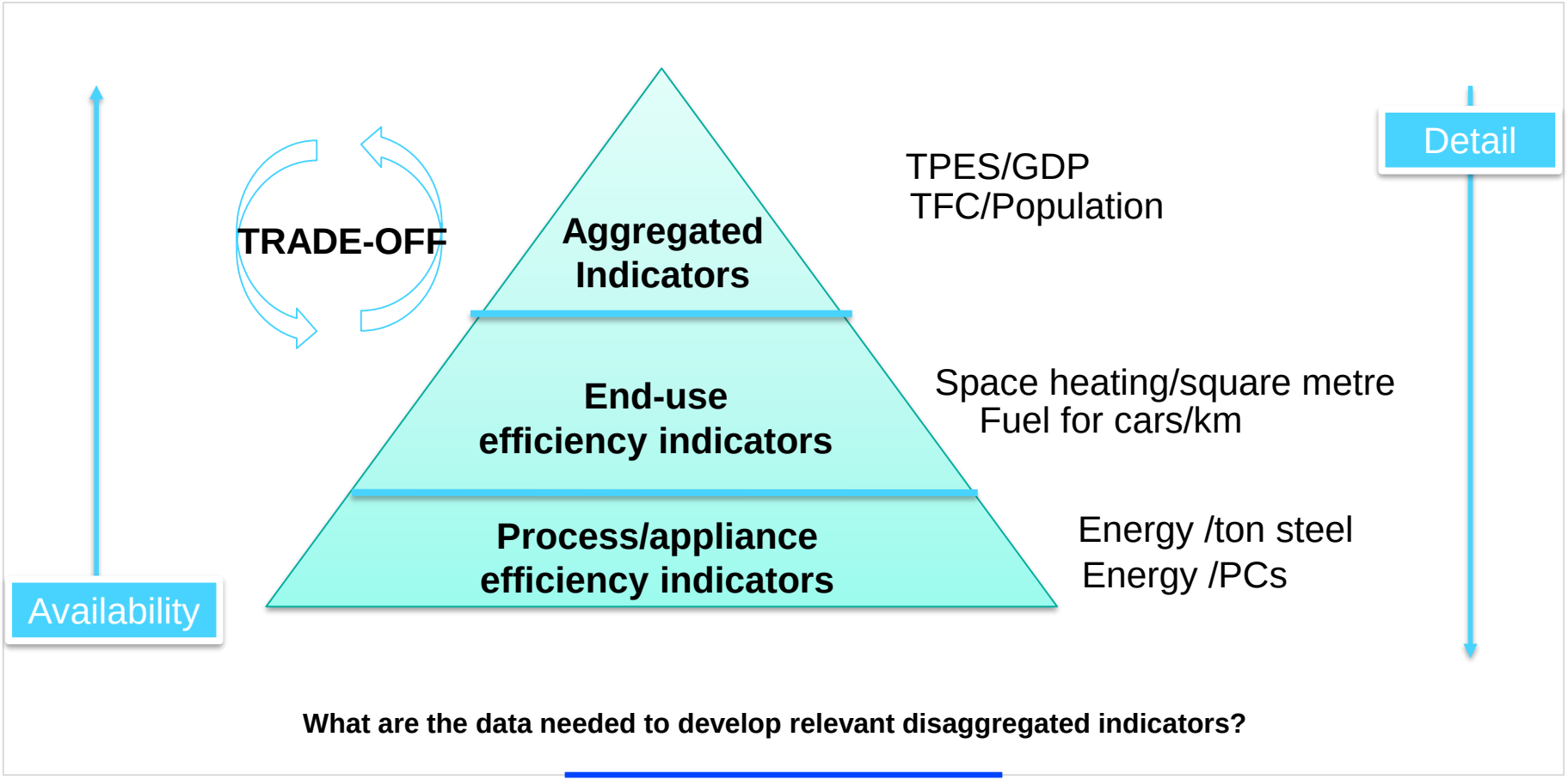
Energy needed to provide a given service

Basically, intensities at end use level.
***Per se,* don't tell much about energy efficiency, but enable further analysis.**

Energy efficiency indicators

Methodologies for development at national level

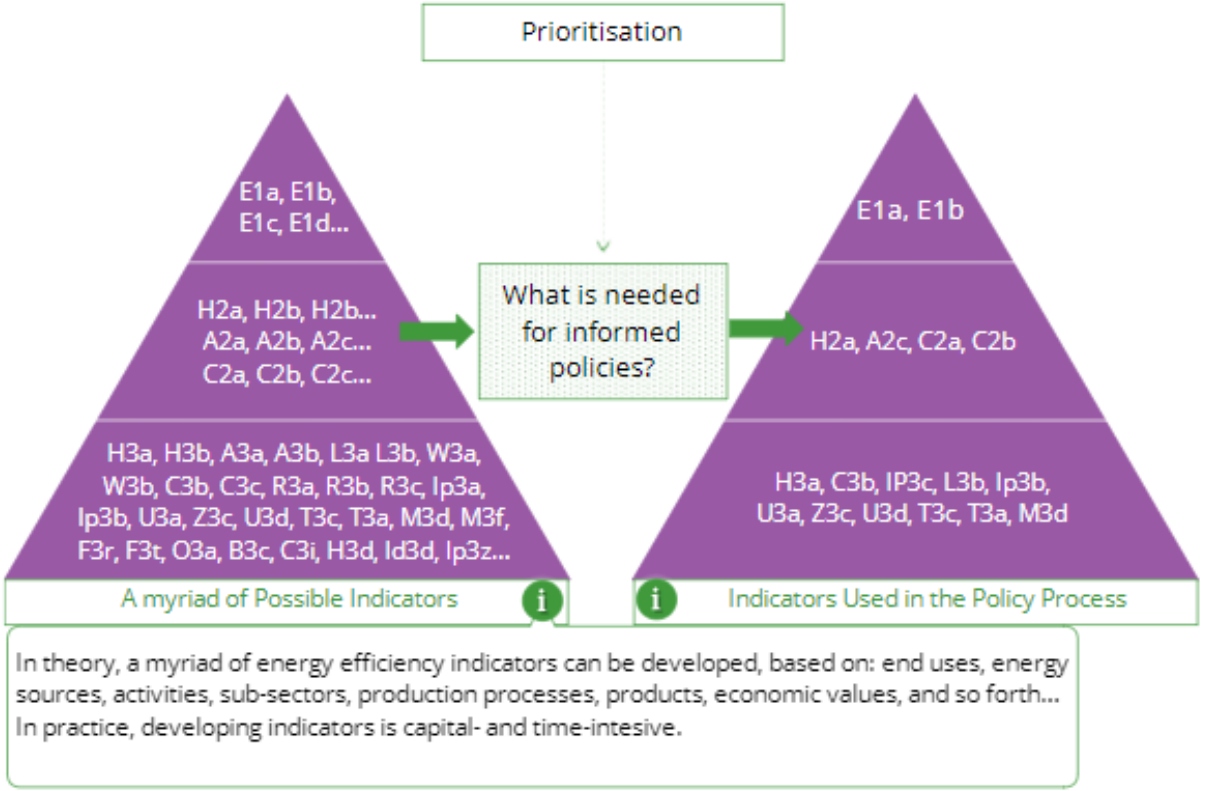
Energy efficiency indicators: stronger data requirements



What are the data needed to develop relevant disaggregated indicators?

Prioritisation of indicators

- A number of indicators can be developed to inform policies
- Prioritiation needed in line with policy goals and scope

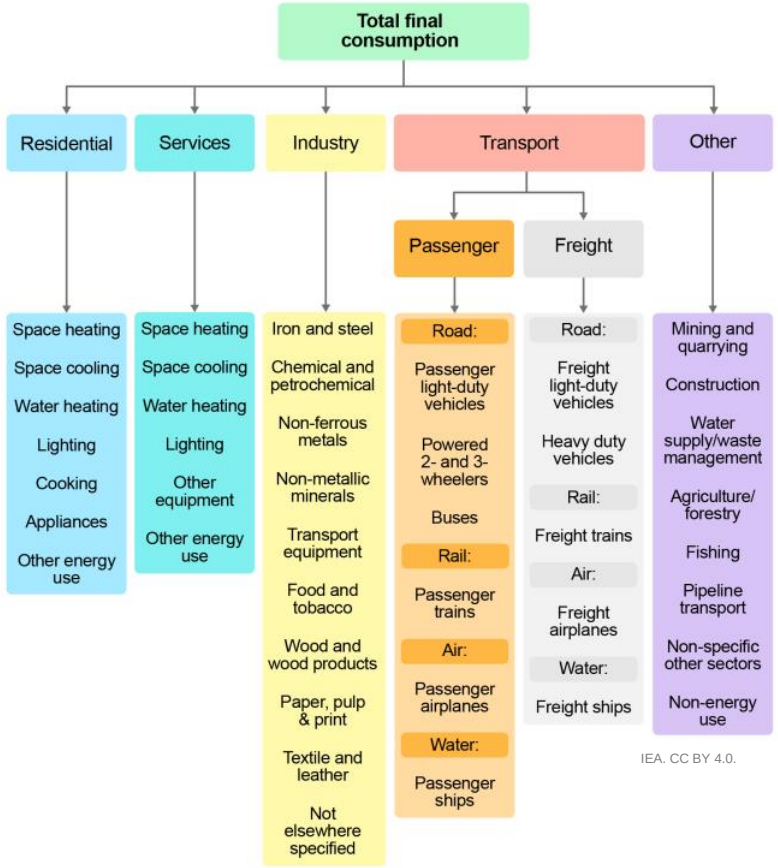


Source: IEA elearning courses

Understanding end uses across sectors

Energy balances: Sectoral consumption

Energy efficiency: End-use consumption



Data and indicators for the residential sector

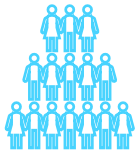
Energy consumption data:

- 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



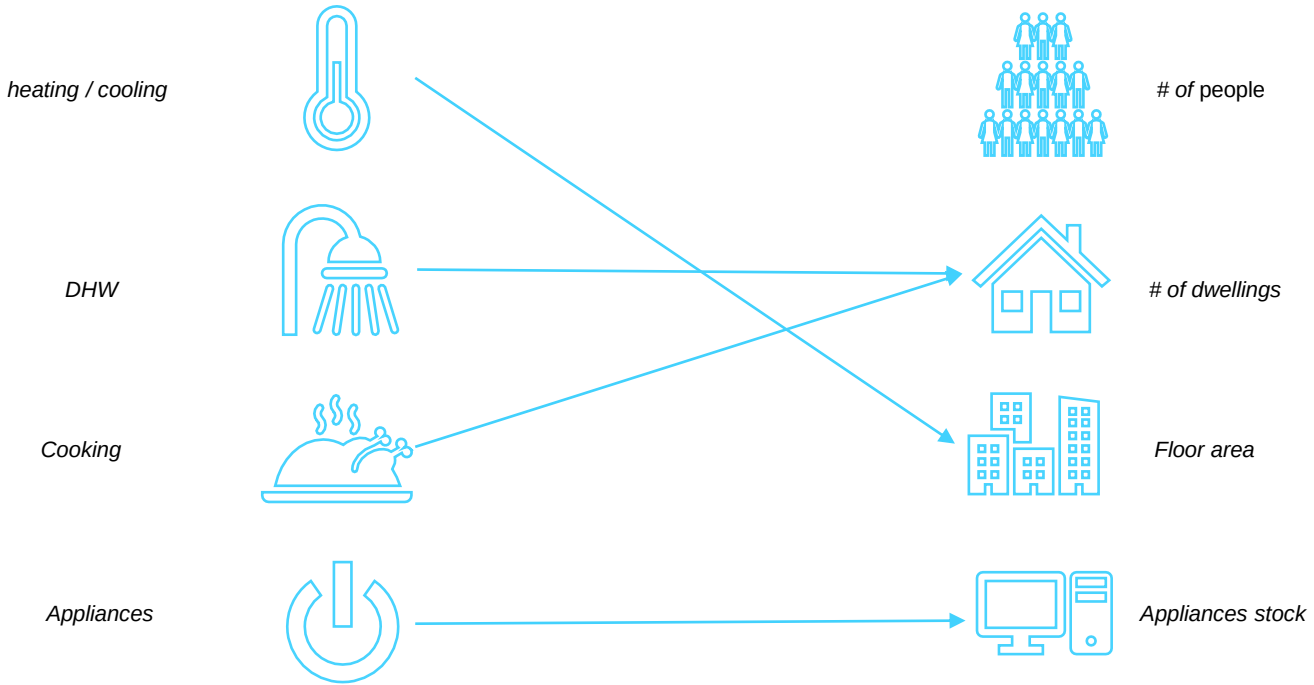
 # of people

# of dwellings

Floor area

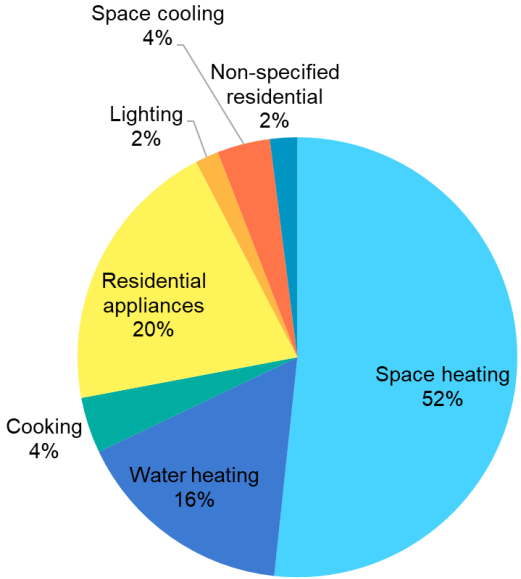
# of appliances

Boundary matching exercise

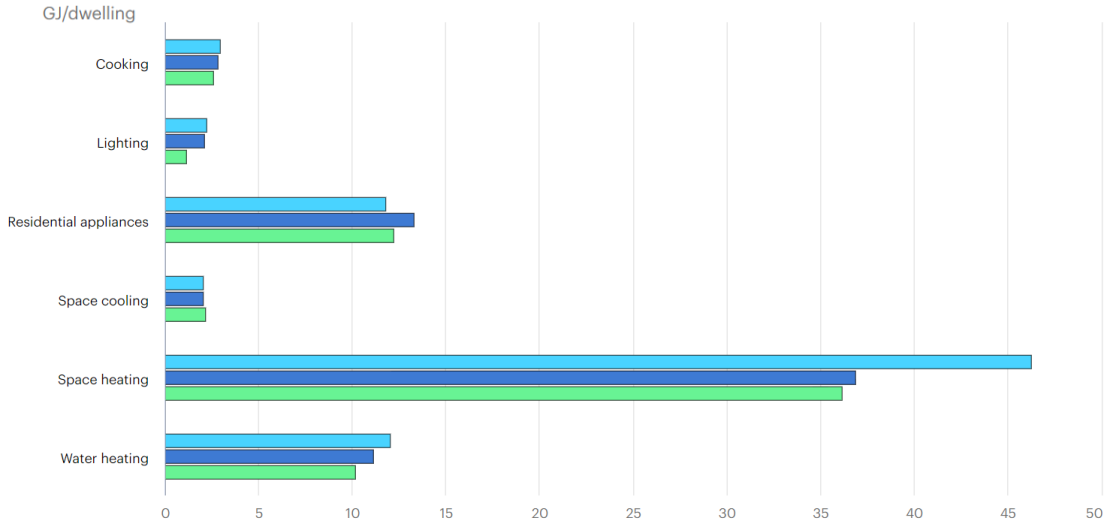


Example for the residential sector

Residential energy consumption by end use, 2020, IEA Total



Energy intensity for residential, 2000-2019, IEA



Source: IEA , *Energy Efficiency Indicators Highlights* , OECD/IEA, Paris.

Services

Energy consumption data

By end uses:

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

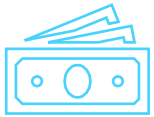
- Temperature corrected, using HDD & CDD

By ISIC sub-sectors:

- Sewerage, waste collection and remediation activities
- Wholesale and retail trade
- Warehousing, support activities for transportation, postal services
- Accommodation and food services
- Information and communication
- Financial, insurance, real estate, scientific, and administrative activities
- Public administration, excluding defense [ISIC 8422]
- Education
- Health and social work
- Arts, entertainment and recreation
- Other services activities

Activity data:

- Value added
- Service floor area
- Number of employees



Value added

Floor area

# of employees

Data and indicators for the industry sector

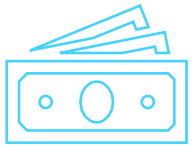
Energy consumption data

(major ISIC sub-sectors):

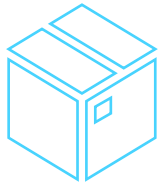
- Chemical
- Iron and steel
- Non-ferrous metals
  - Aluminum
- Non-metallic minerals
  - Cement
  - Clinker
- Pulp and paper
  - Pulp
  - Paper
- .... etc.

Activity data:

- Value added
- Physical production

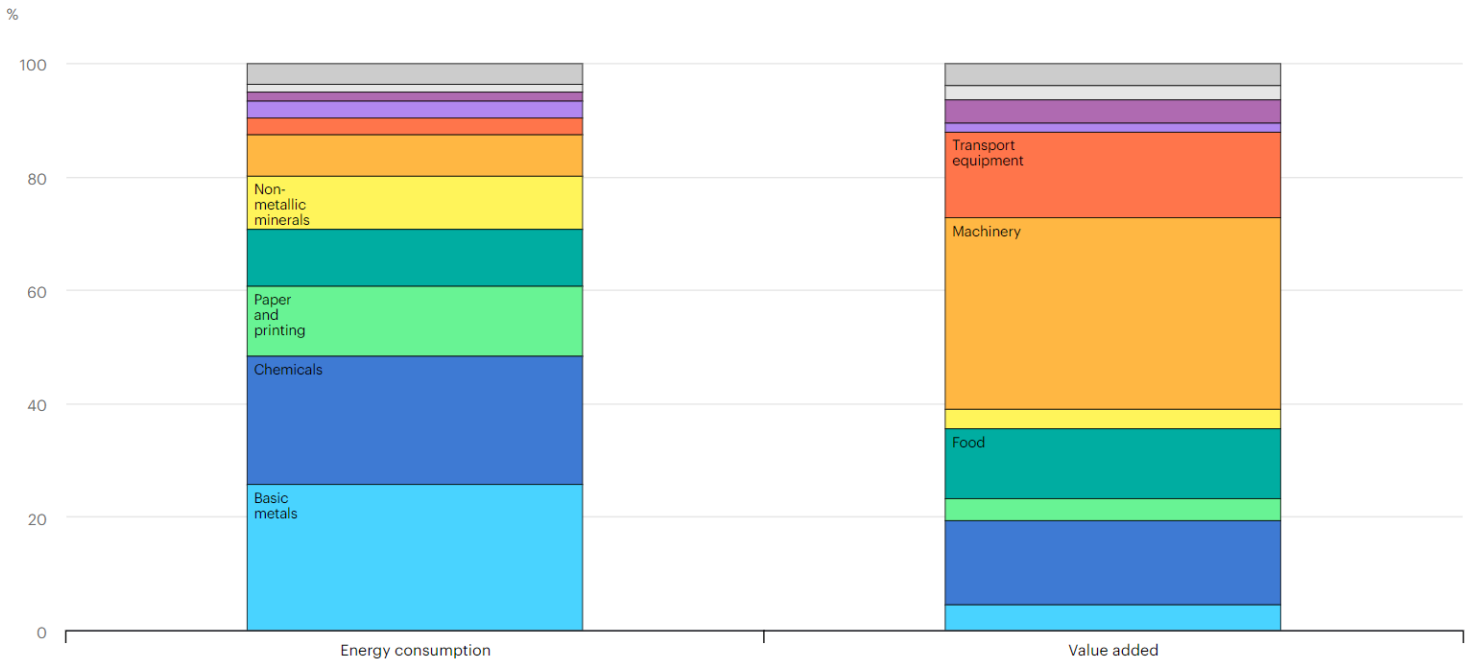


Value added



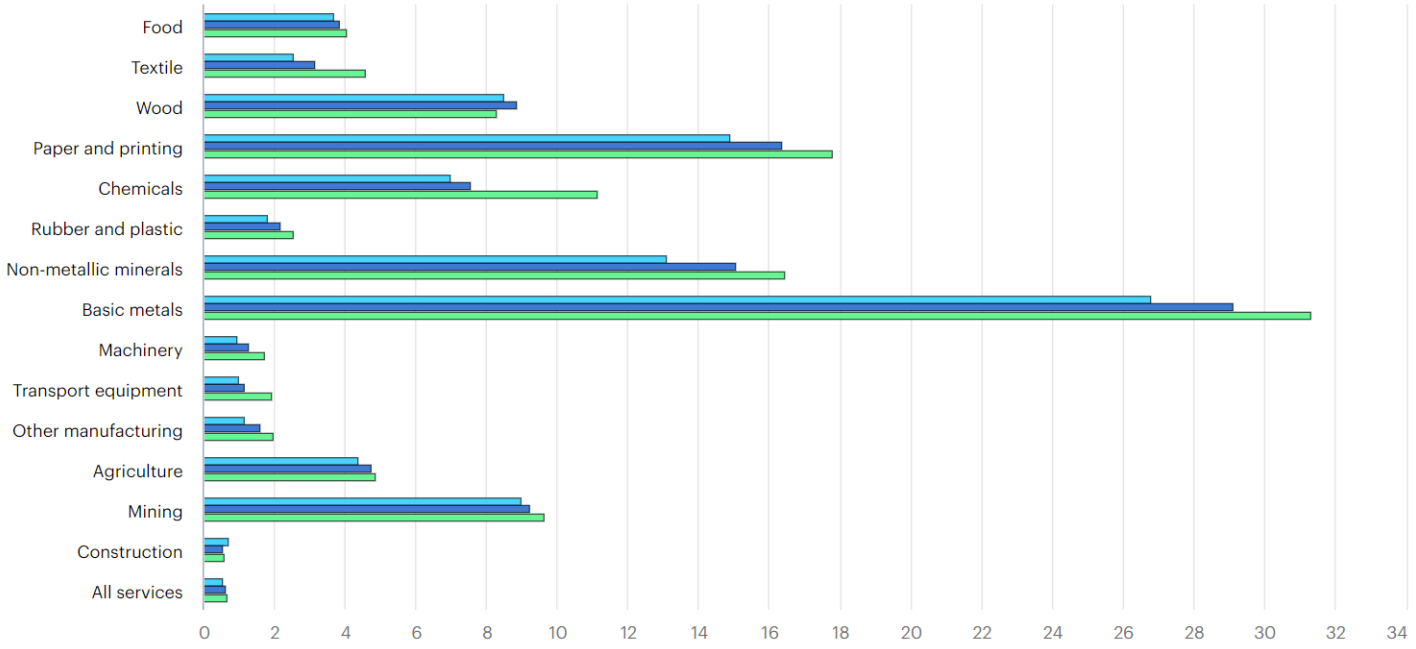
Volume

Examples for the industry sector



Source: IEA, *Energy Efficiency Indicators Highlights* , OECD/IEA, Paris.

Examples for the industry sector



Source: IEA, *Energy Efficiency Indicators Highlights* , OECD/IEA, Paris.

Transport

Energy consumption data:

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

Activity data:

- Vehicle stock
- Vehicle- kilometres
- Passenger-kilometers
- Tonne-kilometers

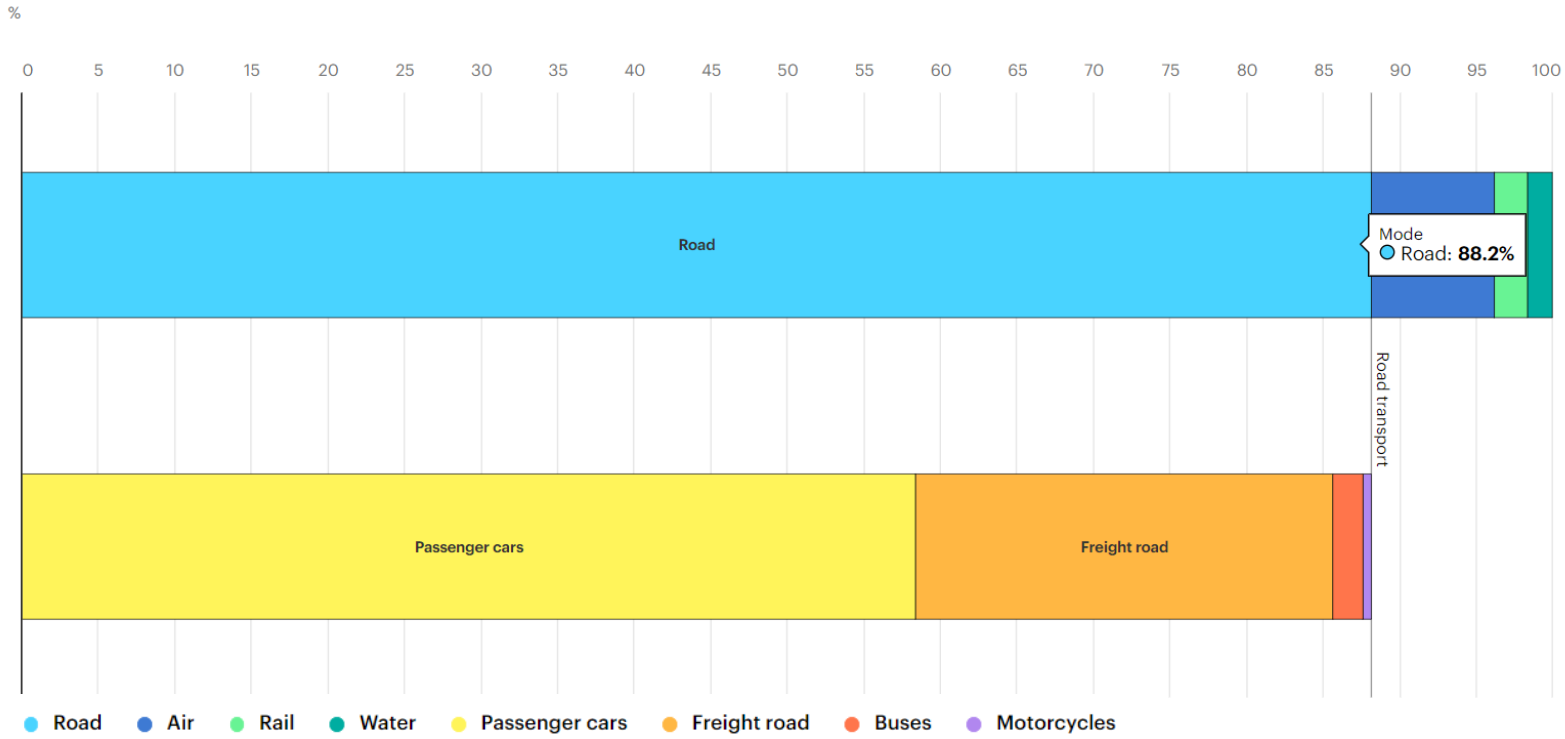
Vehicle stock

Distance travelled

Occupancy

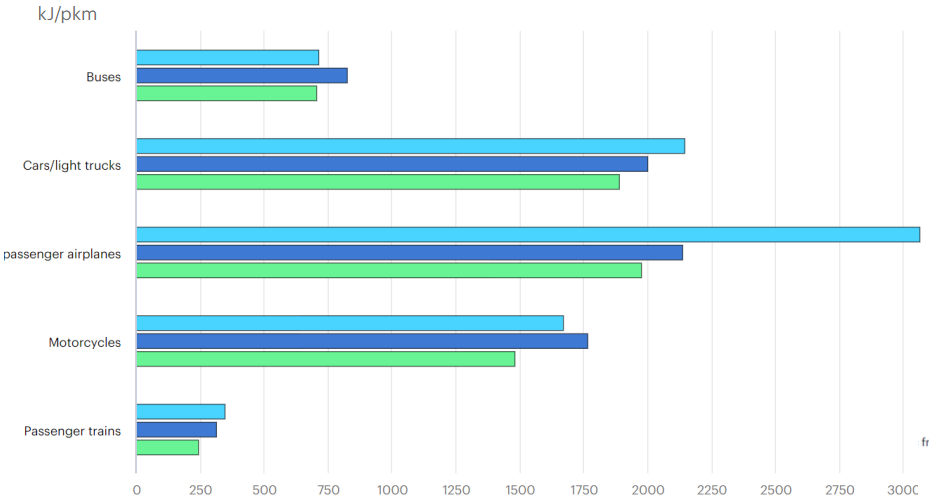
Load

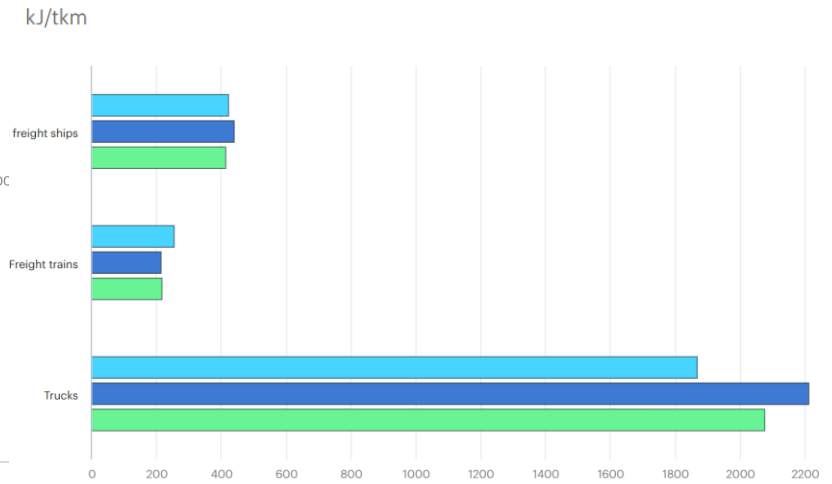
Examples for the transport sector



Source: IEA, *Energy Efficiency Indicators Highlights* , OECD/IEA, Paris.

Examples for the transport sector



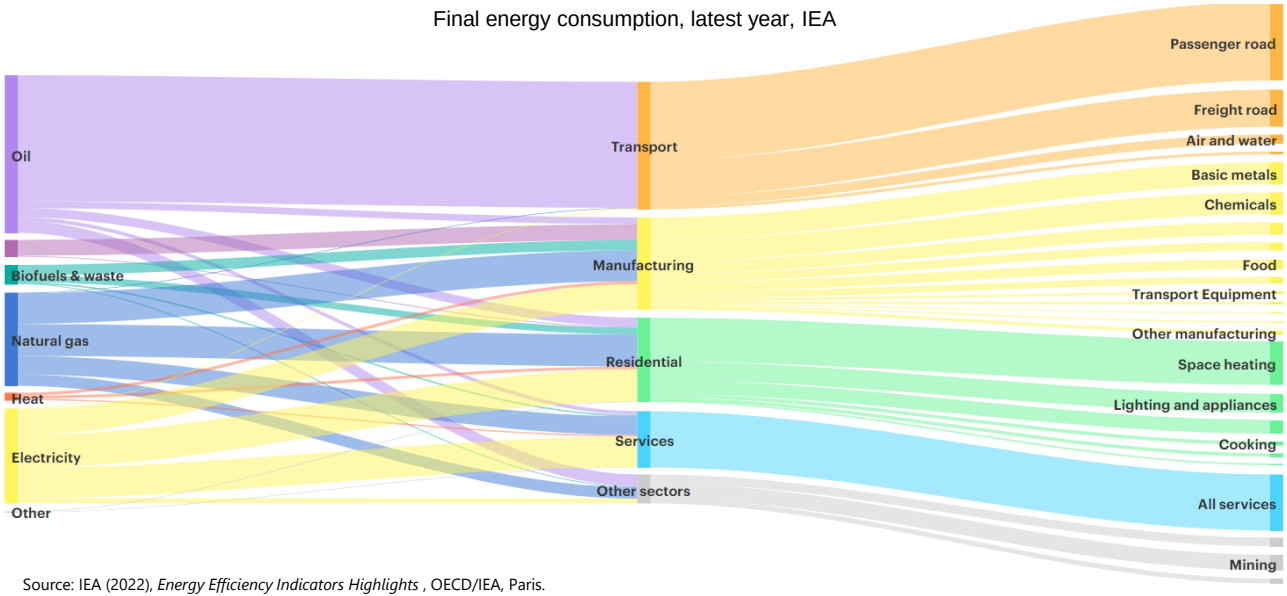


Source: IEA, *Energy Efficiency Indicators Highlights* , OECD/IEA, Paris.

Insights from end use data

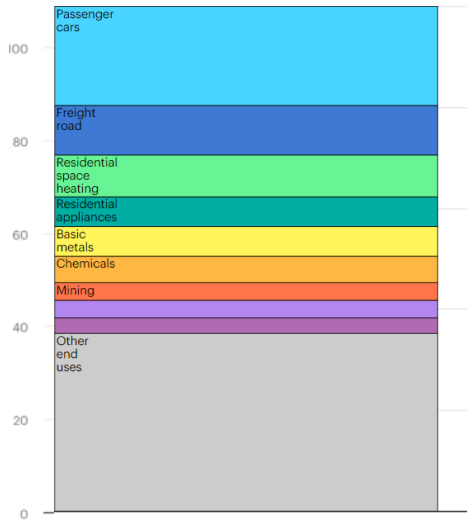
PJ

Final energy consumption, latest year, IEA



Source: IEA (2022), *Energy Efficiency Indicators Highlights* , OECD/IEA, Paris.

Top ten CO_2 emitting end uses, IEA, 2019



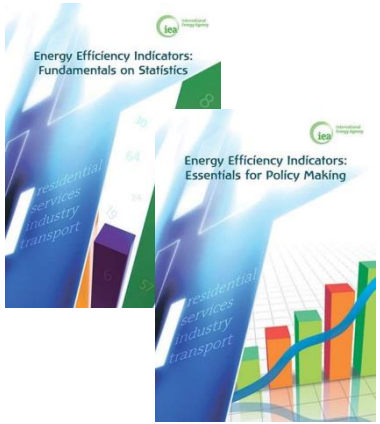
Resources and guidance

International guidelines and recommendations

- Development of EEI under the broader field of Energy Statistics – **consistency required with more aggregate indicators** e.g. from the Energy Balances

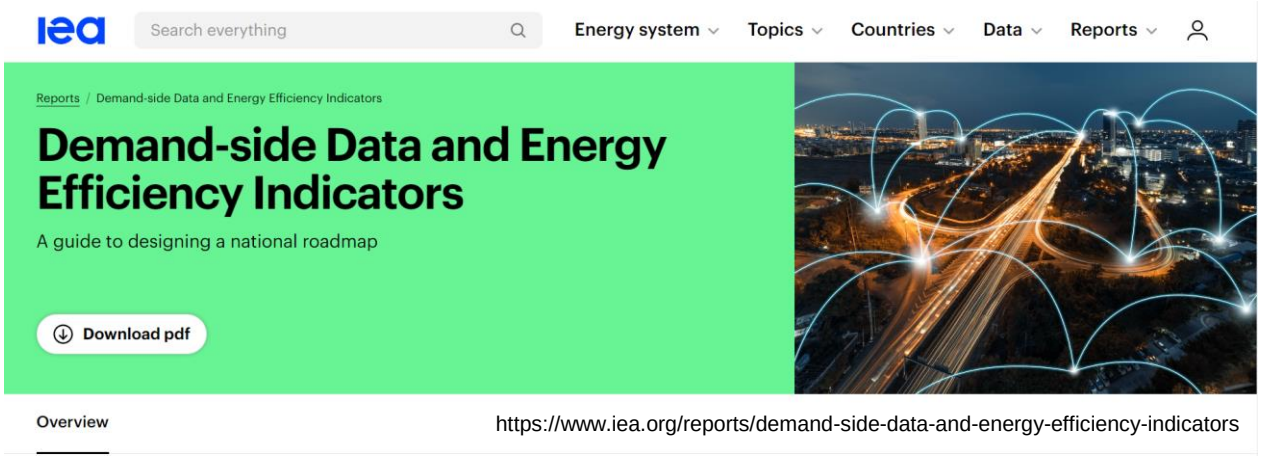
- **Alignment with international guidelines and recommendations** are essential for cross-country comparability

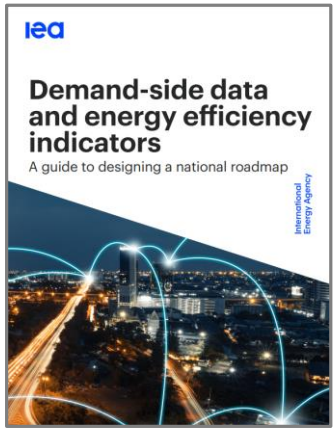
- Important to **understand underlying methodologies** (e.g. admin sources, surveys, metering, or modelling), even from a **user perspective**, as this may significantly affect the insights obtained from data analysis



A guide to designing a national roadmap

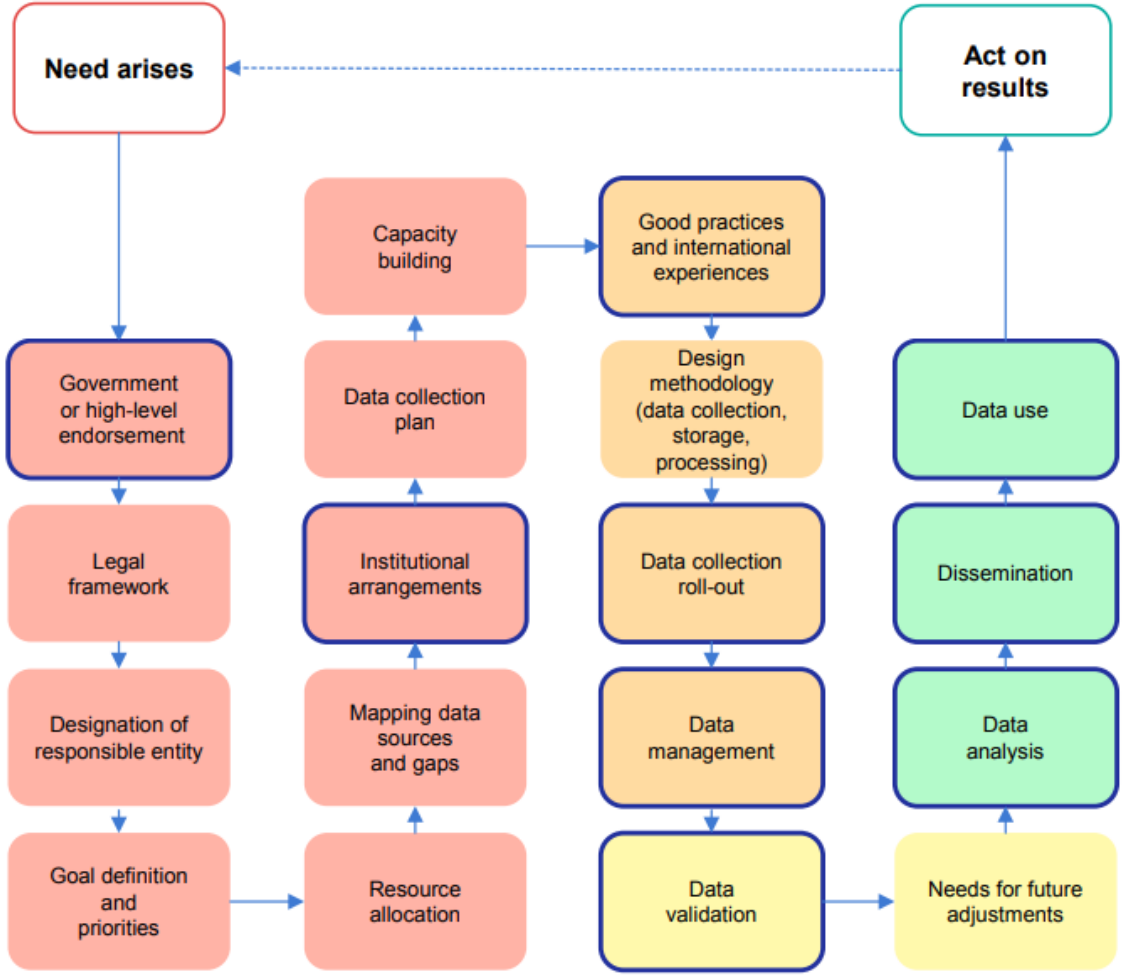
Demand-side data and energy efficiency indicators

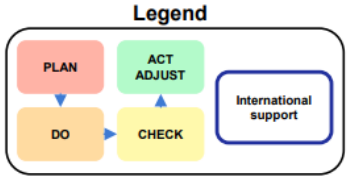




d-energy-efficiency-indicators

THE ROADMAP





THE ROADMAP

- FOR EACH STEP OF THE WAY:

The question(s) it addresses

An explanation of what it means

Actionable tips on the trigers to pull

Good pratices from countries / economies to illustrate how others have made it work

Budget definition (including physical office, HR, IT, and data collection)

(**Linked enablers**: proper resource allocation and staff capacity and stability)

1. What resources are needed to develop the indicators required?
2. What budget is available initially and what activities can it cover?

The allocation of a proper budget is an essential step. This is not only to collect data needed, which is in itself an important share of the overall budget and it may largely determinate the choice of the data collection methods and its accuracy; but also, to the development /improvement of the national energy data management system, to hire qualified staff /train them, to acquire the necessary infrastructure and software, etc…

In principle, surveys should be as short and least-cost as possible to address data needs. It is often found that countries conduct less detailed surveys with relatively high frequency and understake more ambitious and detailed data collection (with higher budget requirements) with lower periodicity.

Defining the relevant budget in the United States

The U.S. Energy Information Administration (EIA) provides independent, impartial information to support development of U.S. energy efficiency indicators. The development of these indicators is not specifically itemized in the budget, but is instead a component within EIA's overall annual appropriation.

International Energy Agency

Case study: Nigeria household survey

Yusuf Bello Habib

March 18 2024

Nairobi

Introduction to the case study

Charles Michaelis

March 18 2024

Nairobi

Doubling global progress on energy efficiency

COP28 final text:

Calls on Parties to contribute to … doubling the global average annual rate of energy efficiency improvements by 2030

Why doubling?

Why should we double?

A critical step on the path to net zero

Over 7 Gt CO_2 emissions savings in 2030

Today's home energy bills in advanced economies lowered by a third

4.5 million more jobs than today

Energy savings equivalent to twice the EU's consumption in 2022

Source: IEA(2023) Energy efficiency, Paris

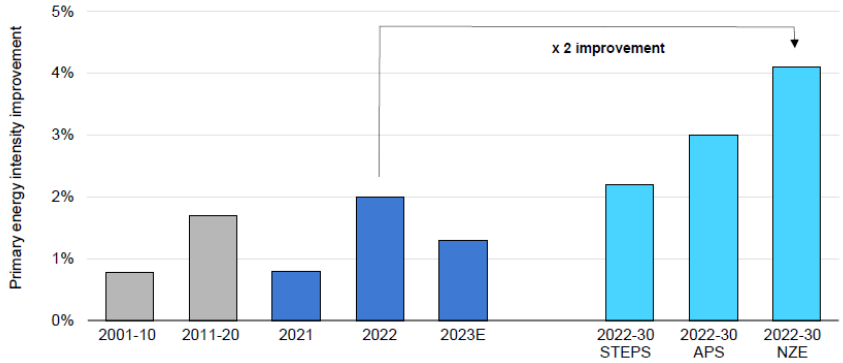
Doubling global progress on energy efficiency: what does it mean?

- Indicator used as proxy : Energy intensity (Total energy supply /GDP) ; needs to be carefully interpreted

- Double the anual rate of improvement in relation to 2022 level (2%) up to 2030 (i.e. 4%), towards NZE.

- The target is a global one: All parties count!

Annual primary energy intensity improvement, 2001-2022, 2023E, and by scenario, 2022-2030

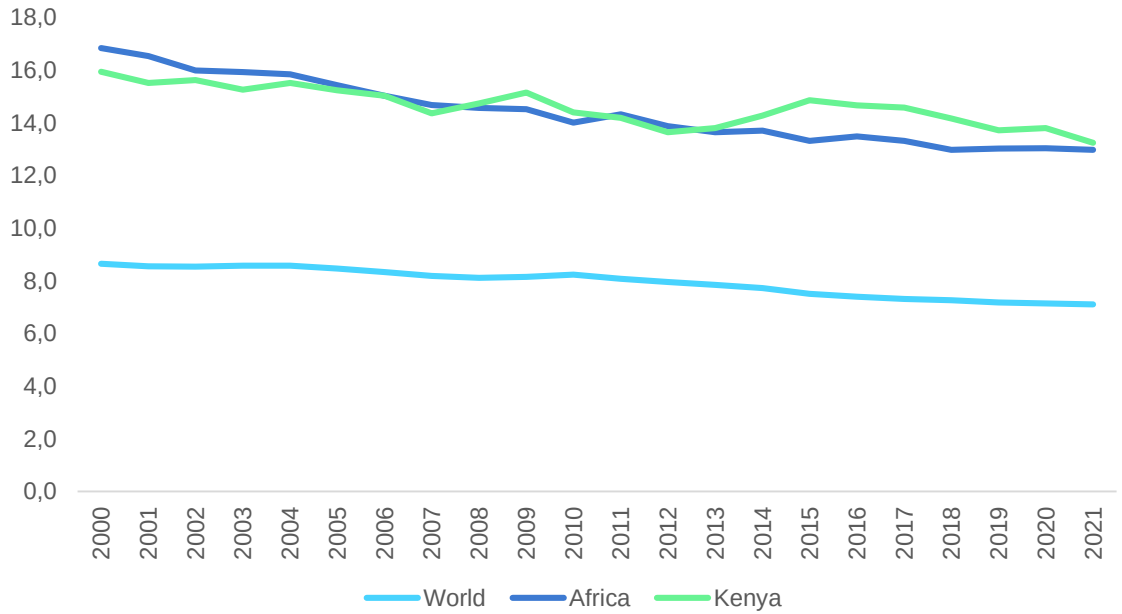


Note: STEPS = Stated Policies Scenario; APS = Announced Pledges Scenario; and NZE = Net Zero Emissions by 2050 Scenario.

Source: IEA(2023) Energy efficiency, Paris

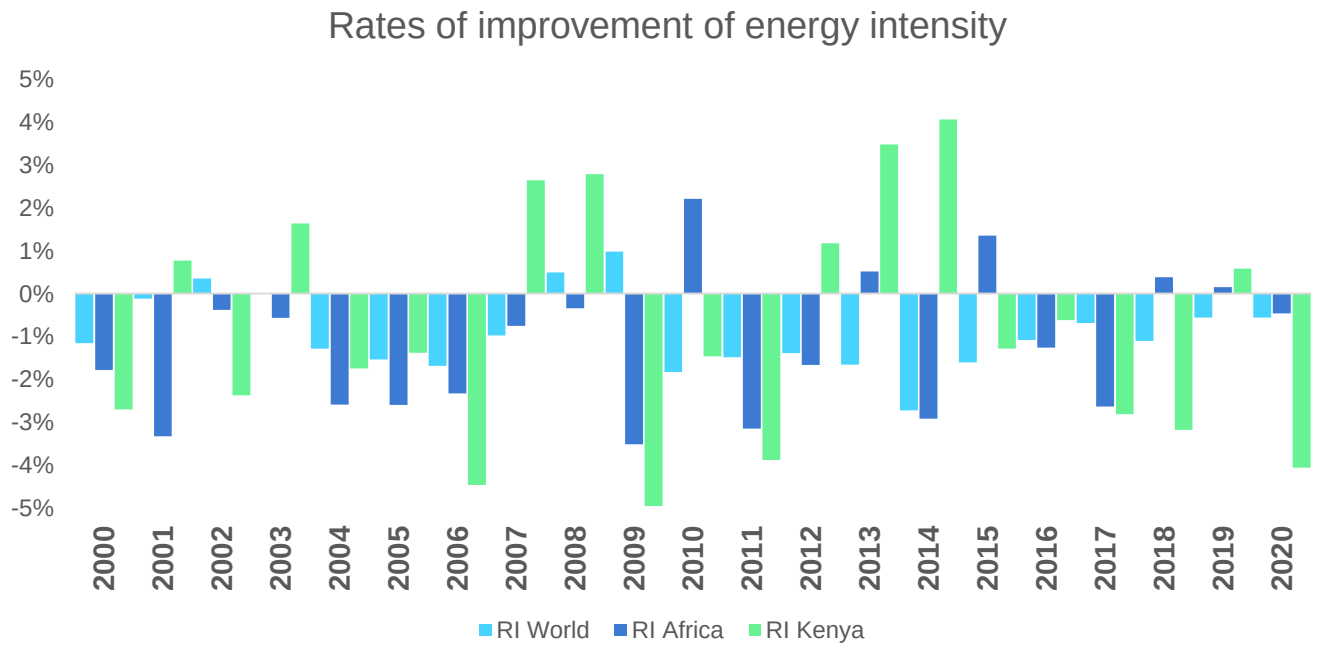
Energy intensity trends

TES/GDP (MJ per 2015 USD)	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
World	8,2	8,1	8,0	7,9	7,7	7,5	7,4	7,3	7,3	7,2	7,1	7,1
Africa	14,0	14,3	13,9	13,6	13,7	13,3	13,5	13,3	13,0	13,0	13,0	13,0



Rates of improvement

	2001-00	2002-01	2003-02	2004-03	2005-04	2006-05	2007-06	2008-07	2009-08	2010-09	2011-10	2012-11	2013-12	2014-13	2015-14	2016-15	2017-16	2018-17	2019-18	2020-19	2021-20
RI World	-1%	0%	0%	0%	-1%	-2%	-2%	-1%	0%	1%	-2%	-1%	-1%	-2%	-3%	-2%	-1%	-1%	-1%	-1%	-1%
RI Africa	-2%	-3%	0%	-1%	-3%	-3%	-2%	-1%	0%	-4%	2%	-3%	-2%	1%	-3%	1%	-1%	-3%	0%	0%	0%
RI Kenya	-3%	1%	-2%	2%	-2%	-1%	-4%	3%	3%	-5%	-1%	-4%	1%	3%	4%	-1%	-1%	-3%	-3%	1%	-4%

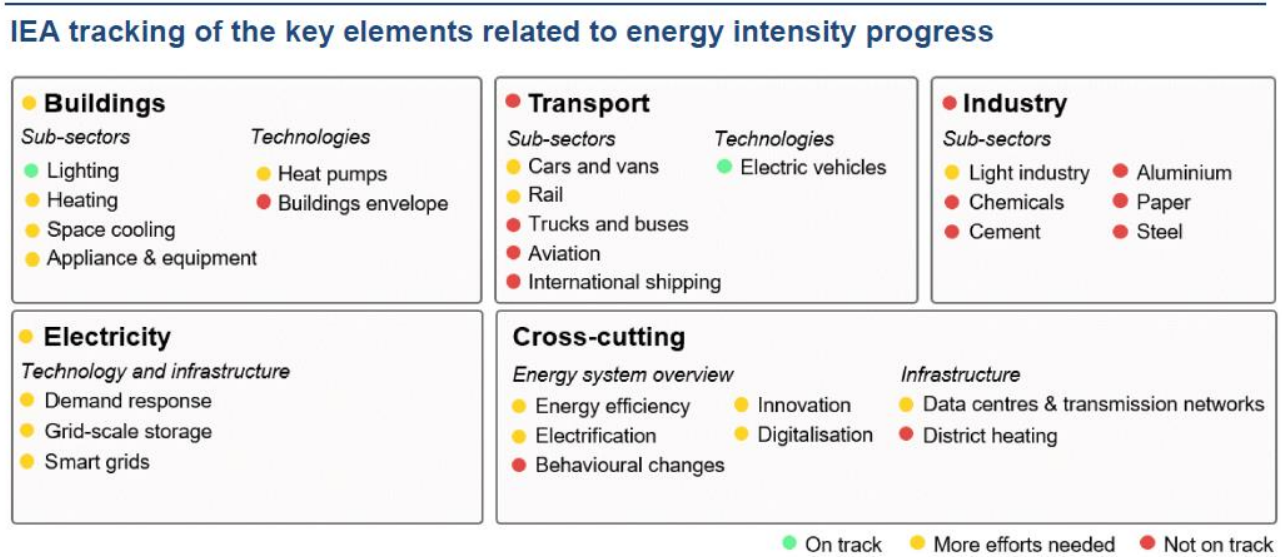


Factor in confounding aspects

- Changes in prices indexation (curretly GDP measured in 2015 prices);
- Climate
- Activity
- Structure
- Others?

Tracking the progress towards the doubling energy efficiency target

- Country / region
- Sector / subsector
- Technology
- Policy coverage
- Investment and R&D



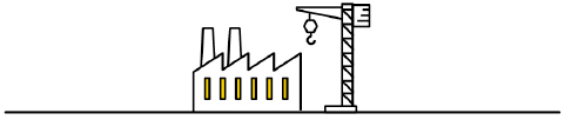
Source: IEA (2023), Tracking Clean Energy Progress 2023.

How to double?

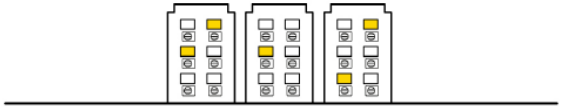
How do we double?

Strong policy packages of **information**, **regulations** and **incentives**, and a **tripling of global investment** in efficiency, lead to the following between now and 2030

Share of electricity in energy demand increases by over a third, and smart grid investment more than doubles

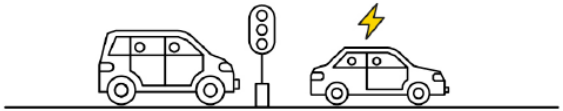


In industry, annual energy productivity grows by 2.3% per year, and electricity accounts for 30% of energy use by 2030



Retrofit rates for buildings more than double to 2.5% per year saving enough energy to power all the buildings in China and India today.

Appliances including ACs and refrigerators require 30% to 40% less energy to do the same job. All markets mainly sell LED lighting



Cars become 5% more efficient each year, largely through electrification and a switch to smaller vehicles

Consumers make active and ongoing behaviour changes in everyday life, like limiting heating to 19-20 °C

Source: IEA(2023) Energy efficiency, Paris

Your mission

- Working in your groups
  - Thinking about one of your countries
  - Develop a policy for doubling the rate of energy efficiency improvements in industry, buildings, transport **or** appliances
- On Tuesday we will develop a theory of change and identify indicators and consider how they could be measured
- On Wednesday we will develop evaluation questions and consider how they might be addressed
- Three presentations:
  - Theory of change
  - Monitoring Plan
  - Monitoring and Evaluation Framework

Kenya’s National Energy Efficiency Policy

Sector	Households	Buildings	Industry and agriculture	Transport	Power utilities
BACKGROUND	*A majority of households still use polluting and inefficient resources for cooking fuel (wood, coal)*	*Building production accounted for 36% of energy use; current efficiency improvements do not meet demand growth*	*Industrial energy efficiency is of great importance to expanding energy access, improving business competitiveness, and enhancing energy security.*	*Upward trend in petroleum fuel consumption; 30% of vehicles are more than 15 years old; transport sector is increasing*	
OBJECTIVES	•Improve the energy efficiency of household electrical appliances •Improve the energy efficiency of household energy	•Develop minimum energy performance standards for buildings •Improve energy performance of new buildings •Improve energy efficiency of lighting in existing public buildings •Promotion of new green public buildings	•Increase the reach of successful industrial energy efficiency programmes. •Improve the acceptance of energy audits and implementation of energy audit recommendations •Enhance the recommendation of recommended EE measures •Improve EE in the agricultural value chain in off-grid areas	•Improve fuel economy and performance and reduce co2 emissions •Increase the adoption of electric and hybrid vehicles •Enhance public transport •Improve urban vehicle management (reduced traffic jams and improved parking capacity)	•Create and implement models for utility-financed energy efficiency implementation, through methods that create payment streams from energy savings •Improve the efficiency of the energy supply system and delivery infrastructure •Grid stability

Think about the policy package