Energy efficiency indicators in the residential sector

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IEA

Why is the residential sector important?

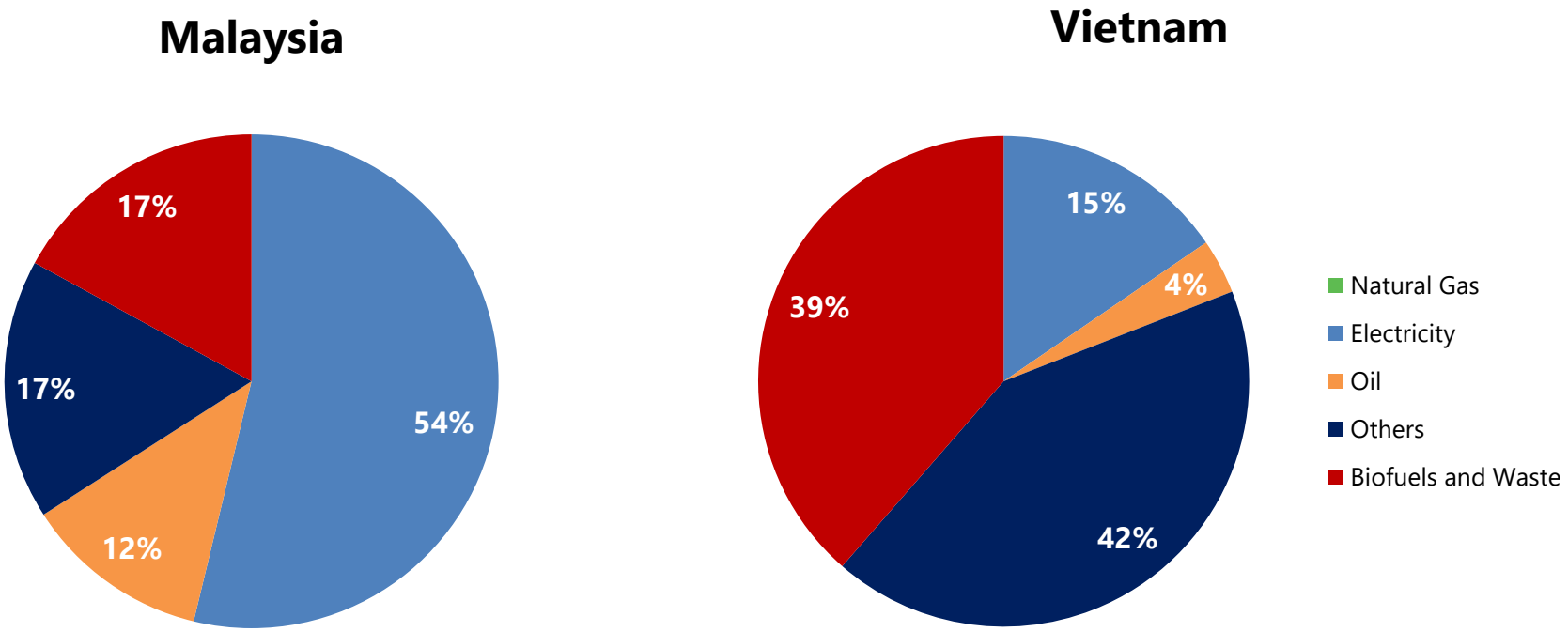
It determines our quality of life!

Overview

- What we can learn from **energy balances (wrap up from yesterday)**?
- What can we learn from **energy efficiency indicators**?
- **Developing energy efficiency indicators** – discussion
- How to perform **temperature correction**?

What we can learn from energy balances?

Fuel mix in residential sector

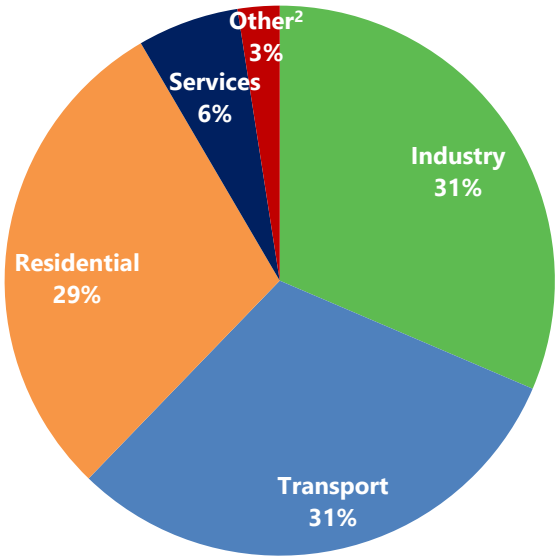


Fuel mix in the residential sector varies across countries

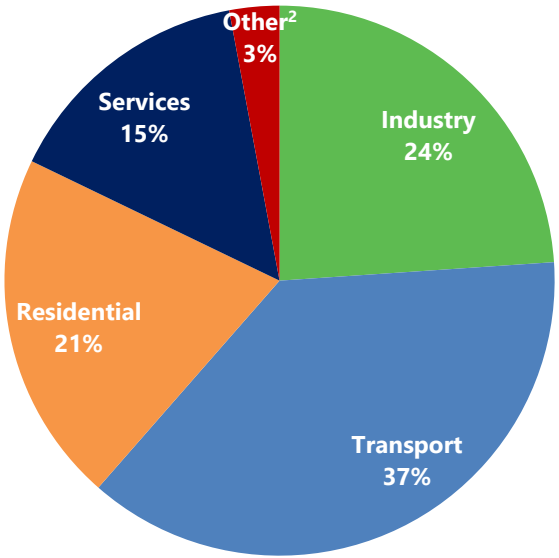
Source: *IEA Energy Balances, 2018*

Sectoral shares in Asian focus region[1] and IEA

Asian focus region, 2016



IEA, 2016



Source: IEA Energy Balances, 2018

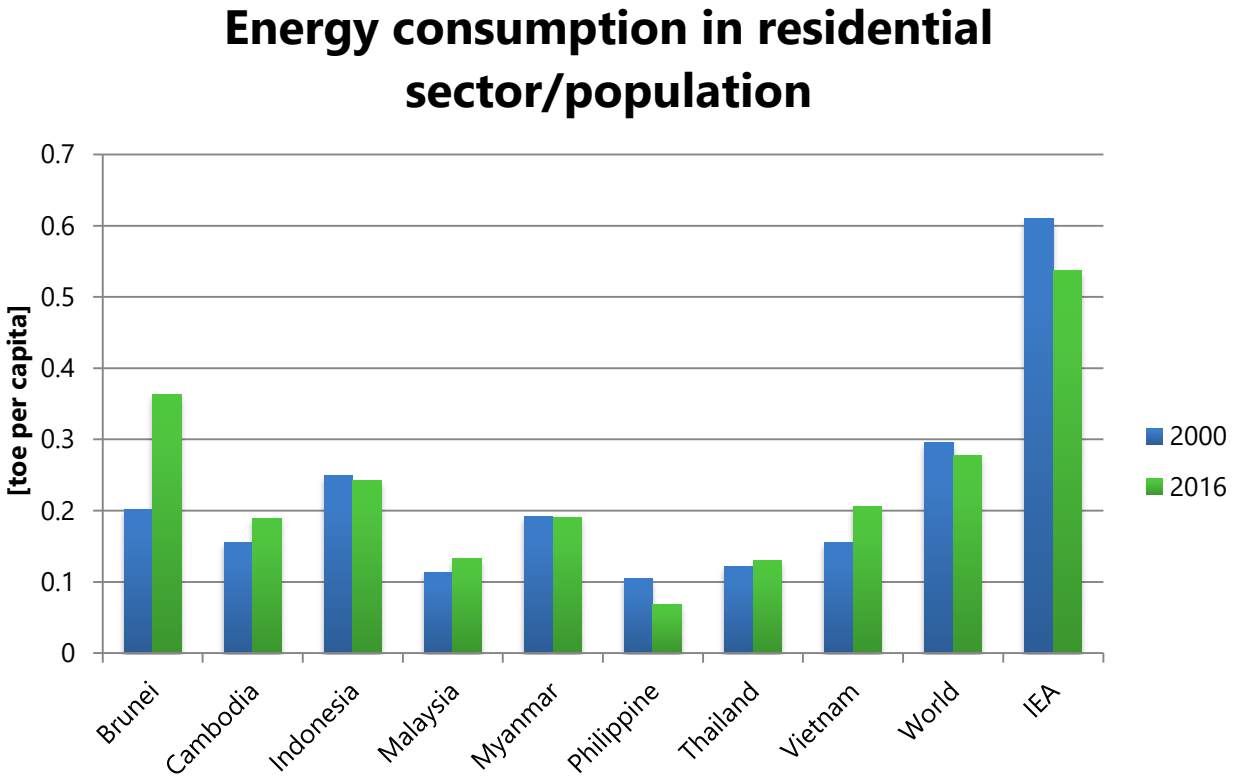
[1] Asian focus region: Brunei, Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand, Vietnam

[2] Other includes agriculture, forestry, fishing and non-specified final consumption

TFC – Total final consumption excluding non-energy use

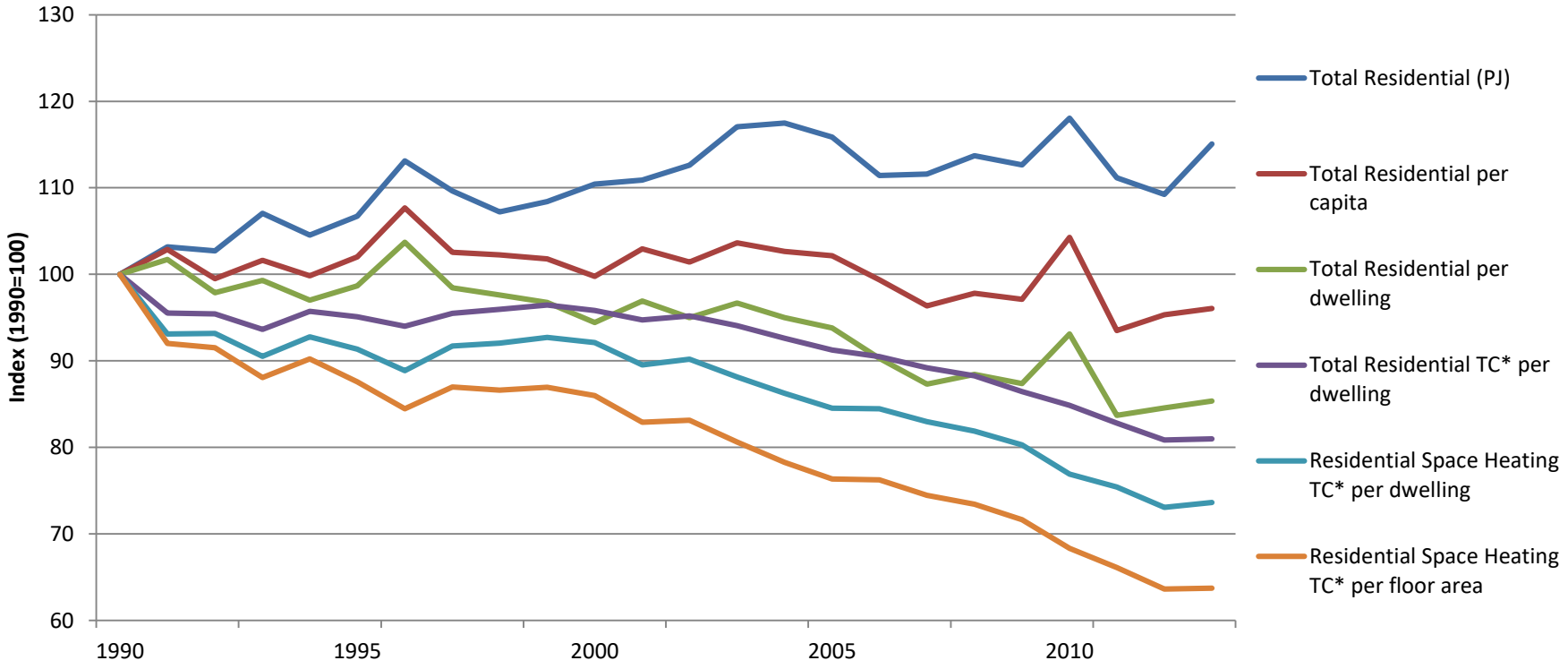
In the Asian focus region, the residential sector accounts for ~29% of final energy consumption

High level indicators trends



Source: *IEA Energy Balances, 2018*

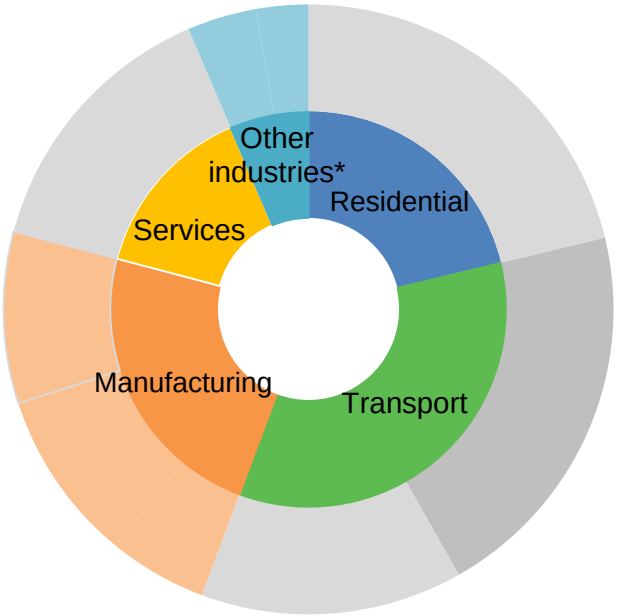
Efficiency indicators explain basic consumption patterns



Data for IEA 20 (Australia, Austria, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA).
* Temperature correction using heating degree days
Data source: IEA, Energy efficiency indicators.

Final consumption – data coverage ambition

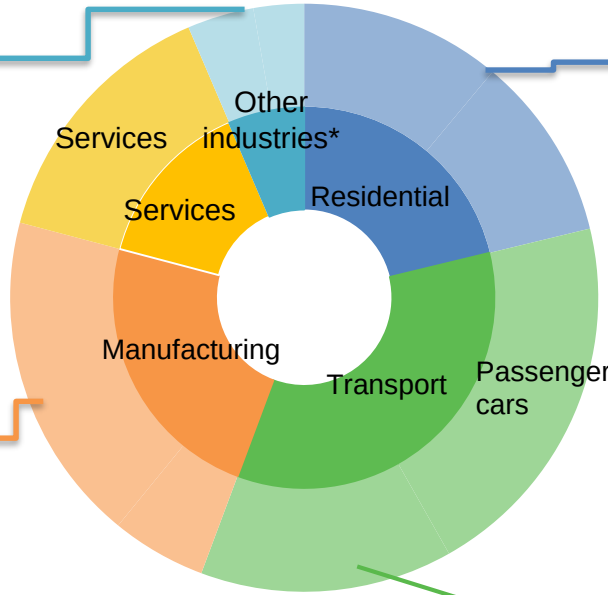
Energy balance



Energy efficiency indicators

Mining
Construction
Agriculture
Fishing
etc.

Space heating
Space cooling
Water heating
Lighting
etc.



Iron and steel
Chemical and petrochemical
Food and tobacco
Wood and wood products
Textile and leather
etc.

Trucks
Buses
Motorcycles
Passenger rail
Freight rail
Passenger ships
Freight ships
Passenger airplanes
Freight airplanes

Source: *IEA Energy Efficiency Indicators, 2016*

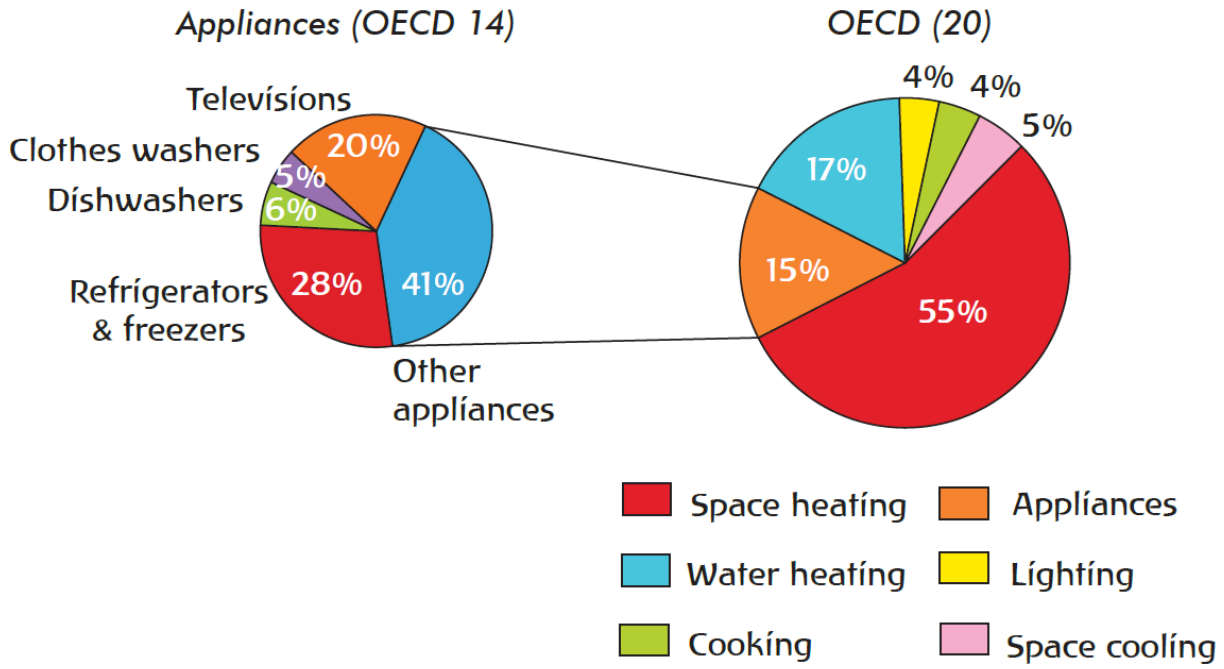
What else do we need to know?

- What **end use** consume most of the energy (cooking/heating…)?
- Which **aspect of our life** will be affected in case of **electrical blackout**?
- What is the **share of LPG** used for cooking?
- Are we using energy for **space heating** more efficiently over time?

What can we learn from energy efficiency indicators?

With more detailed data we can see where energy is used

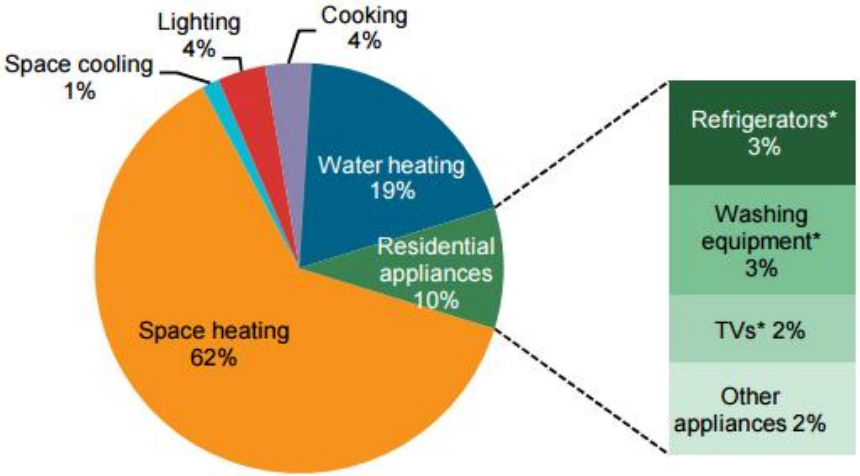
Figure 4.4 • *Breakdown of residential consumption by end use in 2010 for 20 selected OECD countries*



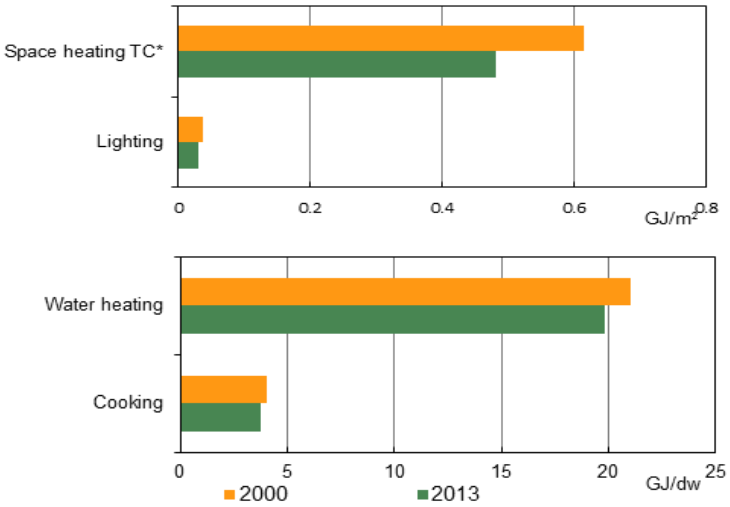
Note: The breakdown into individual appliances is available only for 14 countries.

Source: *IEA, Energy Efficiency Indicators: Fundamentals on statistics, 2014*

Example of insights from end use data: residential sector



Example of shares of end -uses on energy consumption



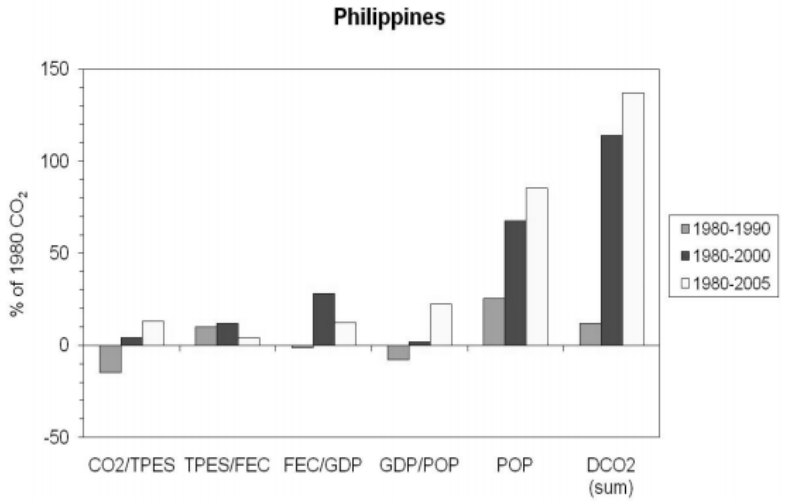
Example of selected energy intensities

Understanding the trends - decomposition

Drivers of the variation in the consumption in Philippines (1980-2005)

- Similar approach to IEA decomposition analysis, **at a macroeconomic level** - GDP and Population

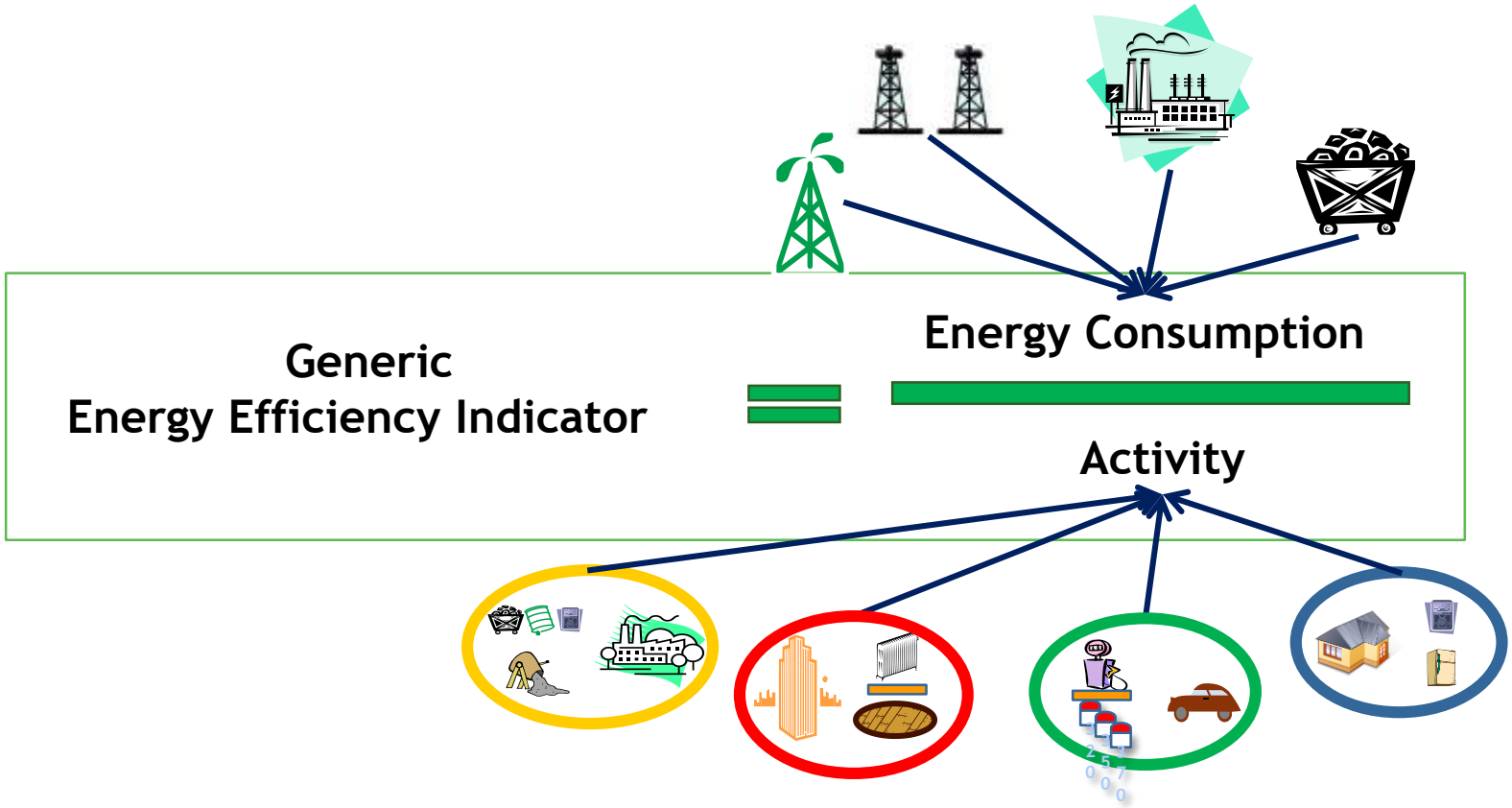
- This example **does not include more detailed data**: appliances stocks, travel activity data, share of VA in industry



Source: *Finland futures Research centre "Key Trends of Climate Change in the Asean Countries", 2012*

Developing energy efficiency indicators - discussion

Energy efficiency indicators: definition



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

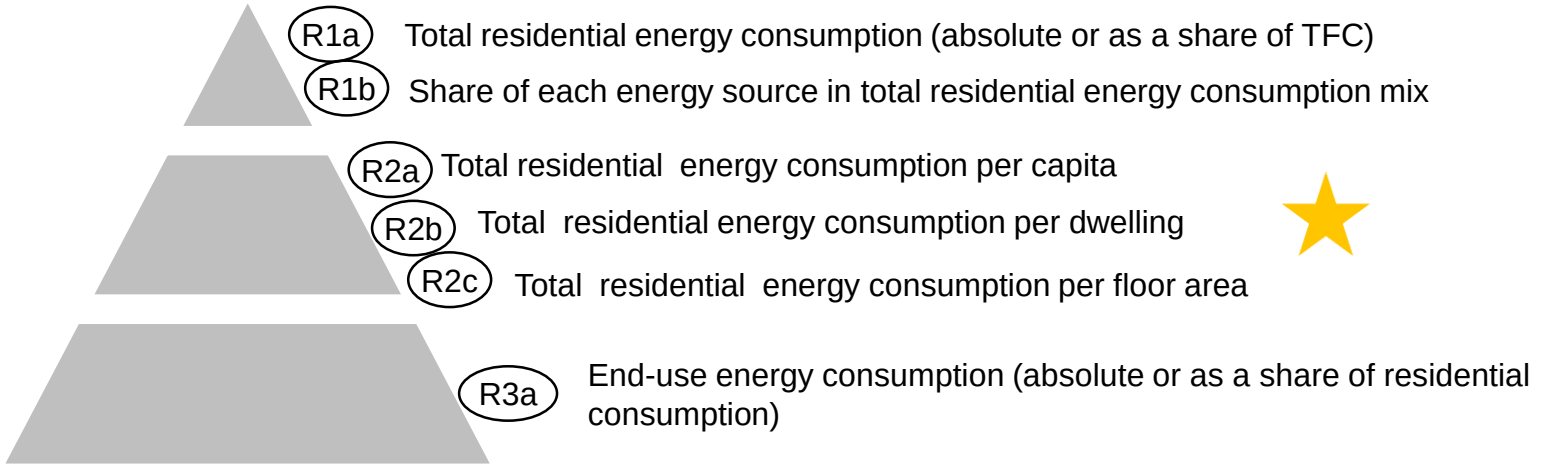
 # of people

# of dwellings

Surface

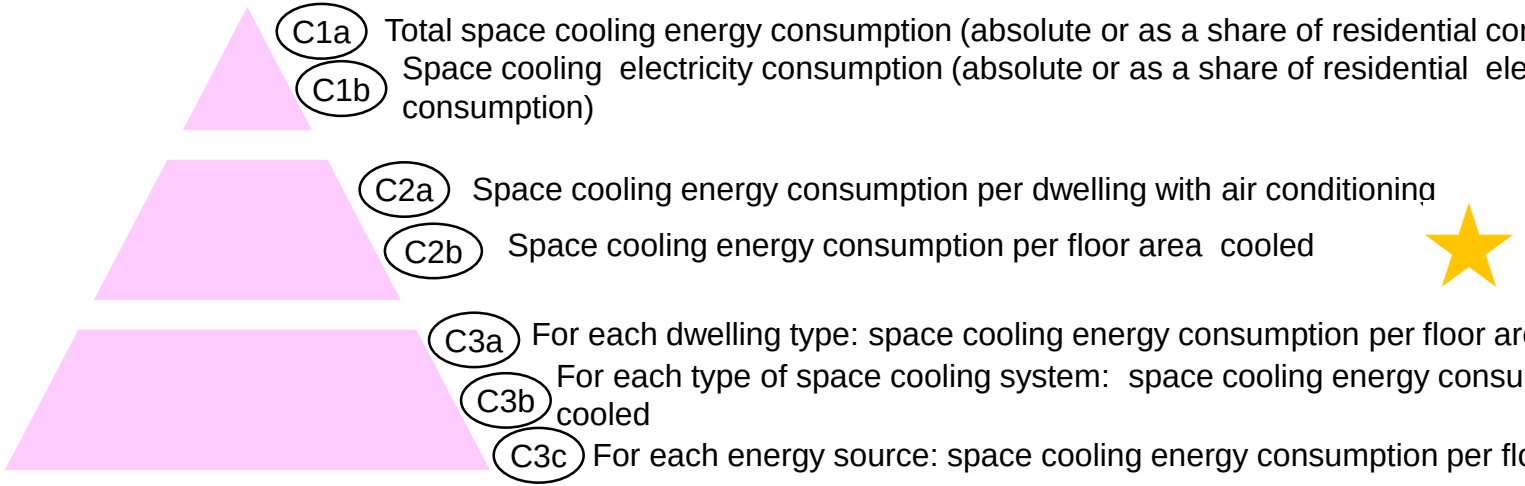
# of appliances

Pyramid of residential* indicators – What indicator would you choose?

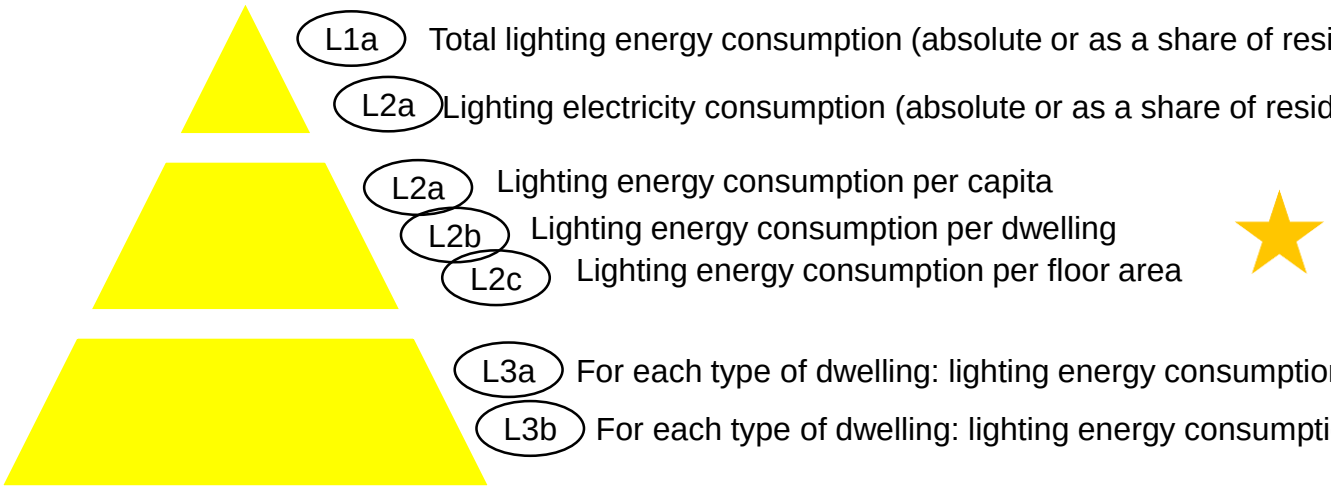


*Note that this disaggregation applies to the total sector, as well as to each of the dwelling types (e.g. detached single-unit houses, semi-detached dwellings, etc)

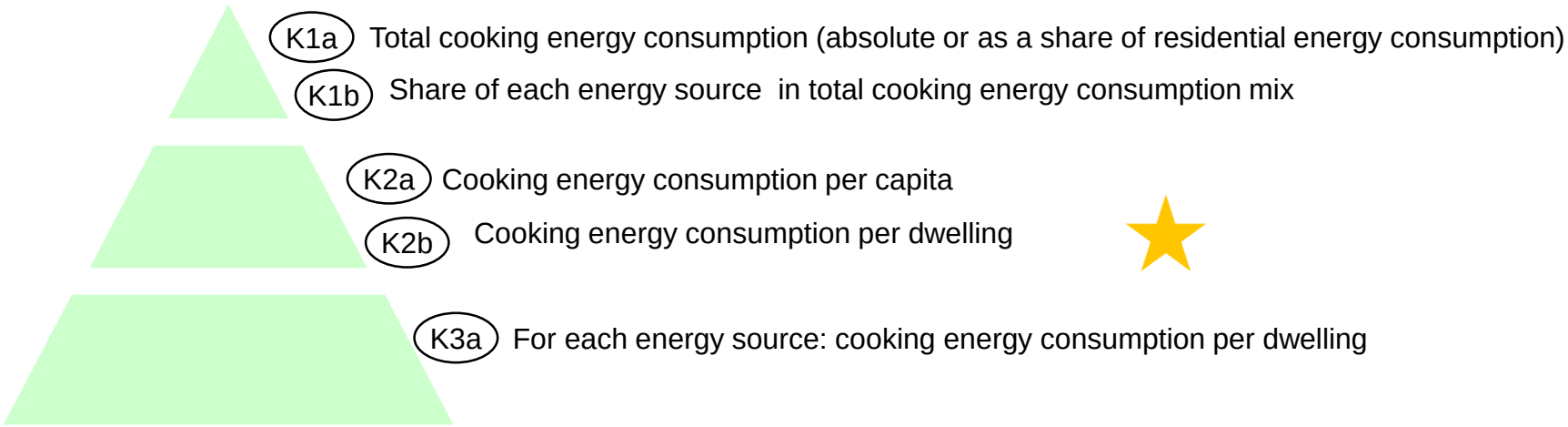
Pyramid of space cooling indicators – What indicator would you choose?



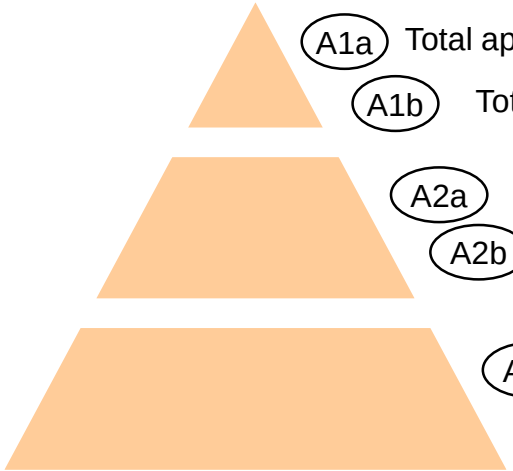
Pyramid of lighting indicators – What indicator would you choose?



Pyramid of cooking indicators – What indicator would you choose?



Pyramid for appliances indicators – What indicator would you choose?



A1a Total appliances energy consumption (absolute or as a share of residential energy consumption)

A1b Total appliances electricity consumption (absolute or as a share of residential electricity consumption)

A2a Appliances energy consumption per capita

A2b Appliances energy consumption per dwelling (and per dwelling with electricity)

A3a For each appliance type: energy consumption per appliance unit

Occupied dwellings *vs* total dwellings

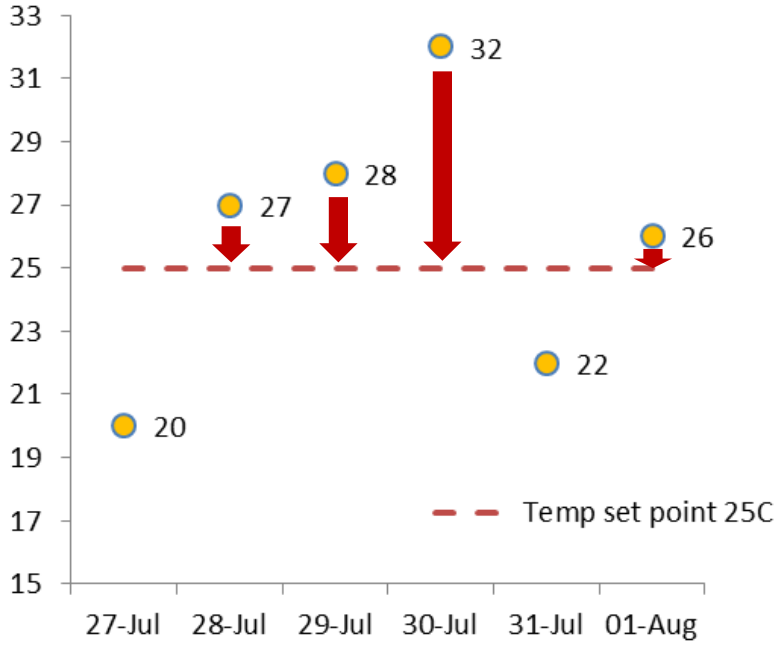
Primary residences

Unoccupied dwellings

Vacation homes

How to perform temperature correction?

Temperature correction: cooling degree days



$CDD_{(27Jul\text{-}01Ago)} = 2+3+7+1 = 13$

With warmer weather, cooling needs increase (residential and services)

Temperature correction: adjusting energy consumption

- Adjusted energy for cooling (simplified method):

- Actual energy for SC (current year) × $\frac{\text{Average CDD (period)}}{\text{CDD (current year)}}$

- Calculation example:

Avg. CDD: **929**

	2001	2002	2003
CDD	905	874	1008
Energy for SC (PJ)	20.5	19.2	21.8
Adj. Energy for SC (PJ)	20.5×929÷905	19.2×929÷874	21.8×929÷1008

www.iea.org/statistics

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