Did it work?
Evaluation and energy efficiency indicators

Buildings

Buildings energy efficiency sessions in partnership with:

UCL ENERGY INSTITUTE

INDO-SWISS BUILDING ENERGY EFFICIENCY PROJECT

IEA #energyefficientworld
Energy Efficiency Training Week: Buildings programme

1. **Where to start:** Energy use in buildings
2. **Where to start:** Energy efficiency potential in buildings
3. **Toolkit:** Energy efficient building design
4. **Toolkit:** Energy efficient building technologies
   - **Special session.** Technology demonstration
5. **Toolkit:** Energy efficiency policies and target setting
6. **What are the steps?** Enabling investment with energy efficiency policies
7. **What are the steps?** Implementing building energy codes and standards
8. **What are the steps?** Building operations and procurement
   - **Special session.** The multiple benefits of energy efficiency
9. **Did it work?** Evaluation and energy efficiency indicators
   - **Where do I get help?** International and regional energy efficiency initiatives
10. **Energy efficiency quiz:** Understanding energy efficiency in buildings
Energy Efficiency Training Week: Buildings

9. Did it work? Evaluation and energy efficiency indicators

Trainers: Brian Dean and Ian Hamilton

Purpose: To teach the fundamentals of tracking progress with energy efficiency indicators that are applicable to the buildings sectors. The course will include a discussion of IEA’s methodologies and how to collect or model data that can be used to estimate progress from energy efficiency efforts.

Scenario: Leadership wants to know how effective the building energy efficiency policies have been. How do you determine the benefits of your policies and programmes?
Evaluation

What is evaluation?
Ex-ante evaluation
Ex-post evaluation
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**.

It leads to **more effective** policies and programmes.
When should you evaluate?

**Ex-post** evaluation

The term **ex-post** is a phrase meaning "after the fact"

**Ex-ante** evaluation

The term **ex-ante** is a phrase meaning "before the event"
Ex-ante evaluation analysis approaches

1. **Technical potential:** analysing the total energy efficiency potential without any economic or market constraints (*e.g.* analysing the energy savings potential *if all buildings used best available technology*)

2. **Economic potential:** analysing the energy efficiency potential assuming economic constraints for cost effectiveness (*e.g.* analysing the energy savings potential *if buildings used the most-efficient cost-effective technology*)

3. **Market potential:** analysing the energy efficiency potential assuming market constraints in implementing energy efficiency (*e.g.* analysing the energy savings potential using a adoption curve to estimate typical market implementation given the available policies and technologies)

Technical potential, economic potential and market potential are used for different purposes
Ex-post evaluation: did it work?

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

The policy → The outcomes

Why is it more difficult?
Ex-post evaluation: did it work?

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

Other factors include:
- Global, national, local trends / events
- Other policies
- Something you haven’t even thought of...
Energy efficiency data

Indicators manuals

Indicators data pyramid
Data is essential at all stages of the policy cycle

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

Each step requires appropriate data to be effective
Why do we need data for policy design?

Where do you set your minimum energy performance standards (MEPS)?

*Without national market data, you may set the MEPS here...*
Why do we need data for policy design?

In this case, without appropriate data, MEPS were set too low.

Providing an unfair advantage to benefit importers over local companies...
How does data help in implementation?

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

**Monitoring** provides headline data on policy performance

- What happens as a result of the policy?

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

- Why and what can be done about it?

Why is monitoring and evaluation needed?

- Understand what happens as a result of the policy
- Verify the policy is performing as expected
- Ability to change policy during its implementation
- Learn for other policies
- Understand the energy efficiency and energy market more
  - What drives changes in the market?
  - How do energy consumers react?
Main sources of data, information and indicators

- Management information/reporting
- Measurement e.g. meter readings, compliance data
- Experiments/testing
- Modelling
- Surveys
- Interviews and focus groups
Resource of methods for capturing data, information and indicators

Energy Efficiency Indicators Statistics: Country Practices Database

A supplement to the publication Energy Efficiency Indicators: Fundamentals on Statistics, this database presents practices on collection of data for developing efficiency indicators from a variety of OECD Members and non-Members.

Practices are searchable by country and territory, sector, methodology and type of available documentation. By sharing these experiences, we hope to help countries and organisations to develop their own energy efficiency indicators programmes.
Energy efficiency indicators: manuals

Source: IEA energy efficiency indicators
Energy efficiency indicators pyramid

- **Level 1**: Aggregate indicators
- **Level 2**: Sub-sector indicators
- **Level 3**: End-use indicators

More detailed data is required to get to Level 3 indicators

**Source:** IEA energy efficiency indicators
Energy efficiency indicators pyramid: residential per household

Data and analysis can be used to get end-use and fuel values

Source: IEA energy efficiency indicators
Energy efficiency indicators pyramid: residential per floor area

Data and analysis can be used to get end-use and fuel values

Source: IEA energy efficiency indicators
Energy efficiency indicators pyramid: non-residential per floor area

Level 1: Energy consumption per floor area
Energy use per value-added.

Level 2: Energy consumption by building type per floor area

Level 3: Energy consumption by end use, by building type and per floor area

Level 4: Energy consumption by fuel type, by end use, by building type and per floor area

Data and analysis can be used to get end-use and fuel values

Source: IEA energy efficiency indicators
Energy efficiency indicators: online courses

Welcome to the IEA online course on Energy Efficiency Indicators.

By joining our first online professional courses, you will come face-to-face with the IEA’s work to train and build capacity, allow experiences to be shared and global progress to be tracked.

• Step-by-step and sector-by-sector through energy efficiency indicators.

• Self-paced and interactive.

• No set time limit to complete the course, to fit into your professional and personal lives.
Energy efficiency indicators online course: expert videos

The IEA's Work on Energy Efficiency

Please check your network firewall if the video does not load automatically.

Data Collection Methods: An Overview

Welcome to lesson 3 of Module 3, where we will review the 4 key methods for data collection and how they can be applied in the context of the services sector.

*Please check your network firewall if the video does not load automatically.
Energy efficiency indicators online course: interactive exercises

Energy Efficiency Potential In Four Sectors

Energy efficiency gains can be realised in many economic sectors. The graph below shows the realised vs unrealised potential for energy efficiency in four sectors. Do you know which sectors offer the highest potential? Have a guess and try to associate the four sectors with each column. Drag and drop accordingly. This exercise does not count for your final grade.

Practice Exercise: Building Indicators Using Energy and Activity Data

Energy and activity data are indispensable for the construction of indicators. Energy consumption data usually serves as a numerator, while activity data serves as a denominator. For example, to construct the indicator “space cooling energy consumption per value added” (ECA), we need the energy data “total cooling energy consumption” and the activity data “total value added”.

Have a look at the incomplete equations, as well as the list of energy and activity data beneath them. Drag and drop the data to build five indicators, each one associated to an end use in the services sector. Reflect on the level of disaggregation of the indicators you constructed.

- **Space heating**
- **Lighting**
- **Water heating**
- **Space cooling**
- **Other equipment**

### ENERGY DATA
- Total heating energy consumption
- Total cooling energy consumption
- Water heating energy consumption in office buildings
- Lighting energy consumption in schools
- Other equipment energy consumption in warehouses

### ACTIVITY DATA
- Total floor area cooled
- Total floor area heated
- Number of employees for warehouses
- Number of employees for offices
Module 2: Assessment Test

1. In the context of the residential sector, understanding how various factors impact energy consumption is essential to determine where the largest potential to reduce energy consumption lies.

   1.0 point possible (graded)

   - True
   - False

2. Which are the six main end uses in the residential sector:

   1.0 point possible (graded)

   - Space heating
   - Water heating
Module 3: Discussion Forum

Discussion

Topic: Energy efficiency indicators for the services sector

Barriers to data collection in the services sector
To construct energy efficiency indicators, statisticians need both energy data and activity data. Yet in the case of services sector both activity and energy data might be har...

Main end use in the services sector in your country
What is the main end use in the services sector in your country?

Addressing data collection challenges in the services sector
Think about these challenges in the case of your country and try to propose possible solutions for improving data collection in key services subsectors such as office buildi...

Add a Post
Evaluation approaches

**Energy performance metrics:** Typically primary level indicators (e.g. energy per person) that do not clearly show the role of efficiency.

**Energy demand analysis:** A “bars held” or “what if” approach by holding indicators constant than can under-estimate energy efficiency gains

**Decomposition analysis:** Can be complex to understand, but very valuable.
Energy performance metrics

Limitations
Energy consumption
Energy per person
Energy per floor area
The right energy performance metric is crucial to understanding & tracking progress over time.

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

What are these types of energy performance metrics not telling us about energy demand and efficiency progress?

- Behaviour?
- Technology?
- Efficiency?
- Income?

Source: IEA energy efficiency indicators database
Evaluation: Building energy performance metrics

Limitations of Energy Performance Metrics

• Metrics cannot predict variation in overall energy consumption or quantify the impact of individual components or factors on overall energy consumption.

• It is often necessary to undertake more detailed analysis to fully understand the combined impact of a number of different factors or driving forces on overall energy consumption.

Source: IEA Building Energy Performance Metrics 2015
Building energy performance metrics: energy consumption

What does this tell us about energy efficiency in buildings?

Source: IEA Building Energy Performance Metrics 2015
What does this tell us about energy efficiency in buildings?

Source: IEA Building Energy Performance Metrics 2015
Building energy performance metrics: energy per person

What does this tell us about energy efficiency in buildings?

Source: IEA Building Energy Performance Metrics 2015
Building energy performance metrics: change in energy per person

What does this tell us about energy efficiency in buildings?

Source: IEA Building Energy Performance Metrics 2015
Building energy performance metrics: energy per floor area

What does this tell us about energy efficiency in buildings?

Source: IEA Building Energy Performance Metrics 2015

IEA 2019. All rights reserved.
Building energy performance metrics: change in energy per floor area

What does this tell us about energy efficiency in buildings?

Source: IEA Building Energy Performance Metrics 2015
Energy demand analysis

Bars held analysis
Evaluation: Energy demand/bars held analysis or “what if” analysis

- Proportional distribution of energy savings

**How much energy service?**
Depends on behaviour, income, culture, etc.

**Energy service demand**
- E.g. incandescent bulbs v. CFLs or LEDs

**How efficient is the technology used?**

*Energy service =*

\[
\sum_{tech} \frac{Energy_{useful} \times share_{tech}}{Efficiency_{tech}}
\]

Source: IEA Energy Technology Perspectives
Decomposition

Logarithmic Mean Divisia Index (LMDI)
Proportional distribution of energy savings by holding only changing one indicator at a time. Decomposition analyses can be extremely valuable – but complex.

Source: IEA Energy Technology Perspectives
Through decomposition, we can see that energy efficiency is significant, but not keeping up with the growth in total energy consumption in buildings.

Source: IEA Energy Technology Perspectives 2017
Process for Tracking Progress

Key steps in the process

Examples
Tracking progress: Key steps in the process

Step 1: Identify what needs to be tracked
- What story should be told?
- What were the objectives?
- What are the risks?

Step 2: Define the tracking indicators
- What performance metrics can you use?
- What data is needed?

Step 3: Assess the data
- What analysis method should you use?

Step 4: Tell the story
- How do you visualise the results?
- How would it vary across countries?
Example: Tracking progress in the Building Efficiency Accelerator

Stage 0: Commitment
- Goal: Establish shared vision
- Indicators:
  - Number and type of organizations at kick-off event
  - Type of engagement with organizations
- Methods:
  - Recognition in event summary report and media coverage
  - Participation in working groups

Stage 1: Assessment
- Goal: Collect baseline data to inform selection of policy and project
- Indicators:
  - Number of public buildings for which we collect energy consumption and use characteristic data
- Methods:
  - Enter data into ENERGY STAR Portfolio Manager

Stage 2: Development
- Goal: Select project and develop project documentation
- Indicators:
  - Obtain project funding
  - Investment grade audits for 4 buildings
  - Identify funding/finance to implement EE measures in audits
- Methods:
  - Share audit results with key stakeholders and potential funders
  - Meet funders terms and metrics

Stage 3: Implementation
- Goal: Successfully install EE measures in buildings
- Indicators:
  - Reduce energy use of buildings by 15% or more
  - Reduce energy costs of buildings by 15% or more
- Methods:
  - Track energy use and costs in ENERGY STAR Portfolio Manager

Stage 4: Improvement
- Goal: Improve city energy productivity
- Indicators:
  - $GDP per kWh
  - Residents with Tier 1 energy services per kWh
- Methods:
  - Develop data and management system for continuous measurement, monitoring and improvement

Source: Building Efficiency Accelerator

For continuous improvement
Step 1: Identify what needs to be tracked

- What story should be told about the impact of cooling?
  - What objectives could be achieved through policies on cooling?
  - What are the risks and threats from increasing cooling energy use?

Potential issues related to cooling

- Demand for and access to cooling thermal comfort
- Energy used for cooling based on AC efficiency levels
- Peak electricity loads, grid stability and power sector investments
- Job creation through design, manufacturing, selling or installing ACs
- Sales tax and public budgets financial impacts
- Market availability of efficient products
Tracking progress example: cooling

**Step 2: Define the tracking indicators**

- What performance metrics can you use?
- What data do you have on cooling and buildings?

**Issues with metrics and indicators**

- How do you separate the influences? (Income; demand; population; climate; efficiency)
- What options are there for metrics?
  - Final energy use for cooling
  - Final energy use for cooling per square meter cooled per cooling degree-day
  - Change in average efficiency of ACs (stock, sold, manufactured, imported, exported)
  - Share of products covered by labels or MEPS policies
Tracking progress example: cooling

**Step 3: Assess the data**
- What analysis method can you use?
- Which method will provide the information needed?

**Step 4: Tell the story**
- How do you visualise the data?
- What part of the story is important for your country?

**Issues with metrics and indicator analysis methods**
- What results will be compelling and told with simple visuals or statements?
- What options are there for methods?
  - Energy performance metrics
  - Bars held analysis
  - Energy decomposition (LMDI)
Tracking progress: cooling example 1

Efficiency of air-conditioners by country, 2017

Best available technology efficiency levels vary widely between countries. And, best available technology is much more efficient than the market average.
“Energy use per m² cooled per CDD” may be an accurate performance indicator at the building. But depending on the story you want to tell, “energy use” offers a different story for the country.
More efficient cooling technologies are being sold. But the efficiency levels are well below the best available technologies.

Source: IEA
Increasingly more policies are covering space cooling energy use. But the strength of those policies are not keeping pace with best available technologies.

Source: IEA
Energy efficiency has saved 200 TWh of cooling final energy from 2000 to 2015, but this has been offset by activity factors contributing to a 650 TWh increase during this period.

Source: IEA
Group discussion

Scenario:

The Minister wants to know how effective the building energy efficiency policies have been.

How do you go about answering this?
### Energy efficiency indicators: residential buildings

#### Space Heating

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space heating energy consumption per capita</td>
<td>Overall</td>
<td>Total space heating energy consumption</td>
<td>Total population</td>
<td>H2a</td>
</tr>
<tr>
<td>Space heating energy consumption per dwelling</td>
<td>Overall</td>
<td>Total space heating energy consumption</td>
<td>Total number of dwellings</td>
<td>H2b</td>
</tr>
<tr>
<td>Space heating energy consumption per floor area</td>
<td>Overall</td>
<td>Total space heating energy consumption</td>
<td>Total floor area</td>
<td>H2c</td>
</tr>
<tr>
<td></td>
<td>By dwelling type</td>
<td>Space heating energy consumption of dwellings type A</td>
<td>Floor area of dwellings type A</td>
<td>H3a</td>
</tr>
<tr>
<td></td>
<td>By heating system</td>
<td>Space heating energy consumption of dwellings with system α</td>
<td>Floor area of dwellings with heating system α</td>
<td>H3b</td>
</tr>
<tr>
<td></td>
<td>By energy source</td>
<td>Space heating energy consumption of dwellings with energy source Z</td>
<td>Floor area of dwellings with energy source Z</td>
<td>H3c</td>
</tr>
</tbody>
</table>

#### Code Legend
- **H2a**: Space heating energy consumption per capita
- **H2b**: Space heating energy consumption per dwelling
- **H2c**: Total floor area
- **H3a**: Space heating energy consumption of dwellings type A
- **H3b**: Space heating energy consumption of dwellings with system α
- **H3c**: Space heating energy consumption of dwellings with energy source Z
# Energy efficiency indicators: residential buildings

## Space Cooling

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
<th>Recommended indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space cooling energy consumption per dwelling with air conditioning (A/C)</td>
<td>Overall</td>
<td>Total space cooling energy consumption</td>
<td>Total number of dwellings with A/C</td>
<td>C2a</td>
<td></td>
</tr>
<tr>
<td>Space cooling energy consumption per floor area of dwellings with A/C</td>
<td>Overall</td>
<td>Total space cooling energy consumption</td>
<td>Total floor area cooled</td>
<td>C2b</td>
<td>😊</td>
</tr>
<tr>
<td>By dwelling type</td>
<td>Space cooling energy consumption of dwellings type A</td>
<td></td>
<td>Floor area cooled of dwellings type A with A/C</td>
<td>C3a</td>
<td></td>
</tr>
<tr>
<td>By type of cooling system</td>
<td>Space cooling energy consumption of dwellings with A/C system α</td>
<td></td>
<td>Floor area cooled of dwellings with A/C system α</td>
<td>C3b</td>
<td></td>
</tr>
<tr>
<td>By energy source</td>
<td>Space cooling energy consumption of dwellings with A/C system energy source Z</td>
<td></td>
<td>Floor area cooled of dwellings with A/C energy source Z</td>
<td>C3c</td>
<td></td>
</tr>
</tbody>
</table>

### Legend

- **Red**: Heating
- **Pink**: Cooling
- **Blue**: Water heating
- **Yellow**: Lighting
- **Green**: Cooking
- **Orange**: Appliances
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water heating energy consumption per capita</td>
<td>Overall</td>
<td>Total water heating energy consumption</td>
<td>Total population</td>
<td>W2a</td>
</tr>
<tr>
<td>Water heating energy consumption per dwelling</td>
<td>Overall</td>
<td>Total water heating energy consumption</td>
<td>Total number of dwellings</td>
<td>W2b</td>
</tr>
<tr>
<td></td>
<td>By type of water heating system</td>
<td>Water heating energy consumption for dwellings with water heating system α</td>
<td>Total number of dwellings with water heating system α</td>
<td>W3a</td>
</tr>
<tr>
<td></td>
<td>By type of energy source</td>
<td>Water heating energy consumption for water heating systems with energy source Z</td>
<td>Total number of dwellings with systems with energy source Z</td>
<td>W3b</td>
</tr>
</tbody>
</table>

IEA 2019. All rights reserved.
### Energy efficiency indicators: residential buildings

#### Lighting

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting energy consumption per capita</td>
<td>Overall</td>
<td>Total lighting energy consumption</td>
<td>Total population</td>
<td>L2a</td>
</tr>
<tr>
<td>Lighting energy consumption per dwelling</td>
<td>Overall</td>
<td>Total lighting energy consumption</td>
<td>Total number of dwellings</td>
<td>L2b</td>
</tr>
<tr>
<td></td>
<td>By dwelling type</td>
<td>Lighting energy consumption of dwellings of type A</td>
<td>Number of dwellings of type A</td>
<td>L3a</td>
</tr>
<tr>
<td>Lighting energy consumption per floor area</td>
<td>Overall</td>
<td>Total lighting energy consumption</td>
<td>Total floor area</td>
<td>L2c</td>
</tr>
<tr>
<td></td>
<td>By dwelling type</td>
<td>Lighting energy consumption of dwellings of type A</td>
<td>Total floor area of dwellings type A</td>
<td>L3b</td>
</tr>
</tbody>
</table>
## Energy efficiency indicators: residential buildings

### Cooking

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
<th>Recommended indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking energy consumption per capita</td>
<td>Overall</td>
<td>Total cooking energy consumption</td>
<td>Total population</td>
<td>K2a</td>
<td></td>
</tr>
<tr>
<td>Cooking energy consumption per dwelling</td>
<td>Overall</td>
<td>Total cooking energy consumption</td>
<td>Total number of dwellings</td>
<td>K2b</td>
<td>😊</td>
</tr>
<tr>
<td>By energy source</td>
<td></td>
<td>Cooking energy consumption with cooking energy source Z</td>
<td>Number of dwellings with cooking energy source Z</td>
<td>K3a</td>
<td></td>
</tr>
</tbody>
</table>
## Energy efficiency indicators: residential buildings

### Appliances

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliances energy consumption per capita</td>
<td>Overall</td>
<td>Total appliances energy consumption</td>
<td>Total population</td>
<td>A2a</td>
</tr>
<tr>
<td>Appliances energy consumption per dwelling</td>
<td>Overall</td>
<td>Total appliances energy consumption</td>
<td>Total number of dwellings</td>
<td>A2b</td>
</tr>
<tr>
<td>Energy consumption per appliance unit</td>
<td>By appliance type</td>
<td>Energy consumption for all appliances of type A</td>
<td>Number of appliances of type A</td>
<td>A3a 😞</td>
</tr>
</tbody>
</table>
## Energy efficiency indicators: non-residential buildings

### Space Heating

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space heating energy consumption per value added</td>
<td>Overall</td>
<td>Total heating energy consumption</td>
<td>Total value added</td>
<td>H2a</td>
</tr>
<tr>
<td>Space heating energy consumption per floor area</td>
<td>Overall</td>
<td>Total heating energy consumption</td>
<td>Total floor area</td>
<td>H2b</td>
</tr>
<tr>
<td></td>
<td>By heating system</td>
<td>Heating energy consumption with system $\alpha$</td>
<td>Floor area heated with heating system $\alpha$</td>
<td>H3a</td>
</tr>
<tr>
<td></td>
<td>By energy source</td>
<td>Heating energy consumption with energy source $Z$</td>
<td>Floor area heated with energy source $Z$</td>
<td>H3b</td>
</tr>
<tr>
<td>Space heating energy consumption per unit of activity</td>
<td>By service category</td>
<td>Heating energy consumption for service category $A$</td>
<td>Unit activity of service category $A$</td>
<td>H3c</td>
</tr>
</tbody>
</table>

- **Red**: Heating
- **Pink**: Cooling
- **Blue**: Water heating
- **Yellow**: Lighting
- **Green**: Other equipment
# Energy efficiency indicators: non-residential buildings

## Space Cooling

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
<th>Recommended indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space cooling energy consumption per value added</td>
<td>Overall</td>
<td>Total cooling energy consumption</td>
<td>Total value added</td>
<td>C2a</td>
<td></td>
</tr>
<tr>
<td>Space cooling energy consumption per floor area cooled</td>
<td>Overall</td>
<td>Total cooling energy consumption</td>
<td>Total floor area cooled</td>
<td>C2b</td>
<td>😊</td>
</tr>
<tr>
<td>Space cooling energy consumption per floor area cooled</td>
<td>By space cooling system</td>
<td>Cooling energy consumption by cooling system α</td>
<td>Floor area with cooling system α</td>
<td>C3a</td>
<td></td>
</tr>
<tr>
<td>Space cooling energy consumption per floor area cooled</td>
<td>By service category</td>
<td>Cooling energy consumption for service category A</td>
<td>Floor area cooled of service category A</td>
<td>C3b</td>
<td></td>
</tr>
<tr>
<td>Space cooling energy consumption per unit of activity</td>
<td>By service category</td>
<td>Cooling energy consumption for service category A</td>
<td>Unit activity of service category A</td>
<td>C3c</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- Heating
- Cooling
- Water heating
- Lighting
- Other equipment
# Energy efficiency indicators: residential buildings

## Water Heating

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
<th>Recommended indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water heating energy consumption per value added</td>
<td>Overall</td>
<td>Total water heating energy consumption</td>
<td>Total value added</td>
<td>W2a</td>
<td></td>
</tr>
<tr>
<td>Water heating energy consumption per unit of activity</td>
<td>By service category</td>
<td>Water heating energy consumption for service category A</td>
<td>Unit activity of service category A</td>
<td>W3a</td>
<td>🙂</td>
</tr>
</tbody>
</table>

- **Heating**
- **Cooling**
- **Water heating**
- **Lighting**
- **Other equipment**
# Energy efficiency indicators: residential buildings

## Lighting

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
<th>Recommended indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting energy consumption per value added</td>
<td>Overall</td>
<td>Total lighting energy consumption</td>
<td>Total value added</td>
<td>L2a</td>
<td></td>
</tr>
<tr>
<td>Lighting energy consumption per floor area</td>
<td>Overall</td>
<td>Total lighting energy consumption</td>
<td>Total floor area</td>
<td>L2b</td>
<td></td>
</tr>
<tr>
<td></td>
<td>By service category</td>
<td>Lighting energy consumption for service category A</td>
<td>Floor area of service category A</td>
<td>L3a</td>
<td></td>
</tr>
<tr>
<td>Lighting energy consumption per unit activity</td>
<td>By service category</td>
<td>Lighting energy consumption for service category A</td>
<td>Unit activity of service category A</td>
<td>L3b</td>
<td>😊</td>
</tr>
</tbody>
</table>
### Energy efficiency indicators: residential buildings

#### Other equipment

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coverage</th>
<th>Energy data</th>
<th>Activity data</th>
<th>Code</th>
<th>Recommended indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other equipment energy consumption per value added</td>
<td>Overall</td>
<td>Total other equipment energy consumption</td>
<td>Total value added</td>
<td>E2a</td>
<td></td>
</tr>
<tr>
<td></td>
<td>By service category</td>
<td>Other equipment energy consumption for service category A</td>
<td>Value added of service category A</td>
<td>E3a</td>
<td></td>
</tr>
<tr>
<td>Other equipment energy consumption per floor area</td>
<td>Overall</td>
<td>Total other equipment energy consumption</td>
<td>Total floor area</td>
<td>E2b</td>
<td></td>
</tr>
<tr>
<td>Other equipment energy consumption per unit of activity</td>
<td>By service category</td>
<td>Other equipment energy consumption for service category A</td>
<td>Unit activity of service category A</td>
<td>E3b</td>
<td>😊</td>
</tr>
</tbody>
</table>