EPATEE

Definitions and typologies related to the evaluation of energy savings

The articles in the EPATEE knowledge base and the Policy/Sector/Method Combination guides (PSMCs) make use of terminology that the reader may not be familiar with. The aim of this document is to function as a background document to refer to when encountering terms that need clarification.

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to be added

1 | Definitions related to the evaluation of energy savings

1.1 General definitions

Energy savings

Energy savings are about avoided energy consumption. Energy savings are determined as the difference between the energy consumption of a reference situation (or baseline) and the actual energy consumption, taking into account factors to make both situations comparable. The actual energy consumption is usually the energy consumption after implementing energy saving action(s).

Notes on the definition:

The calculated energy savings depend on the choice of the reference situation or baseline. Energy savings from the same action can be calculated using different baselines, depending on the evaluation objectives. For more details, see below for the definition of reference (or baseline) energy consumption, and the typology of baselines as used in the EPATEE project.

Examples of factors that need to be taken into account to make the reference (or baseline) energy consumption and the actual energy consumption comparable are weather conditions, occupancy, production, etc.

The definition of energy savings also means that it is possible that energy consumption has increased while energy has been saved. For example if 10% has been saved per unit of production of a certain product, but at the same time the production has grown by 20%.

Energy savings are the result of energy saving actions, which can be technical (e.g., insulation or a more efficient electric motor), organisational (e.g., implementing an energy management system) or behavioural (e.g., not heating unused rooms or driving more slowly by car).

Reference (or baseline) energy consumption

When calculating energy savings, the actual energy consumption is compared to the energy consumption that would have taken place in the absence of energy saving actions. The latter energy use is called the reference (or baseline) energy consumption.

Notes on the definition:

The reference (or baseline) energy consumption can be defined in different ways, depending on the evaluation objectives and evaluation method used (for more details, see the typology of baselines used in the EPATEE project below).

It is important to be aware of the reference (or baseline) used when calculating the energy savings, as it can have a strong influence on the result of energy savings.

Energy efficiency

Energy efficiency is the ratio between the output (performance, activity, service, goods, etc.) and the input of an energy using system.

Examples: the amount of light generated by a lamp per unit of electricity input, the amount of heat in hot water from a boiler per unit of gas used.

Notes on the definition:

Energy efficiency and energy savings are sometimes used interchangeably in publications. Improving energy efficiency is indeed a major way to obtain energy savings. However, other ways can also lead to energy savings. For example, not heating unused rooms does not improve energy efficiency, but it does result in energy savings.

Energy efficiency is related to the choice of an energy efficiency indicator, and more particularly to the choice of the output (e.g. indicator of activity) that will be monitored. This choice depends on the objective of the energy efficiency action or policy measure. For cars for example one may choose vehicle kilometres a as a measure of activity, or person kilometres. If the development of the number of people in a car changes, the two definitions will result in different outcomes for the energy efficiency.

Energy efficiency translates into energy savings depending on the amount of output, performance or activity. Therefore, a more efficient boiler in a large building saves more energy than a boiler with the same efficiency in a smaller dwelling.

In this approach the term energy efficiency depicts relative savings and the term energy savings depicts the absolute amount of energy saved, expressed in an energy unit e.g. GJ or toe.

Final energy consumption

Final energy consumption is consumption of energy carriers as delivered to final consumers (households, industry, services, agriculture).

Examples: natural gas, electricity, heating oil, heat supplied by district heating, fuels for vehicles.

Final energy savings

Final energy savings are energy savings calculated taking into account final energy consumption.

Examples: Installing a more efficient boiler using gas will save on the final consumption of natural gas. Installing LED for lighting will save on the consumption of electricity. If these savings are defined in the same unit, e.g. GJ, they can be summed up to total final energy savings.

Primary energy and primary energy consumption

Primary energy is the quantity or content of energy before any conversion has taken place. The Energy Efficiency Directive (article 2(2)) then defines 'primary energy consumption' as "*gross inland consumption, excluding non-energy uses*".

Examples of primary energy: energy content of a ton of coal from the mine, energy content of a ton of imported crude oil or uranium.

Notes on the definition:

Primary energy consumption is an indicator commonly used in national energy balances. It can be used to monitor the consumption of energy resources.

Primary energy can be converted to final energy (i.e. energy delivered to the final consumers) by taking into account the different energy losses due to conversions, transport and distribution of energy. Especially for electricity considerable losses occur in power stations (typically 30 to 70% of the input), and then further losses occur along the transport and distribution networks.

Primary energy savings

Primary energy savings are energy savings calculated taking into account primary energy consumption.

Notes on the definition:

Saving one unit of final electricity consumption can lead to much more savings on primary energy consumption. Saved (final consumption of) electricity can be expressed in primary energy saved by multiplying the amount of saved electricity by a factor accounting for the energy losses in electricity generation, transport and distribution (currently in the order of 2 to 2.5).

Ex-ante evaluation

An **ex-ante evaluation** is an evaluation that is done before the policy measure is implemented (or revised).

Note on the definition:

By definition, an ex-ante evaluation cannot include data about the actual number of actions implemented, or other measured, metered or surveyed data about what occurred after the implementation of the actions.

Ex-post evaluation

An **ex-post evaluation** is an evaluation that is done after the policy measure has been implemented.

Notes on the definition:

An ex-post evaluation may make use of various data sources, and not only of data collected along or after the policy implementation. An ex-post evaluation may for example also use data that were available before the policy measure started (e.g. from previous studies) or that are not specific to the policy measure (e.g. manufacturers' data, national statistics).

The minimum condition used in the EPATEE project to qualify an evaluation as "ex-post" is that the evaluation should take into account data about the number of actions actually implemented, either from the monitoring of the policy measure or collected specifically for the evaluation.

Speaking of ex-ante and ex-post evaluation is an easy way to distinguish evaluations according to their timing in the policy cycle. At the opposite, it could be confusing to speak of ex-ante or ex-post energy savings. For example, how should energy savings be called that are evaluated based on the actual number of actions implemented (as monitored along the policy) multiplied by standardised energy savings ratios per action type defined as deemed savings? In this case, the number of actions would be ex-post, but the energy savings ratios would be ex-ante… A distinction between "data specific to the actions implemented" and "data taken from other studies or references" can be more explicit.

Likewise, we recommend to speak of "expected energy savings" when they were clearly assessed before the policy was implemented (e.g., for an impact assessment), and of "reported energy savings" when the energy savings are the results reported about the policy implementation, or "achieved energy savings" when the energy savings were evaluated mostly based on data collected after the actions were implemented.

1.2 Definitions of energy savings metrics

Relative energy savings

Relative energy savings are energy savings expressed either as a percentage compared to the baseline energy consumption, or as a ratio of energy quantity to an indicator (e.g., kWh/m².year; litre of fuel/km).

Absolute energy savings

Absolute energy savings are energy savings expressed in an energy unit (e.g., GJ; toe; MWh).

Year-to-year energy savings

Year-to-year savings are energy savings calculated by comparing the energy consumption in a given year with the energy consumption in the previous year, taking into account factors to make both energy consumption comparable.

Year-to-year energy savings can either be absolute energy savings expressed in energy unit per year (e.g., PJ/year; Mtoe/year; GWh/year), or relative energy savings expressed in percentage compared to the previous year.

Note on the definition:

When calculating year-to-year energy savings, the energy consumption in the previous year represents the reference (or baseline) energy consumption.

This metric is usually used when calculating energy savings with a top-down method (see definition below), and particularly methods based on energy consumption indicators or diffusion indicators (see typology of calculation methods). Because of statistical fluctuations in top down data sources that often cannot be completely explained and corrected, energy saving evaluations based on one or a few years are not very reliable.

Annual energy savings

Annual energy savings are energy savings calculated for a period equivalent to one year, or achieved in a given year.

Annual energy savings can either be absolute energy savings expressed in energy unit per year (e.g., PJ/year; Mtoe/year; GWh/year), or relative energy savings expressed in percentage compared to a reference year.

Note on the definition:

When the energy savings are calculated for the same year as the year after installing or implementing the action, the annual energy savings are sometimes presented as first-year energy savings.

Cumulated annual energy savings

Cumulated annual energy savings are the sum of annual energy savings achieved in a given year, as the result of actions that can have been installed or implemented in different years.

Cumulated annual energy savings can either be absolute energy savings expressed in energy unit per year (e.g., PJ/year; Mtoe/year; GWh/year) or relative energy savings expressed in percentage compared to a reference year.

Example 1 (in absolute energy savings):

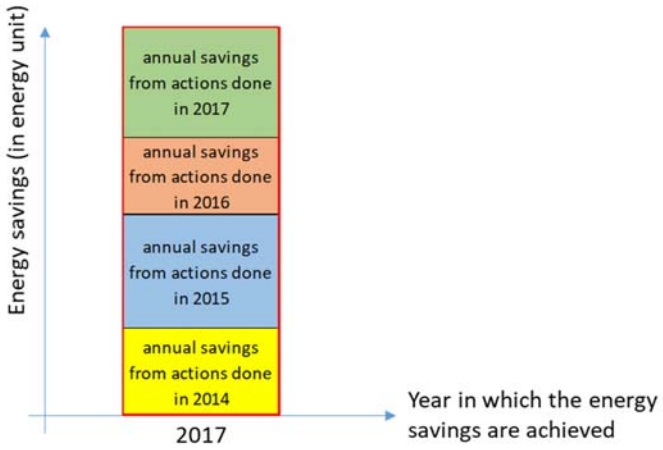

Figure 1. Illustration for cumulated annual energy savings.

In the example shown in Figure 1, the cumulated annual energy savings (area within the frame in red) correspond to absolute energy savings achieved in year 2017 and resulting from actions installed or implemented in years 2014, 2015, 2016 and 2017.

Example 2 (in relative energy savings):

The reference year is taken as the year before the policy measure started (e.g. 2013). Cumulated annual energy savings are then calculated as the percentage of decrease in energy consumption in year 2017 compared to energy consumption in year 2013, after taking into account factors to make energy consumption in 2013 and 2017 comparable.

Cumulative energy savings

Cumulative energy savings are the sum of energy savings achieved each year and over a period of several years. These cumulative energy savings include energy savings from the actions installed or implemented over a given period, usually (but not necessarily) the same as the period over which energy savings are summed up.

Cumulative energy savings are energy savings expressed in an energy unit (e.g., PJ; Mtoe; GWh).

Example:

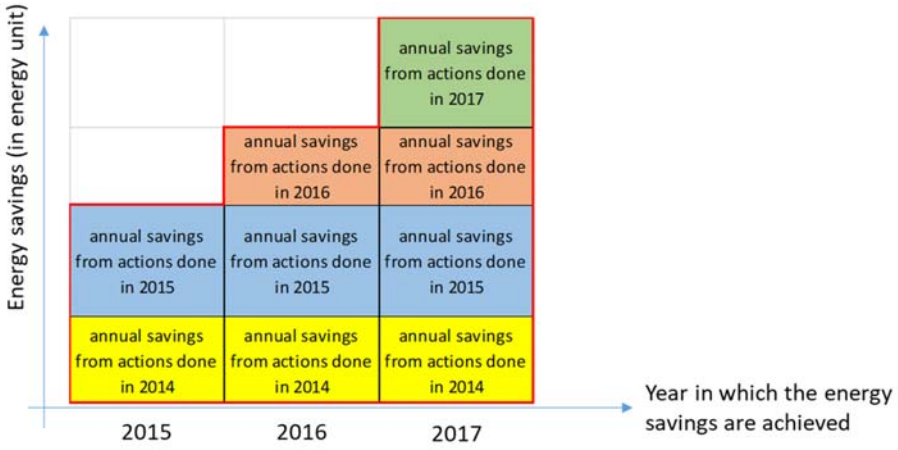

Figure 2. Illustration for cumulative energy savings.

In the example shown in **Error! Reference source not found.**, the cumulative energy savings (area within the frame in red) correspond to energy savings achieved in years 2015 to 2017, and resulting from actions installed or implemented in years 2014, 2015, 2016 and 2017.

This is a simplified representation, as in practice the annual energy savings from actions done e.g. in 2014 are likely smaller in 2014 compared to the next years, as not all actions are installed or implemented at the beginning of the year. For other savings actions, the effect diminishes in time, for example when information campaigns are discontinued.

Cumulative energy savings (as defined in article 7 of the EED)

In the context of EED article 7, EU Member States need to report the cumulative energy savings over the period 2014-2020, i.e. the sum of energy savings achieved in years 2014 to 2020 and resulting from actions installed or implemented in years 2014 to 2020.

Under some conditions (see points 2(d) and 3 of EED article 7), Member States can also count energy savings achieved in years 2014 to 2020 and resulting from actions installed or implemented between 31 December 2008 and 31 December 2013 and that continue to have an impact in 2020.

1.3 Definitions specific to top-down methods

Top-down methods

Top-down methods start from aggregated (statistical) data on energy consumption and related physical/economic quantities, that can be further disaggregated to distinguish different effects explaining changes in energy consumption or energy efficiency indicators, including energy savings.

Example: The savings can be determined by comparing the trends in energy consumption and activity of a factory, a subsector (e.g. cement production) or an end use sector. After taking the changes in energy consumption due to the changes in activity into account, the remaining changes in energy consumption show the top-down energy savings.

Notes on the definition:

For more details about the different types of top-down methods, see the typology of calculation methods below.

Top-down methods do not regard specific saving actions by individual energy users (see Bottom-up savings). The top-down approach leads to energy savings that can include other effects than effects from policy measures, such as structural changes and so called autonomous savings (see Autonomous energy savings). The structural effects regard e.g. changes in the production mix that lead to less energy use, which is not the effect of savings but the effect of a change in the mix of production of different products that each use different amounts of energy per ton of product. At the sector level many structural or activity effects occur, including effects that lead to increased energy use, such as larger dwellings, larger cars and increased application of air-conditioning.

Examples of top-down methods can be found at:

http://www.evaluate-energy-savings.eu/emeees/en/evaluation_tools/top-down.php

Top-down energy savings

Top-down energy savings are energy savings calculated using top-down method(s), i.e. starting from aggregated (statistical) data on energy consumption and related physical/economic quantities.

Policy (induced) savings

The implementation of saving actions is often stimulated or forced by policy measures, such as insulation standards, appliance labels, subsidies for more efficient boilers or campaigns on energy sound behaviour. The energy savings, attributable to these policy measures, are called policy savings. It should be clear that these savings have actually been induced by the policy measures.

Autonomous savings

Not all energy savings are the result of energy savings policy measures (see Policy savings). Savings also occur in the absence of policy measures when existing equipment is replaced by new equipment. New equipment available on the market is more efficient in most cases. Another cause for autonomous savings are higher energy prices that make the more efficient equipment the economically sound choice. These savings in the absence of relevant policy measures are called autonomous savings.

1.4 Definitions specific to bottom-up methods

Bottom-up methods

Bottom-up methods start by evaluating energy savings at the level of an energy saving action or project (group of actions), or participant. These unitary energy savings are then summed up over the number of actions, projects or participants to obtain the total energy savings from the policy measure(s) under evaluation.

Notes on the definition:

For more details about the different types of bottom-up methods, see the typology of calculation methods below.

In general, two main ways can be used to calculate the total energy savings:

- Either summing up each unitary energy savings from all the energy saving actions or all the participants, as monitored for the policy measure(s) under evaluation:

$$Total\ energy\ savings\ for\ the\ policy\ measure(s) = \sum_{i=1}^{n} (unitary\ energy\ savings\ of\ action_i)$$

With:

i: index of each action (or project or participant)

n: total number of actions (or projects or participants)

- Or first calculating the total energy savings for actions assumed to have the same unitary energy savings (by multiplying the unitary energy savings by the number of similar actions), and then summing up the total energy savings for each action type to obtain the total energy savings for the policy measure(s) under evaluation:

$$Total\ energy\ savings\ for\ action\ type_{\ j} =$$

$$[\ unitary\ energy\ savings\ for\ action\ type\ j\ ] \times [\ number\ of\ actions\ for\ action\ type\ j\ ]$$

$$Total\ energy\ savings\ for\ the\ policy\ measure(s) =$$

$$\sum_{j=1}^{m} (Total\ energy\ savings\ for\ the\ action\ type_j)$$

With:

j: index of each action type

m: total number of action types considered in the evaluation of the policy measure(s)

Examples of bottom-up methods can be found at:

http://www.evaluate-energy-savings.eu/emeees/en/evaluation_tools/bottom-up.php

Bottom-up energy savings

Bottom-up energy savings are energy savings calculated using bottom-up method(s), i.e. by starting to evaluate energy savings at the level of an action, project or participant.

Deemed energy savings

Deemed energy savings are energy savings that are calculated based on data and assumptions from sources of data and expertise available beforehand (e.g., previous studies, manufacturers' data, national statistics, expert estimates). Deemed energy savings are usually unitary energy savings defined for a given action type.

Notes on the definition:

Deemed energy savings are usually multiplied by the number of actions for each action type to obtain the total energy savings from the policy measure.

The use of deemed energy savings can only be relevant for well-defined uniform actions, i.e. when the action type can be clearly specified in order to ensure that the actions counted with the same deemed energy savings are indeed similar (e.g. replacement of a refrigerator with a refrigerator with a given energy class; insulation of walls defined with specific requirements and according to a predefined typology of buildings). The deemed savings concept is not useful for more complex cases, such as actions on a particular industrial process, behavioural savings in households or savings due to an energy tax.

Deemed energy savings are often used in ex-ante evaluations. They can be used in ex-post monitoring and evaluation as well. This is for example the case for most of the Energy Efficiency Obligation (EEO) schemes for which standardised action types have been defined.

In the case of EEO schemes, the large number of actions implemented makes it possible to use the assumption of the Law of Large Numbers: the average energy savings from the actions implemented tend towards the energy savings calculated for an action in average conditions (as commonly used in the calculation of deemed energy savings). In other words, when the number of actions is large enough, the differences from one action to the other compensate. For example, it would not be relevant to use deemed energy savings to estimate the energy savings from insulating one building. But it can be relevant to use deemed energy savings to estimate the energy savings from 100 000 wall insulations meeting the same requirements and done on the same type of buildings.

Deemed energy savings may differ from actual energy savings. For example if insulation for dwellings results in less savings than estimated, because the behaviours of the occupants would differ from the normalised behaviours assumed in the calculation of the deemed savings. When deemed savings are based on earlier comparable cases, they may include factors to take into account differences between

standard assumptions and actual conditions. See for example the "in-use factor" used for the Supplier Obligations in UK (Rosenow, 2017) [1].

Measured (or metered) energy savings

Measured (or metered) energy savings are energy savings evaluated based on measured or metered data of energy consumption.

Notes on the definition:

The measurement or metering can be established at equipment level or at a more aggregated level (e.g., building, site).

Measured savings can include changes in energy consumption that are due to other effects than the direct effects of the energy saving action(s). For example, occupants might raise the thermostat setting (temperature setpoint) in their dwelling after it has been insulated, because a higher indoor temperature became more affordable (rebound effect). This increases the measured consumption after the action, which leads to lower measured energy savings. Depending on the evaluation objectives and data availability, these other effects may be taken into account when calculating the energy savings.

Gross energy savings

Gross energy savings are energy savings calculated from the point of view of the final consumers. Gross energy savings are the energy savings that occurred among participants of a policy measure, independently of whether they would have acted the same or differently in the absence of the policy. These calculations do not take into account effects related to the causality or attribution of the actions or energy savings to policy measures.

Notes on the definition:

Usually the baseline energy consumption used when calculating gross energy savings is the energy consumption before the energy saving actions were installed or implemented. When data are not available for each action or participant, the baseline energy consumption can be defined as the average energy consumption in the stock of building or equipment.

The calculation of gross energy savings does take into account factors needed to make reference (or baseline) energy consumption and actual energy consumption comparable. For example, when calculating energy savings from an action on the heating system, the calculations usually take into account possible changes in weather conditions (e.g. changes in the number of Heating Degree Days).

[1] Rosenow, J., 2017. Supplier Obligations in Great Britain. Case study prepared by IEECP for the EPATEE project, funded by the European Union's Horizon 2020 programme.
https://epatee.eu/sites/default/files/epatee_case_study_uk_supplier_obligations_ok.pdf

Baseline energy consumption and actual energy consumption can thus be normalised to the same weather conditions (e.g. same number of Heating Degree Days).

Net energy savings

Net energy savings are energy savings evaluated from the point of view of the public authority, policy maker or other stakeholder that provides any type of support or incentive to promote the energy saving actions. The evaluation of net energy savings take into account effects related to the causality or attribution of the actions or energy savings to policy measures.

Notes on the definition:

For more details about evaluating net energy savings, see (Voswinkel et al. 2018)[2].

Net energy savings can be determined using two general ways. One is to define or assess a baseline that represents the scenario of "what would have happened" without the policy. The other one is adjusting the gross energy savings by taking into account effects related to causality or attribution, such as free-rider effect, spill-over effect, double counting (see definitions below).

Other effects can be taken into account either in gross or net energy savings, depending on the evaluation objectives: rebound effect (direct and indirect), prebound effect, performance gaps, non-compliance (see definitions below).

Free-rider effects

A free-rider is an end-user who benefitted from the support (energy advice, financial incentives, etc.) provided by the measure, but who would have implemented the energy efficiency action anyway, also in the absence of the measure. This effect results in a lower effect of subsidies than in the case in which only parties that would not have taken action would get subsidy.

Note on the definition:

Several types of free-rider effects may be distinguished when considering the time when the end-user would have implemented the action in the absence of the policy measure ("deferred free-ridership") and/or the level of energy performance of the action that the end-user would have implemented in the absence of the policy measure ("partial free-ridership"). For more details, see for example p.66 of (SRCI et al., 2001) [3].

[2] Voswinkel, F., Broc, J.S., Breitschopf, B., Schlomann, B., 2018. Evaluating net energy savings. Topical case study of the EPATEE project, funded by the European Union's Horizon 2020 programme. https://epatee.eu/sites/default/files/epatee_topical_case_study_evaluating_net_energy_savings.pdf

3 SRCI, NOVEM, Electricity Association, MOTIVA, et al., 2001. A European Ex-Post Evaluation Guidebook for DSM and EE Service Programmes. SAVE Project No. XVII/4.1031/P/99-028, April 2001. http://www.evaluate-energy-savings.eu/emeees/downloads/Ex-post_Eval_Guidebook_DSM.pdf

Spill-over effects (or multiplier effects)

Spill-over effects correspond to energy savings caused by the policy measure, but other than those resulting from participants implementing energy efficiency actions promoted by the measure. Spill-over effects are sometimes named multiplier effects.

Note on the definition:

Several types of spill-over effects may be distinguished, in particular participants' spill-over (when participants implement other actions than the ones promoted by the policy measure) and non-participants' spill-over (when the policy measure has influenced end-users to implement actions, but the end-users did not ask for or receive support from the policy measure). For more details, see for example p.69 of (SRCI et al., 2001)[3].

Double-counting

Several policy measures may aim at the same target and can therefore interact: one action can be influenced by two or more policy measures. Double counting means that the energy savings from the same action would be counted for several policy measures. This can lead to overestimating the energy savings if this is not corrected when summing up energy savings from these policy measures.

Direct rebound effect

"*Improved energy efficiency for a particular energy service will decrease the effective price of that service and should therefore lead to an increase in consumption of that service. This will tend to offset the reduction in energy consumption provided by the efficiency improvement*" (Sorrell and Dimitropoulos, 2008)[4].

Indirect rebound effect

"*The lower effective price of the energy service may lead to changes in the demand for other goods, services and factors of production that also require energy for their provision. For example, the cost savings obtained from a more efficient central heating system may be put towards an overseas holiday*" (Sorrell and Dimitropoulos, 2008)[4].

[4] Sorrell, S., Dimitropoulos, J., 2008. The rebound effect: Microeconomic definitions, limitations and extensions. *Ecological Economics*, 65(3), 636-649.

Prebound effect

Cases where, before implementing an energy efficiency action, end-users tend to consume less energy than estimated by engineering models. For more details, see for example (Sunikka-Blank and Galvin, 2012)[5].

Performance gaps

Cases where the observed energy performance of the energy efficiency action installed is lower than the expected energy performance, for example due to differences in operating conditions or due to quality issues like defects when installing the action.

Non-compliance

Stipulations are not fulfilled (especially in case of regulatory instruments).

1.5 Other terms and definitions used in the EPATEE project

In the EPATEE project, it was decided to make a clear distinction between the terms “measure” and “action”, in order to avoid possible confusion when “measure” is used for multiple meanings.

Measure

“**measure**” is used when speaking of policy measures (e.g. financial incentive schemes, EEO schemes, voluntary agreements, information campaign).

For more details about the different types of policy measures, see the typology of policy instruments.

Action

“**action**” is used for the actions implemented at the end-user sites (or on an energy-using equipment), and that can be either technical (e.g. replacement of a boiler, installation of insulation, replacement of lighting), organisational (e.g. implementation of an energy management system) or behavioural (e.g. eco-driving, switching off equipment to avoid stand-by consumption, efficient behaviours about ventilation).

[5] See for example: Sunikka-Blank M, Galvin R., 2012. Introducing the prebound effect: the gap between performance and actual energy consumption. *Building Research & Information*, 40(3), 260-273.

Means

Means are the financial means used to implement the policy measures and the actions. It can include the public budget committed, investments made by participants, costs for obligated parties and other financial means used to get the energy efficiency actions implemented.

Outputs

Outputs are the direct results of the policy measures. It can include the number of participants, number of energy efficiency actions implemented, etc.

2 | Typologies related to the evaluation of energy savings

Typology of policy instruments

We chose to use the same typology as defined in the MURE database (http://www.measures-odyssee-mure.eu/) for the EPATEE project, to ensure consistency with already existing databases about energy efficiency policies in Europe:

- **legislative/normative** (mandatory standards, mandatory demand side management (DSM), regulations on buildings, heating systems, vehicles, others)
- **legislative/information** (mandatory audits / energy managers / building certificates / labelling)
- **financial** (grants, subsidies, loans, others)
- **fiscal/tariffs** (eco-/energy-/CO_2-taxes; tax exemptions / reductions)
- **information/education/training** (energy billing, information campaigns, voluntary energy audits, regional/local information centres, voluntary labelling, others)
- **cooperative** (technology procurement, voluntary agreements, voluntary demand side management (DSM) measures, others)
- **market-based** (energy efficiency obligations, energy efficiency auctions/tender systems, emission trading systems, JI/CDM)
- **infrastructure** (only relevant for transport, e.g. modal shift, urban traffic management))

Typology of sectors

Likewise, we chose to use the same typology as defined in the MURE database for the end-use sectors in the EPATEE project:

- **Household**
- **Tertiary** (with the possibility to distinguish "public sector" or "private sector" when relevant)
- **Industry**
- **Transport**
- **General cross-cutting** (for measures that cover all end-use sectors listed above; for measures that cover several but not all of these sectors, then the different sectors covered are mentioned; for example: "Household + Tertiary")

Other types of sectors were added to this typology as the case studies could have a broader scope:

- **Agriculture**
- **Energy distribution** (with the possibility to distinguish "electricity distribution", "gas distribution" and "district heating" when relevant)

- **Energy transmission** (with the possibility to distinguish "electricity transmission", "gas transmission" when relevant)
- **Energy generation** (for policies about energy generation plants that are not "energy generation for self-consumption" ; for example CHP in industrial sites is included in "Industry", and domestic solar water heaters is included in "Household")

Typology of calculation methods

We chose to use the same typology as defined in the MURE database (http://www.measures-odyssee-mure.eu/) for the EPATEE project, to ensure consistency with already existing databases about energy efficiency policies in Europe.

Table 1. Types of methods as used in EPATEE, based on the typology used in the MURE database.

Bottom-up methods (starting from assessing unitary energy savings)		***Link with EED Annex V categories*** *(see Table 2)*
Method 1 – Direct measurement	Unitary energy savings are calculated by using data from direct measurements or metering of energy consumption	"metered energy savings" or "surveyed savings"
Method 2 – Billing analysis	Unitary energy savings are calculated by using data from energy bills.	"metered energy savings" or "surveyed savings"
Method 3 – Deemed estimates	Unitary energy savings are based on simplified engineering calculations, mostly using data available beforehand (apart from the number of actions or participants)	"deemed savings"
Method 4 – Mixed deemed and ex post	Unitary energy savings are determined by intermediate engineering calculations, combining data available beforehand and data specifically collected for monitoring or ex-post evaluation.	"deemed savings"
Method 5 – Engineering estimates	Unitary energy savings are determined with an engineering model or detailed engineering calculations, used to model a complex system (building, industrial process, company).	"scaled savings"

Mixed methods		***Link with EED Annex V categories***
Method 6 – Stock modelling	Stock modelling based on stock and market statistics, and surveys monitoring diffusion / uptake of energy-efficient solutions.	other
Method 7 – Diffusion indicator	Indicators of the share of specific equipment or practice in the market (diffusion indicators), combined with deemed estimates of energy savings per equipment or practice.	other

Top-down methods		*Link with EED Annex V categories*
Method 8 – Consumption indicator	Monitoring of energy consumption indicators either at the sector or sub-sector level (unit energy consumption for whole sectors or sub-sectors), or at the equipment level (specific energy consumption indicators for specific end use equipment).	Other (top-down energy savings)
Method 9 – Econometric modelling	Use of econometric models or simulation at aggregated/macro level (e.g., price elasticities analysis, regression analysis).	Other (top-down energy savings)
Combined bottom-up and top-down methods		*Link with EED Annex V categories*
Method 10 – Other type(s) of method	Other types of method that cannot be described with one of the types described above, or with a combination of several of these 9 types.	other

Table 2. General categories of results of energy savings as defined in EED Annex V.

Categories	**Explanations** (quotes are from EED Annex V)
Deemed savings	"***deemed savings**, by reference to the results of previous independently monitored energy improvements in similar installations*"
Metered savings	"***metered savings**, whereby the savings from the installation of a measure, or package of measures, is determined by recording the actual reduction in energy use, taking due account of factors such as additionality, occupancy, production levels and the weather which may affect consumption*"
Scaled savings	"***scaled savings**, whereby engineering estimates of savings are used (…) or where they are carried out on the basis of nationally established methodologies and benchmarks by qualified or accredited experts that are independent of the obligated, participating or entrusted parties involved*"
Surveyed savings	"***surveyed savings**, where consumers' response to advice, information campaigns, labelling or certification schemes, or smart metering is determined. This approach may only be used for savings resulting from changes in consumer behaviour. It may not be used for savings resulting from the installation of physical measures*"
Other	When not covered by one of the categories above (for example in case of top-down methods or bottom-up stock modelling, see correspondences in **Table 1** above)

Typology of baselines

This typology was slightly adapted from the one defined in the MURE database:

- **actual before** energy consumption: metered energy consumption for the site, equipment, etc. where the energy efficiency action was implemented later
- **stock average**: statistics available about the existing stock of buildings, equipment, etc. that make possible to estimate an average energy consumption of buildings, equipment, etc. in the total current stock
- **before** energy consumption: when the baseline can be either "actual before" energy consumption or "stock average"
- **market average:** statistics available about the newly constructed or produced buildings, equipment, etc. sold on the market that make it possible to estimate an average energy consumption of new buildings, equipment, etc. sold on the market

- **control group**: energy consumption of households, companies, etc. that do not participate in the saving action and can be used for a statistical comparison with the group of participants in the policy
- **trend**: development of energy consumption over time without the influence of new policy; e.g. consumer behaviour, autonomous technical progress, "business as usual" scenario
- **minimum or performance standards**: only savings exceeding the standards are accounted
- **other**: in case the baseline used does not correspond to any of the types listed above (then provide a definition of this type of baseline in the case study)

Note: several types of baselines may be combined depending on the evaluation method used.

3 | Frequent acronyms

The following acronyms are frequently used in the documents of the EPATEE project:

Article 7 notification: notification made by the Member States to the European Commission about the energy savings target required by the EED article 7, about the strategy to achieve this target

DSM: demand side management – the ability of energy consumers to increase or decrease their energy consumption rate to help stabilize the energy (mostly electricity) system.

EED: Energy Efficiency Directive (EU Directive 2012/27/EU)

EED art.7: article 7 of the Energy Efficiency Directive (setting an energy savings target to be achieved either by the implementation of an Energy Efficiency Obligation scheme or by alternative policy measures)

EEO: Energy Efficiency Obligation (as defined in the EED)

ESD: Energy Services Directive (EU Directive 2006/32/EC)

EU: European Union

NEEAP: National Energy Efficiency Action Plan (plans to be reported by the EU Member States to the European Commission every three years, according to the ESD and then to the EED)

JI/CDM: joint implementation / clean development mechanism - flexibility mechanisms that can help countries meet their greenhouse gas emission reduction obligations

WCS: White Certificate Scheme. An extension of the Energy Efficiency Obligations instrument (EEO) that requires energy companies to achieve energy savings at their customers. The certificates are assigned to savings that have been achieved, and are tradable, which means the energy companies do not have to realize all savings themselves, but they can buy certificates from third parties.