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| From: | Secretary-General of the European Commission, signed by Ms Martine DEPREZ, Director |
| date of receipt: | 30 June 2025 |
| To: | Ms Thérèse BLANCHET, Secretary-General of the Council of the European Union |
| No. Cion doc.: | C(2025) 4133 final |
| Subject: | ANNEXES to the Commission Delegated Regulation supplementing Directive (EU) 2024/1275 of the European Parliament and of the Council as regards the establishment of a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements |

Delegations will find attached document C(2025) 4133 final.

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ANNEXES 1 to 3

**ANNEXES**

**to the**

**Commission Delegated Regulation**

**supplementing Directive (EU) 2024/1275 of the European Parliament and of the Council as regards the establishment of a comparative methodology framework for calculating cost-optimal levels of minimum energy performance requirements for buildings and building elements**

# ANNEX I

## Cost-optimal methodology framework

1. Establishment of reference buildings

1.1. Member States shall establish reference buildings for the following building categories:

(a) single-family buildings;

(b) apartment blocks and multifamily buildings;

(c) office buildings.

1.2. In addition to office buildings, Member States shall establish reference buildings for other non-residential building categories listed in paragraph (6)(d) to (i) of Annex I to Directive (EU) 2024/1275 for which specific energy performance requirements exist.

1.3. If a Member State is able to demonstrate in the report referred to in Article 6 of this Regulation that an established reference building can be applicable to more than one building category, it may reduce the number of reference buildings used and with that the number of calculations. Member States shall justify this approach on the basis of an analysis showing that a reference building that is used to serve several building categories is representative of the building stock for all the categories covered.

1.4. For each building category, at least one reference building shall be established for new buildings and at least two for existing buildings subject to major renovation. Reference buildings can be established on the basis of building subcategories (e.g. differentiated by size, age, cost structure, construction material, use pattern or climatic zone) that take into account the characteristics of the national building stock. Reference buildings and their characteristics shall correspond to the structure of current or planned energy performance requirements.

1.5. Member States shall make use of the reporting template provided in Annex III to report to the Commission the parameters considered in establishing the reference buildings. The underlying dataset on the national building stock used for establishing the reference buildings shall be communicated to the Commission as part of the report referred to in Article 6. In particular the choice of characteristics that underpin the establishment of reference buildings shall be justified.

1.6. For existing buildings (both residential and non-residential), Member States shall apply at least one measure/package/variant representing a standard renovation necessary to maintain the building/building unit (without additional energy efficiency measures beyond legal requirements).

1.7. For new buildings (both residential and non-residential), the currently applicable minimum energy performance requirements shall constitute the basic requirement to be met.

1.8. Member States shall calculate cost-optimal levels also for minimum performance requirements for building elements installed in existing buildings or derive them from the calculations done at buildings level. When setting requirements for building elements installed in existing buildings, the cost-optimal requirements should to the extent possible take into account the interaction of that building element with the entire reference building and other building elements.

1.9. Member States shall calculate and set cost-optimal requirements at the level of individual technical building systems for new and existing buildings or derive these from the calculations done at buildings level not only for heating, cooling, hot water, air-conditioning and ventilation (or a combination of such systems), but also for lighting systems for non-residential buildings.

1.10. If a Member State opts to take the life-cycle global warming potential (GWP) into account for the calculation of the cost-optimal levels, parameters that go beyond the operational energy and emission performance of the reference building and that have an impact on its whole life-cycle GWP, shall also be taken into consideration as part of the measures/packages/variants.

2. Identification of energy efficiency measures, measures based on renewable energy sources and/or packages and variants of such measures for each reference building

2.1. Energy efficiency measures for both new and existing buildings shall be defined for all input parameters for the calculation that have a direct or indirect impact on the energy performance of the building.

2.2. Measures may be bundled into packages of measures or variants. If certain measures are not suitable in a local, economic or climatic context, Member States should indicate this in their reporting to the Commission in accordance with Article 6 of this Regulation.

2.3. Member States shall also identify measures/packages/variants using renewable energy for both new and existing buildings. Binding obligations laid down in the national legislation transposing Article 15a of Directive (EU) 2018/2001 of the European Parliament and of the Council[1] shall be considered as one measure/package/variant to be applied in that Member State.

2.4. Energy efficiency measures/packages/variants identified for the calculation of cost-optimal requirements shall include measures necessary to meet the currently applicable minimum energy performance requirements. If applicable, they shall also include measures/packages/variants necessary to meet the requirements of national support schemes. Member States shall also include measures/packages/variants necessary to meet the minimum energy performance requirements for zero-emission buildings for new and possibly also existing buildings as defined by Article 11 of Directive (EU) 2024/1275.

2.5. If a Member State can demonstrate, by submitting previous cost analyses as part of the reporting referred to in Article 6, that certain measures/packages/variants are far from cost-optimal, these may be excluded from the calculation. However, such measures/packages/variants should be revisited in the subsequent review of the calculations.

2.6. The selected energy efficiency measures and measures based on renewable energy sources, and packages/variants, shall be compatible with the basic requirements for construction works as listed in Annex I to Regulation (EU) No 2024/3110 and specified by Member States and the predetermined environmental essential characteristics listed in Annex II to that Regulation. They shall also be compatible with levels of indoor environmental quality (IEQ), as defined in Article 2(66) of Directive (EU) 2024/1275. IEQ requirements introduced in Articles 7(6), 8(3), and

[1] Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (recast) (OJ L 328, 21.12.2018, p. 82-209. ELI: http://data.europa.eu/eli/dir/2018/2001/2024-07-16).

13(5) shall be considered. In cases where measures produce different comfort levels, this shall be made transparent in the calculations.

3. Calculation of the total primary energy use and emission performance resulting from the application of such measures and packages of measures to a reference building

3.1. Energy performance is calculated in accordance with the common general framework provided in Annex I to Directive (EU) 2024/1275.

3.2. Member States shall calculate the energy performance of measures/packages/variants by calculating, for the nationally defined reference floor area, first the energy needed for heating and cooling. Subsequently the delivered energy for space heating, cooling, ventilation, domestic hot water and lighting systems is calculated.

3.3. Renewable energy produced and self-used on site for EPB services shall not be accounted in the total primary energy use. Renewable energy produced on site and used on site for non-EPB uses or exported to the grid may be deducted from the primary energy use. On-site renewable energy production shall be calculated by using sub-hourly, hourly or monthly modelling adjusted e.g. through considering monthly correction factors.

3.4. Member States shall calculate the resulting total primary energy use using renewable and non-renewable primary energy conversion factors or weighting factors per energy carrier established at national level, pursuant to Annex I to Directive (EU) 2024/1275. They shall report to the Commission the primary energy conversion factors or weighting factors in the reporting referred to in Article 6 of this Regulation.

3.5. Member States shall use:

(a) either the relevant existing CEN standards for the calculation of energy performance;

(b) an equivalent national calculation method provided that it complies with Article 2(8) of and Annex I to Directive (EU) 2024/1275.

3.6. For the purpose of the cost-optimal calculation, energy performance results shall be expressed in square metres of reference floor area of a reference building and refer to, at least, total primary energy use.

3.7. Member States shall also calculate the emission performance using emissions factors established at national, regional, and/or local level. The emission performance, in this context, refers to the operational emissions. Member States may take into account the life-cycle GWP and, for that purpose, they may use a calculation methodology pursuant to Annex III to Directive (EU) 2024/1275, designed for the calculation of the GWP of new buildings.

3.8. In the calculation, Member States may take into account future changes of outdoor climate conditions according to best available climate projections, including heat and cold waves. To do this, Member States may refer to the data on heating degree days and cooling degree days, published annually by Eurostat to build their national projections, or refer to the projections prepared by the Commission and referred to Annex II. Other relevant sources can be used, provided that they are sufficiently documented and reported to the Commission.

4. Calculation of the global cost in terms of net present value for each reference building

4.1. Categories of costs

Member States shall establish and describe the following separate cost categories to be used, noting that for the calculation at macroeconomic level applicable charges and taxes are to be excluded:

(a) Initial investment costs.

(b) *Annual costs*. In addition, these might include the earnings from energy produced that Member States may, if appropriate, take into account in the financial calculation.

(c) Waste management costs, if appropriate.

For the calculation at macroeconomic level, Member States shall also establish the following cost categories:

(d) *Cost of greenhouse gas emissions*. These shall reflect the quantified, monetised and discounted operational costs of $CO_2$ resulting from the greenhouse gas emissions in tonnes of $CO_2$ equivalent over the calculation period. If a Member State opts to take into account the life-cycle GWP for the calculation of the cost-optimal levels, indicating the building's overall contribution over its whole life cycle to emissions that lead to climate change, the cost of greenhouse gas emissions may be expanded to include it.

(e) *Cost of environmental and health externalities of energy use*. These shall reflect the quantified and monetised operational costs of air pollutants related to energy use (namely, at least $PM_{2.5}$ and NOx).

4.2. General principles for cost calculation

(a) In projecting energy cost developments, Member States may use the energy price development referred to in Annex II to this Regulation for oil, gas, and coal, starting with the average absolute energy prices (expressed in euro) for these energy sources in the year of the calculation exercise.

Member States shall also establish national energy price development forecasts for other energy carriers used to a significant extent in their regional/local context and if appropriate also for peak load tariffs. They shall report the projected price trends and the current shares of the different energy carriers in building energy use to the Commission.

(b) The effect of (expected) future price developments for costs other than energy costs, the replacement of building elements during the calculation period, and waste management costs where applicable, may also be included in the cost calculation. Price developments, including through innovation and adaptation of technologies, have to be taken into account when the calculations are reviewed and updated. To this end, Member States may use the technology cost assumptions referred to Annex II to this Regulation.

(c) Cost data for cost categories (a) to (c) shall be market-based and shall be coherent as regards location and time. Costs should be expressed as real costs excluding inflation. Costs shall be assessed at country level.

(d) When determining the global cost of a measure/package/variant, the following may be omitted:

(a) costs that are the same for all assessed measures/packages/variants;

(b) costs related to building elements which have no influence on the energy and, where relevant, emission performance of a building.

All other costs need to be fully taken into account for the calculation of global costs.

(e) The residual value shall be determined by a straight-line depreciation of the initial investment or replacement cost of a given building element until the end of the calculation period discounted to the beginning of the calculation period. The depreciation time is determined by the economic lifetime of a building or building element. Residual values of building elements may need to be corrected for the cost of removing them from the building at the end of the estimated economic life cycle of the building.

(f) Waste management costs, if applicable, are to be discounted and can be subtracted to the final value. They might need to be first discounted back from the estimated economic lifetime to the end of the calculation period and in a second step discounted back to the beginning of the calculation period.

(g) At the end of the calculation period, the waste management costs (if applicable) or the residual value of the components and building elements are taken into account to determine the final costs over the estimated economic lifecycle of the building.

(h) Member States shall use a calculation period of at least 30 years for residential and public buildings, and a calculation period of at least 20 years for commercial, non-residential buildings.

(i) Member States are encouraged to use Annex D to EN 15459-1 on economic data for building elements when defining estimated economic lifetimes for those building elements. If other estimated economic lifetimes for building elements are established, these should be reported to the Commission as part of the reporting referred to in Article 6. Member States shall define at national level the estimated economic lifecycle of a building.

4.3. Calculation of global costs for a financial calculation

(a) When determining the global cost of a measure/package/variant for the financial calculation, the relevant prices to be taken into account are the prices paid by the customer including all applicable taxes including VAT and charges. Ideally also the subsidies available for different variants/packages/measures are to be included into the calculation, but Member States can choose to leave subsidies aside, ensuring however that in that case both subsidies and support schemes for technologies but also possibly existing subsidies for energy prices are taken out.

(b) Global costs for buildings and building elements shall be calculated by summing the different types of costs and applying to these the discount rate by means of a discount factor so as to express them in terms of value in the starting year, plus the discounted residual value as follows:

$$C_g(\tau) = C_I + \sum_j \left[ \sum_i^{\tau} \left( C_{a,i}(j) \times R_d(i) \right) - V_{f,\tau}(j) \right]$$

where:

$\tau$ means the calculation period

$C_g(\tau)$ means global cost (referred to starting year $\tau_0$) over the calculation period

$C_I$ means initial investment costs for measure or set of measures j

$C_{a,i}(j)$ means annual cost during year i for measure or set of measures j

$V_{f,\tau}(j)$ means residual value of measure or set of measures j at the end of the calculation period (discounted to the starting year $\tau_0$)

$R_d(i)$ means discount factor for year i based on discount rate r to be calculated as:

$$\boldsymbol{R_d(p) = \left(\frac{1}{1 + {}^{r}/_{100}}\right)^{p}}$$

where p means the number of years from the starting period and r means the real discount rate.

(c) Member States shall determine the discount rate to be used in the financial calculation after having performed a sensitivity analysis on at least two different rates of their choice.

4.4. Calculation of global costs for the macroeconomic calculation

(a) When determining the global cost for the macroeconomic calculation of a measure/package/variant, the relevant prices to be taken into account are the prices excluding all applicable taxes, VAT, charges and subsidies.

(b) When determining the global cost at macroeconomic level of a measure/package/variant, in addition to the cost categories listed under 4.1, points (a) to (c), other cost categories are included so that the adjusted global cost methodology reads as:

$$\boldsymbol{C_g(\tau) = C_I + \sum_j \left[\sum_i^{\tau} \left((C_{a,i}(j) + C_{a,EN,i}(j)) \times R_d(i) + C_{C,i}(j)\right) - V_{f,\tau}(j)\right]}$$

where:

$C_{a,EN,i}(j)$ means annual cost of the environmental and health externalities of energy use for measure or set of measures j during year i

$C_{C,i}(j)$ means carbon cost for measure or set of measures j during year i.

(c) Member States shall calculate the cumulated carbon cost of measures/packages/variants over the calculation period by taking the sum of the annual greenhouse gas emissions multiplied by the expected prices per tonne $CO_2$ equivalent of greenhouse gas emission allowances in every year issued, and are recommended to use the most recent carbon price trajectories provided by the Commission as recommended key parameter for national GHG projections (as referred to Annex II).

(d) To calculate the annual cost of the environmental and health externalities of energy use for measures/packages/variants, Member States shall multiply the corresponding annual pollutant emissions by the respective price per tonne. The pollutants to be considered in this calculation are at least fine particulate matter ($PM_{2.5}$) and nitrogen oxides (NOx). For the cost calculation, Member States are recommended to use as reference the values referred to in Annex II and may also decide to include in the calculation the other relevant air pollutants mentioned in Article 1 of Directive (EU) 2016/2284: sulfur dioxide ($SO_2$) and non-methane volatile organic compounds

(NMVOC). For the calculation of the environmental and health externalities of energy use, reference values in terms of pollutant emission of different energy sources (g/kWh of fuel) can be found in the EMEP/EEA air pollutant emission inventory guidebook and the related emission factor database.

(e) Member States shall determine the discount rate to be used in the macroeconomic calculation after having performed a sensitivity analysis on at least two different rates, one of which shall be 3% in real terms.

5. Undertaking a sensitivity analysis for cost input data including energy prices

The purpose of a sensitivity analysis is to identify the most important parameters of a cost-optimal calculation. Member States shall perform a sensitivity analysis on the discount rates using at least two discount rates each expressed in real terms for the macroeconomic calculation and two discount rates for the financial calculation. One of the discount rates to be used for the sensitivity analysis for the macroeconomic calculation shall be 3% in real terms. Member States shall perform a sensitivity analysis on the energy price development scenarios for all energy carriers used to a significant extent in buildings in their national context. It is recommended to extend the sensitivity analysis also to other crucial input data, including, for example, future technology prices, primary energy factors and weighting factors, emission factors.

6. Derivation of a cost-optimal level of energy performance for each reference building

6.1. For each reference building, Member States shall compare the global cost results calculated for different energy efficiency measures and measures based on renewable energy sources and packages/variants of those measures.

6.2. In cases where the outcome of the cost-optimal calculations gives the same global cost range for different levels of energy performance, Member States are encouraged to use the requirements resulting in lower use of total primary energy as the basis for comparison with the existing minimum energy performance requirements. Member States are also encouraged to use the requirements minimising the energy needs of the building.

6.3. Once a decision is taken on whether the macroeconomic or the financial calculation is to become the national benchmark, averages of the calculated cost-optimal energy performance levels for all the reference buildings used, taken together, shall be calculated in order to compare them with the averages of the existing energy performance requirements for the same reference buildings. This is to allow the calculation of the gap between existing energy performance requirements and the calculated cost-optimal levels.

## ANNEX II

### Relevant data and data projections

The data and data projections included in the following table are available for Member States to download from the dedicated webpage on the Energy Performance of Buildings Directive[2], on the European Commission website.

The information will refer to the latest available data and will be updated regularly, e.g. when new relevant information becomes available.

Member States may use their own assumptions for data and data projections, provided that they are sufficiently documented and reported to the Commission.

| | **Data projection** | **EU-level** | **MS-level** |
|---|---|---|---|
| A | Estimated long-term energy price developments | X | |
| B | Environmental costs for air pollutants | X | X |
| C | Heating degree days (HDD) projections | X | X |
| D | Cooling degree days (CDD) projections | X | X |
| E | Technology cost assumptions | X | |

1. Information on estimated long-term energy price developments

   For their calculations, Member States may use the fossil fuel prices trajectory provided by the Commission as recommended key parameter (pursuant to Article 18 of Regulation (EU) 2018/1999[3]). Member States may take into account the estimated electricity price developments, where provided for by the European Commission.

2. Information on Environmental Costs for Other Pollutants

   For their macroeconomic calculations, in order to monetize the emissions of air pollutants, and thus to calculate the environmental and health externalities of energy use, Member States are recommended to use the costs per unit of pollutant emission (€/g) provided by the Commission and made available for download as indicated above.

3. Information on estimated long-term carbon price developments

   For their macroeconomic calculations, Member States are recommended to use the most recent EU ETS carbon prices trajectory provided by the Commission as recommended key parameter for national GHG projections (pursuant to Article 18 of Regulation (EU) 2018/1999).

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2 https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en#energy-performance-of-buildings-standards.

3 Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (OJ L 328, 21.12.2018, p. 1-77, ELI: http://data.europa.eu/eli/reg/2018/1999/oj).

## ANNEX III

**Reporting template that Member States shall use for reporting to the Commission pursuant to Article 6(2) of Directive (EU) 2024/1275 and Article 6 of this Regulation**

1. Reference Buildings

1.1. Report synthetic information on the reference buildings for all building categories and how they are representative of the building stock by using Table 1 (existing buildings) and Table 2 (new buildings). Additional information may be added in an annex or in the text accompanying the relevant tables.

1.2. Give the definition of the reference floor area used in your country and how it is calculated.

1.3. List the selection criteria used to define each reference building (both new and existing): e.g. statistical analysis based on use, age, geometry, climate zones, cost structures, construction material, etc., introducing also the indoor and outdoor climatic conditions, and geographic location.

1.4. If a Member State has reduced the number of reference buildings by using a reference building serving several building categories, it shall justify this approach on the basis of an analysis showing that the reference building is representative of the building stock for all the categories covered.

1.5. Indicate whether your reference building is an example building, virtual building, etc.

1.6. Indicate the underlying dataset for the national building stock.

1.7. All buildings and subcategories should be listed in Tables 1 and 2. When, in case of minor variations (e.g. only one parameter is changed), Member States decide not to include every reference building considered, they are required to include the number of variations considered for each category in the relevant column.

1.8. Table 3 shall be filled for each reference building in all its parts, unless the introduction of a specific parameter is not relevant for the reporting of the calculation. Approaches can differ between new and existing reference buildings. For new buildings, on the basis of how the calculations are set, only the basic characteristics of each reference building need to be reported in Table 3, while the results of measures/packages/variants can be reported in Table 5. The ‘Description’ column can be used to provide explanations and comments. In addition, Member States are recommended to add parameters that they deem relevant to report the calculations, including voluntary elements that they decided to include in the calculations.

1.9. The first sections of Table 3 (‘Calculation’, ‘Climatic Conditions’, ‘Building setpoints and schedules’) are general and do not need to be reported for each reference building, if they do not change. In such a case, these sections may also be reported separately with a clear indication of the reference buildings that they apply to.

1.10. If variations of the same reference building are analysed and if the same reference building is calculated in different climatic zones of the national territory, the ‘Quantity’ column in Table 3 may be replicated and filled only with the relevant information, without the need to reproduce the whole table.

*Table 1*

**Reference building for existing buildings (major renovation)**

| **For existing buildings** | Building geometry (1) | Shares of window area on the building envelope and windows with no solar access | Floor area $m^2$ as used in building code | Description of the building (2) | Description of the average building technology (3) | Average total primary energy performance $kWh/m^2y$ (prior to investment) (4) | Component level requirements (typical value) (where relevant) | Total number of variations (if relevant) |
|---|---|---|---|---|---|---|---|---|
| (1) **Single family buildings and subcategories** | | | | | | | | |
| Subcategory 1 | | | | | | | | |
| Subcategory 2 etc. | | | | | | | | |
| (2) **Apartment blocks and multifamily buildings and subcategories** | | | | | | | | |
| | | | | | | | | |
| (3) **Office buildings and subcategories** | | | | | | | | |
| | | | | | | | | |
| (4) **Other non-residential building categories** | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

(1) Reference floor area, S/V (surface to volume), orientation, area of north/west/south/east (N/W/S/E) façade.

(2) Period of construction/age (if appropriate), construction material, typical air tightness (qualitative), use pattern (if appropriate).

(3) Technical building systems; U-values of building elements; area, U-value and g-value of windows; shading; etc.

(4) All EPB uses included: heating, domestic hot water (DHW), ventilation, cooling, built-in lighting and auxiliary energy.

*Table 2*

**Reference building for new buildings**

| **For new buildings** | Building geometry (1) | Shares of window area on the building envelope and windows with no solar access | Floor area $m^2$ as used in building code | Description of the building | Description of the average building technology | Average total primary energy performance $kWh/m^2y$ (prior to investment) (2) | Component level requirements (where relevant) | Total number of variations (if relevant) |
|---|---|---|---|---|---|---|---|---|
| (1) **Single family buildings and subcategories** | | | | | | | | |
| Subcategory 1 | | | | | | | | |
| Subcategory 2 etc. | | | | | | | | |
| (2) **Apartment blocks and multifamily buildings and subcategories** | | | | | | | | |
| | | | | | | | | |
| (3) **Office buildings and subcategories** | | | | | | | | |
| | | | | | | | | |
| (4) **Other non-residential building categories** | | | | | | | | |
| | | | | | | | | |

(1) Reference floor area, S/V, area of N/W/S/E façade. To note: the orientation of the building can already constitute an energy efficiency measure in itself in the case of new buildings.

(2) Other parameters can be used, where relevant.

*Table 3*

**Example of a basic reporting table for energy performance relevant data**

| | | | | Quantity | Unit | Description |
|---|---|---|---|---|---|---|
| **Reference Building** | | | | | - | Where relevant, provide a description of the variants, if variants of the same reference buildings are reported by duplicating the 'quantity' column. Specify whether the building is in a rural, urban or metropolitan area. |
| **Calculation** | Method and tool (s) | | | | - | Short description of the calculation method adopted (e.g. with reference to ISO 52016-1) and comment on the calculation tool(s) used |
| | Calculation period | | | | years | Where relevant, distinguish per building type. |
| | Primary energy conversion factors | Energy carrier 1 | Total | | - | Values of primary energy factors or weighting factors (per energy carrier) used for the calculation. Factors to be differentiated by total, renewable and non-renewable share. Specify possible correction factors considered. The choices made and data sources shall be reported according to EN 17423 or any superseding document. |
| | | | Non-renewable | | - | |
| | | | Renewable | | - | |
| | GHG-emission factors | Energy carrier 1 | | | g/kWh | Values of GHG emission factors (per energy carrier) used for the calculation |
| | Air pollutant emissions factor | Energy carrier 1 | $PM_{2.5}$ | | g/kWh | Values of pollutant emission factors (per energy carrier) used for the calculation. Add rows if pollutants other than $PM_{2.5}$ and NOx are considered. Where relevant, indicate if current factors or the average over the evaluation period is assumed |
| | | | NOx | | | |
| **Climate condition** | Location | | | | - | Name of the city with indication of latitude and longitude |
| | Climate zone | | | | | According to national climatic zone classification, if available |
| | Heating degree days | | | | HDD | HDD and CDD can be evaluated according to EN ISO 15927-6, specifying the calculation period. Indicate whether climate data and their future changes according to best available climate projections, including heat and cold waves were taken into account and the sources of projections data |
| | Cooling degree days | | | | CDD | |
| | Source of climatic dataset | | | | - | Provide references on climatic dataset used for the calculation |
| **Building setpoints and schedules** | Temperature setpoint | Winter | | | °C | Indoor operative temperature or other relevant parameters set in line with IEQ requirements |
| | | Summer | | | °C | |
| | Humidity setpoint | Winter | | | % | Indoor relative humidity or other relevant parameters set in line with IEQ requirements |
| | | Summer | | | % | |

| | | | | | |
|---|---|---|---|---|---|
| | Operation schedules and controls | Occupancy | | - | Provide comments or references (EN or national standards, etc.) on the schedules used for the calculation. Schedules should be appropriately differentiated per building type and do not need to be replicated for each reference building. |
| | | Lighting | | - | |
| | | Appliances | | - | |
| | | Ventilation | | - | |
| | | Heating system | | - | |
| | | Cooling system | | - | |
| **Building geometry** | Volume (or Length × Width × Height) | | | $m^3$ (or m × m × m) | Related to the heated/conditioned air volume (e.g. in line with ISO 52016-1) and, where relevant, considering as 'length' the horizontal dimension of the façade south-oriented |
| | Number of floors | | | - | Where relevant |
| | S/V (surface-to-volume) ratio | | | $m^2/m^3$ | - |
| | Ratio of window area over total building envelope area | S / E / N / W and/or total | | % | Report specifying by façade orientation or, alternatively, report the total ratio |
| | Orientation | | | ° | Azimuth angle of the south façade (deviation from the south direction of the 'south' oriented façade) |
| **Internal gains** | Building utilisation | | | - | According to the building categories proposed in Annex 1 to Directive (EU) 2024/1275 |
| | Average thermal gain from occupants | | | $W/m^2$ | - |
| | Specific electric power of the lighting system | | | $W/m^2$ | Total electric power of the complete lighting system of the conditioned rooms (all lamps + control equipment of the lighting system), where relevant |
| | Specific electric power of electric equipment | | | $W/m^2$ | Where relevant |
| **Building elements** | Average U-value of walls | | | $W/m^2K$ | Weighted U-value of all walls: U_wall = (U_wall_1 × A_wall_1 + U_wall_2 × A_wall_2 + … + U_wall_n × A_wall_n)/(A_wall_1 + A_wall_2 + … + A_wall_n); where: U_wall_i = Uvalue of wall type i; A_wall_i= total surface of wall type i |
| | Average U-value of roof | | | $W/m^2K$ | Similar to walls |
| | Average U-value of basement | | | $W/m^2K$ | Similar to walls |
| | Average U-value of windows | | | $W/m^2K$ | Similar to walls; it should take into account the thermal bridge due to the frame and dividers (e.g. according to EN ISO 10077-1) |
| | Thermal bridges | Total length | | m | - |
| | | Average linear thermal transmittance | | W/mK | - |
| | Thermal capacity per unit area | External walls | | $J/m^2K$ | To be evaluated according to the relevant standards, such as EN ISO 13786 |
| | | Internal walls | | $J/m^2K$ | |
| | | Slabs | | $J/m^2K$ | |
| | Type of shading systems | | | - | E.g. solar blind, roll-up shutter, curtain, etc. |
| | Average g-value of | Glazing | | - | Total solar energy transmittance of glazing (for radiation perpendicular to the glazing): weighted value according to the area of different transparent elements |
| | | Glazing + shading | | - | Total solar energy transmittance for glazing and external solar protection devices to be evaluated according to the relevant standards, such as EN ISO 52022-1 |

| | | | | | |
|---|---|---|---|---|---|
| | Infiltration rate (air changes per hour) | | | 1/h | E.g. calculated for a pressure difference inside/outside of 50 Pa |
| **Building systems** | Ventilation system | Ventilation rate | | l/s | To be evaluated according to the relevant standards, such as EN 16798 |
| | | Heat recovery efficiency | | % | |
| | Efficiencies of heating system | Generation | | % | To be evaluated according to relevant standards, such as EN 15316-1, EN 15316-2-1, EN 15316-4-1, EN 15316-4-2, EN 15120, EN 14825, EN 14511, and subsequent revisions |
| | | Distribution | | % | |
| | | Emission | | % | |
| | | Control | | % | |
| | Efficiencies of air-conditioning system | Generation | | % | To be evaluated according to relevant standards, such as EN 14825, EN 16798-13, EN 14511, EN 15120, and subsequent revisions |
| | | Distribution | | % | |
| | | Emission | | % | |
| | | Control | | % | |
| | Efficiencies of DHW system | Generation | | % | To be evaluated according to the relevant standards |
| | | Control | | % | |
| **Building energy need** | (Thermal) energy contribution of main passive strategies implemented | (1) ... | | kWh/ ($m^2$y) | E.g. solar greenhouse, natural ventilation, daylighting, etc., where relevant |
| | | (2) ... | | kWh/ ($m^2$y) | |
| | | (3) ... | | kWh/ ($m^2$y) | |
| | Energy need for heating | | | kWh/ ($m^2$y) | Heat to be delivered to or extracted from a conditioned space to maintain the intended temperature conditions during a given period of time |
| | Energy need for cooling | | | kWh/ ($m^2$y) | |
| | Energy need for DHW | | | kWh/ ($m^2$y) | Heat to be delivered to the needed amount of DHW to raise its temperature from the cold network temperature to the prefixed delivery temperature at the delivery point |
| | Energy need for other (humidification, dehumidification) | | | kWh/ ($m^2$y) | Latent heat in the water vapour to be delivered to or extracted from a conditioned space by a technical building system to maintain a specified minimum or maximum humidity within the space (if applicable) |
| **Building energy use** | Energy use for heating | | | kWh/ ($m^2$y) | Energy input to the heating/cooling/DHW systems to satisfy the energy needs for heating, cooling and DHW (e.g. in line with ISO 52000-1:2017) |
| | Energy use for cooling | | | kWh/ ($m^2$y) | |
| | Energy use for DHW | | | kWh/ ($m^2$y) | |
| | Energy use for ventilation | | | kWh/ ($m^2$y) | Electrical energy input to the ventilation system for air transport and heat recovery (not including the energy input for preheating or precooling the air) and energy input to the humidification systems to satisfy the need for humidification |
| | Energy use for built-in lighting | | | kWh/ ($m^2$y) | Electrical energy input to the lighting system, where relevant |
| | Energy use for other on-site uses | | | kWh/ ($m^2$y) | Electrical energy input to on-site uses other than EPB services, including appliances, miscellaneous and ancillary loads, or electro-mobility recharging points. Specify where relevant |
| **Renewable energy generation at the building site** | Thermal energy from renewable energy sources (e.g. thermal solar collectors, ambient heat) | | | kWh/ ($m^2$y) | On-site renewable energy production should be calculated by using either sub-hourly, hourly modelling or monthly modelling adjusted e.g. through considering monthly correction factors. |

| | | | | | |
|---|---|---|---|---|---|
| | Electrical energy generated in the building and self-consumed on-site for EPB uses | | | kWh/ ($m^2$y) | Specify the different sources considered, where relevant. Specify, where considered in the calculation, whether the renewable electricity is also considered for other on-site uses (in line with Article 2(60) of Directive (EU) 2024/1275). The energy from on-site generators based on bioenergy should not be considered here, since the primary energy carrier (e.g. solid biomass, biogases or biofuels) is supplied from outside building premises. |
| | Energy generated in the building and exported to the market | | | kWh/ ($m^2$y) | |
| | Other energy generation at the building site | | | kWh/ ($m^2$y) | Only where relevant |
| **Delivered energy** | Delivered energy to the building from nearby or distant sources | Electricity | | kWh/ ($m^2$y) | Energy, expressed per energy carrier, supplied to the technical building systems through the system boundary, to satisfy the uses taken into account (heating, cooling, ventilation, domestic hot water, lighting, etc.) |
| | | Fossil fuel (specify) | | kWh/ ($m^2$y) | |
| | | Other (specify: biomass, district heating/ cooling...) | | kWh/ ($m^2$y) | |
| **Primary energy** | Total primary energy | | | kWh/ ($m^2$y) | Exported energy (e.g. on-site generated renewable electricity not accounted for self-use or other on-site, non-EPB, uses) may be deducted from the total primary energy use. |
| | Non-renewable primary energy | | | kWh/ ($m^2$y) | - |
| | Renewable primary energy | | | kWh/ ($m^2$y) | - |
| **Emissions** | Greenhouse gas emissions | | | kgCO2eq/ ($m^2$y) | Operational emissions |
| | $PM_{2.5}$ emissions | | | kg$PM_{2.5}$/ ($m^2$y) | If other pollutants are considered in the calculation, add the results |
| | NOx emissions | | | kgNOx/ ($m^2$y) | |

*Fill out one table for each reference building.*

2. Selecting measures/packages/variants

2.1. Report in table format the characteristics of selected measures/packages/variants that are applied for the cost-optimal calculation. Start with the most common technologies and solutions and then move towards the more innovative ones. If there is evidence from previous calculations that measures are far from being cost-optimal, no table has to be filled in but this should be reported separately to the Commission. The format below can be used, but note that the examples listed are purely illustrative.

2.2. For renovations and new buildings, minimum IEQ levels need to be ensured pursuant to Article 7(6) and Article 8(3) of the Directive (EU) 2024/1275. These requirements need to be considered when defining the measures/packages.

2.3. Where relevant, Member States can decide to report two separate tables for listing measure/package/variant for new and existing buildings. Where relevant, Member States can add a column to specify the reference building or subcategory the measure/package/variant refers to.

2.4. More measures can be grouped into packages and, where relevant, these should also be reported in Table 4.

2.5. Reporting can be limited to the most important measures/packages but it should be indicated how many calculations have been carried out in total.

*Table 4*

**Illustrative table for listing selected measures/packages/variants**

| Code | Measure | Reference case | Variation 1 | Variation 2 | Etc. |
|---|---|---|---|---|---|
| (e.g. RI - so variations are RI.1… RI.n) | Roof insulation | | | | |
| | Wall insulation | | | | |
| | Windows | 5.7 W/m$^2$K (description) | 2.7 W/m$^2$K (description) | 1.9 W/m$^2$K (description) | |
| | Share of window area of total building envelope | | | | |
| | Building-related measures (thermal mass, etc.) | | | | |
| | Heating system | | | | |
| | DHW | | | | |
| | Ventilation system | | | | |
| | Space cooling system | | | | |
| | Measures based on renewable energy sources (on site) | | | | |
| | Change of energy carrier | | | | |
| | etc. | | | | |

*The listing of measures is purely illustrative, but the main information in the table (description of the variation/s, indicator of performance) must be maintained.*

*For the building envelope, thermal transmittance in W/m$^2$K could be used;*

*For systems, efficiency could be used;*

*For ventilation systems, air renewal rates in l/s could be used;*

*Several levels of improvements can be selected, including performance requirements in force (for example: different thermal transmittance values for windows).*

3. Calculation of the primary energy use and emission performance of the measures

3.1. Energy and emission performance assessment

3.1.1. The calculation procedure for the energy performance assessment that is applied to the reference buildings and to the adopted measures/packages/variants is reported as part of Table 3 (sections ‘Calculation’, ‘Climatic Conditions’, ‘Building setpoints and schedules’). This does not need to be done for each reference building, unless necessary.

3.1.2. Give references to relevant legislation, regulation, standards and norms.

3.1.3. Fill in the calculation period, the calculation interval (annual, monthly or daily) and the used climate data per reference building.

Reporting can be limited to the most important measures/packages/variants but it should be indicated how many calculations have been carried out in total.

3.2. Energy use calculation

3.2.1. Report the results of the energy performance calculation for each measure/package/variant for each reference building differentiated to at least energy need for heating and cooling, energy use, delivered energy and total primary energy use (including renewable and non-renewable parts). Include also the energy savings.

3.2.2. Member States are free to add rows to include relevant information that need to be reported by mirroring the information provided for the reference building in Table 3.

*Table 5*

**Energy use and emission calculation output table**

| | | | | | | |
|---|---|---|---|---|---|---|
| Measure/package/variant (as described in Table 4) | Code | | | | | … |
| Energy needs | For heating | | | | | |
| | For cooling | | | | | |
| Final energy use | Heating | | | | | |
| | Cooling | | | | | |
| | Ventilation | | | | | |
| | DHW | | | | | |
| | Built-in lighting | | | | | |
| | Other (specify) | | | | | |
| Delivered energy specified by carrier | ec1 | | | | | |
| | … | | | | | |
| Renewable energy generation at the building site | Energy generated in the building and used on-site for self-use | | | | | |
| | Energy generated in the building and used on-site for other on-site uses | | | | | |
| | Exported energy | | | | | |
| Primary energy use in kWh/$m^2$y | Total | | | | | |
| | Non-renewable | | | | | |
| | Renewable | | | | | |
| GHG emission performance in kg$CO_2$/$m^2$y | | | | | | |
| $PM_{2.5}$ emission performance in kg$PM_{2.5}$/$m^2$y | | | | | | |
| $NO_x$ emission performance in kg$NO_x$/$m^2$y | | | | | | |
| Primary energy reduction compared to the reference building | | | | | | |
| GHG emission reduction compared to the reference building | | | | | | |
| $PM_{2.5}$ emission reduction compared to the reference building | | | | | | |
| $NO_x$ emission reduction compared to the reference building | | | | | | |
| Additional optional indicators | | | | | | |

*Fill out one table for each reference building.*

*If there is evidence from previous calculations that measures are far from being cost-optimal, no table has to be filled in but this should be reported separately to the Commission.*

4. Global cost calculation

4.1. Calculate the global cost for each measure/package/variant using the following tables, referring to low, medium or high (energy price) scenario. The cost calculation for the reference building shall be put at 100%.

4.2. Report the applied discount rate for the financial and the macroeconomic calculation and the result of the underlying sensitivity analysis on at least two different interest rates each.

4.3. Report the input parameters used for the calculation of the global cost (e.g. labour cost, cost of the technology, cost of pollutant per kg of emission), including relevant sources and assumptions.

4.4. Report the applied energy and carbon price development and the source.

4.5. Include in a separate table the input parameters for the other costs eventually included, where relevant (e.g. health impacts, impacts on GDP).

4.6. Perform a calculation on the sensitivity analysis for the main costs and for energy costs and the applied discount rate for both the macroeconomic and the financial calculation. For each variation of cost use a separate table like the Table below.

*Table 6*

**Output data and global cost calculations**

| Measure/package/variant as given in Table 5 | Code | | | | | … |
|---|---|---|---|---|---|---|
| Initial investment cost (referred to starting year) | | | | | | |
| Annual costs | Annual maintenance cost | | | | | |
| | Operational cost | | | | | |
| | … | | | | | |
| Energy cost by fuel with the medium energy price scenario | Fuel1 | | | | | |
| | … | | | | | |
| Cost of operational greenhouse gas emissions (only for the macroeconomic calculation) | | | | | | |
| Residual value | | | | | | |
| Discount rate (different rates for the macroeconomic and financial calculations) | | | | | | |
| Estimated economic lifetime | | | | | | |
| Waste management costs (when applicable) | | | | | | |
| Environmental and health externalities of energy use (only for the macroeconomic calculation) | Cost of $PM_{2.5}$ emissions | | | | | |
| | Cost of NOx emissions | | | | | |
| Other costs, where applicable | | | | | | |
| Global cost calculated | | | | | | |

*Fill out the table for each reference building using it once for the macroeconomic calculation and once for the financial calculation. Insert the cost data in the relevant currency and specify the currency used in the table.*

5. Cost-optimal level for reference buildings

5.1. Report the economic optimal energy performance level in total primary energy (kWh/$m^2$ year) and, if a system level approach is followed for defining minimum energy performance requirements, in the relevant unit (e.g. W/$m^2$K for the U value, % for system efficiency) for each case in relation to the reference buildings indicating whether it is the cost-optimal levels calculated at macroeconomic or financial level.

5.2. Member States are encouraged to use other indicators to complement total primary energy when setting minimum energy performance requirements, depending on national, regional, or local conditions, such as the emission performance.

6. Comparison

If the difference between the calculated cost-optimal levels and the current minimum energy performance requirements in force is above 15%, indicate a plan with the appropriate steps to adjust the minimum energy performance requirements in place within 24 months from the date of delivery of the cost-optimal report.

*Table 7*

**Comparison table for both new and existing buildings**

| Reference building | Cost-optimal range/level (from-to) in primary energy (kWh/$m^2$y) and, where relevant, in GHG emissions ($kgCO_2/m^2y$)<br>(for a component approach in the relevant unit) | Current requirements for reference buildings in kWh/$m^2$y and, where relevant, in GHG emissions ($kgCO_2/m^2y$)<br>(for a component approach in the relevant unit) | Gap<br>(%) |
|---|---|---|---|
| | | | |

| Plan to adjust the minimum energy performance requirements in place, within 24 months: |
|---|
| |

7. Other

7.1. Reporting can be done in any of the 24 official EU languages.

7.2. Any tables and graphs provided to the Commission as part of the reporting must be made available in a format that allows for selection of their textual content, if any, in order to allow for their machine translation.

7.3. When table or elements of the tables are left empty, Member States should provide a justified explanation for this in the relevant section of the report.

7.4. This template is also available in editable format on the dedicated webpage on the Energy Performance of Buildings Directive[4] on the European Commission website.

[4] https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en#energy-performance-of-buildings-standards.