

## Annex Methodology to compute investment needs and potential energy and emissions savings

The Energy Performance of Buildings Directive (EPBD, EU/2002/91) sets energy savings to be obtained in both the residential and non-

performing buildings in the residential sector (estimated at 474 kWh/m<sup>2</sup>), giving 440 TWh. While for residential buildings we have just taken 16 percent of the 2020 national energy consumption, equivalent to 463 TWh, and then split the efficiency gains between worst performing (55 percent) and other buildings (45 percent). The figure of 903 TWh from 2024 to 2030 is in line with the European Scientific Advisory Board on Climate Change (Bredahl et al., 2024) assessment of required energy savings of 98 TWh/y in the residential sector and 36 to 47 TWh/y in the tertiary sector.

To compute emissions savings, we first took the fuel mix of space heating and cooling and water heating, computing the share of each fuel for households (Figure 6), added it to all buildings. Then we attributed energy savings to the different fuels based on Eurostat's split and multiplied by the emission factors in Table A2.

Table A2: Emission factors

emission factors	Natural gas and LPG	Electricity	Wood	Diesel oil and kerosene	
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neutral and its emission factor was estimated at 420 (see Koet al 2017), then the potential emission reductions would be as high as 218 MtCO<sub>2</sub>e or 31 MtCO<sub>2</sub>e equivalent year in line with the Advisory Board's recommendations

Table 4 Implicit energy savings and emission reductions prescribed by the EPBD by 2030

Source: Bruegel

Note: Only emissions reductions from fossil fuels heating systems are included, hence the estimate does not reflect emission reductions from lower electricity consumption, nor from wood or district heating. The baseline is 2020.

For more details on the building energy renovation activities and the uptake of energy buildings in the EPBDs and Navigant, 2019) published by the European Commission.

of work included under energy renovations:

- Replacement of windows
- Replacement of the/a building entrance door
- Installation of thermal insulation on the facade (incl. cavity wall insulation)
- Installation of thermal insulation of the roof
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minimum of all other countries specific fuel prices. The fuel of final energy consumption for space heating and cooling and water heating by country was used to weight the savings. A uniform carbon price of €60/tonne was also assumed. The price was multiplied by the relative potential emission reductions from fossil fuels to be included in ETS II

Table A. Assumed fuel prices in €/MWh

Country	Natural gas and LPG	Electricity	Wood	Diesel oil and kerosene	District heating	Coal
EU27	0.071	0.229	0.036	0.115	0.036	0.032
Belgium	0.057	0.285	0.042	0.094	0.042	0.032
Bulgaria	5.602	88.08	0.68	11.1	0.04	0.04
Czechia	1.1892	5.3	2m3.7	0.07365	172.4997	655.140-54.MCI-3598.3 (0).

Source: Bruegel based on Eurostat and publicly available information

Multiplying the values in Table A3 by the assumed prices (Table A) gives the estimated energy savings in billions of euros

Table A7 benchmarks our estimates of the additional yearly investment needs in energy renovations with the 2023 overall expenditure on types of building renovations by country.

Table A7. total renovation expenditures in 2023 and additional yearly investment needs, in € b

Country	2023 overall renovation expenditure (€ b)	2024-2040 additional yearly investment needs in energy renovations (Bruegel) (€ b)
Austria	7.1	3.2
Belgium	12.8	5.7
Bulgaria	0.2	1.2
Czechia	2.0	1.4
Germany	145.0	43.8
Denmark	5.6	2.1
Spain	11.9	4.7
Finland	7.8	2.7
France	42.1	30.8
Ireland	2.9	1.9

