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FAIR HEAT FOR ALL
Making the Social Climate Fund work for households

BPIE

Cool Heating Coalition

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EXECUTIVE SUMMARY

Household solid fuel burning remains one of the most problematic drivers of CO_2 and PM2.5 emissions in the EU. The households most dependent on polluting heating systems are also those least equipped to make the switch. The introduction of the EU Emissions Trading System 2 (ETS2) places a carbon price on fossil fuels used in buildings and transport but would risk deepening energy poverty unless matched by well-targeted public investment. The Social Climate Fund, implemented through national Social Climate Plans (NSCPs), will play a key role in shielding vulnerable households from rising costs.

To address these problems, this report analyses how to switch to clean and renewable heating in buildings occupied by vulnerable households by examining: a) the capital investment needs and benefits of such a transition, b) whether the transition is adequately supported by NSCPs, c) best practices for financial support, and d) recommendations for more effective use of NSCPs and ETS2 revenues. By focusing on five countries – Bulgaria, Germany, Italy, Poland and Romania – the project informs on policy and funding decisions that can accelerate clean and fair heating transitions across Europe.

Vulnerable households were identified using two indicators: their inability to keep the home adequately warm, and their housing cost overburden. Their share in the total residential building stock ranges from 4% in Poland to 14% in Bulgaria.

The analysis confirms that easing the financial burden specifically for vulnerable households requires a comprehensive approach which includes renovation. Deep reductions in energy bills require simultaneous building envelope insulation and replacement of the existing fossil-fuel energy systems with heat pumps or district heating. The report therefore analyses only energy efficiency packages that include both measures.

Delivering clean and renewable heating requires capital investments of around 200 EUR/m² in most of the countries covered. Bulgaria stands apart, where the investments may require roughly 75 EUR/m². Regarding financial returns, energy efficiency packages in Bulgaria, Germany and Poland can deliver payback periods of 10 to 15 years. In Italy and Romania, the investment takes longer to repay, at around 30 and 50 years respectively.

Optimal energy efficiency packages may reduce delivered energy by 30–70% across the countries analysed. Air pollution reductions of up to 90% are possible in Italy, and of 10– 50% in the other countries. Running costs fall by 45–55% in Bulgaria and Germany, and by 15–30% in the other countries. Greenhouse gas emissions decrease by around 50% in Romania, and from 5–45% in other analysed geographies. In terms of the quality of the NSCPs, Bulgaria, Italy and Poland appear on the right track, though all three have room for improvement. Romania stands apart since much of its draft plan either lacks a clear link to vulnerable households or provides insufficient detail. Germany's draft NSCP had not been published at the time of writing and was therefore excluded from the assessment.

With several interventions, NSCPs may be upgraded into socially responsive plans that would effectively deliver deep energy savings and protect vulnerable households. Such interventions may include developing granular policies that address vulnerable households while achieving considerable energy efficiency improvements, coupling higher financial support conditional on achieving higher energy performance, mobilising ETS2 revenues to address vulnerable households beyond the minimum percentage required by national contributions, and allocating sufficient financial and human resources for establishing municipal and local one-stop-shops for energy efficiency.

GLOSSARY

CAPEX (CAPital EXpenditure): The upfront investment needed to upgrade (or acquire) assets as in the case of building renovation or heating system replacement.

Coefficient of Performance (COP): The ratio between the heat delivered by a heat pump, e.g. to a building, and the (electrical) power used by the heat pump.

Seasonal Coefficient of Performance (SCOP): This defines a heat pump's average COP over an entire heating season, accounting for varying outdoor temperatures and loads.

Delivered energy (DE): Energy supplied to a building by utilities or on-site sources, measured at the point where it enters the building; delivered energy is the energy charged to building users. It is equivalent to "final" energy.

District heating (DH): System that centrally produces heat in one location and distributes it via insulated underground pipes to provide space heating and hot water for multiple buildings. Energy Performance Certificate (EPC): Rating scheme to summarise the energy performance efficiency of buildings (or building units).

National Social Climate Plans (NSCPs): Mandatory, comprehensive strategies submitted by EU Member States to the European Commission, outlining how they will use the Social Climate Fund (SCF) to mitigate the social impact of the new Emission Trading System 2 (ETS2) for buildings and road transport. These plans focus on protecting vulnerable households and micro-enterprises from rising energy and transport costs during the 2026–2032 period.

Primary energy (PE): Energy as extracted from nature (e.g. coal or biomass) before being turned into electricity, district heat, or other energy carriers supplied to buildings as delivered energy.

Running costs: Ongoing expenses for operating and maintaining a building or its energy system; in this study, energy bills for heating and domestic hot water are included.

Renewable energy sources (RES): Energy sources that replenish (or renew) themselves naturally. Typical examples are solar energy, wind and biomass.

Value Of a Life-Year (VOLY): Economic measure estimating how much society values one additional year of healthy life for an individual.

INTRODUCTION

Household solid fuel burning is a major source of CO_2 and PM2.5 emissions in the EU, and it stands in the way of progress toward the goal of decarbonising heating by 2050. The Fit-for-55 package provides the overall legislative framework supporting heating decarbonisation.

To maintain societal support for the energy transition while turning legislation into reality, strong financial and social support will be essential. As ETS2 introduces CO_2 pricing on heating, the Social Climate Fund, implemented through national Social Climate Plans (NSCPs), will play a key role in shielding vulnerable households from rising costs.

ETS2 and SCF

As part of the Fit-for-55 package, the European Union adopted the amendment to the Emissions Trading System Directive for buildings and transport (ETS2)[1] to decarbonise these sectors. It also adopted the Social Climate Fund Regulation (SCF)[2] to support vulnerable social groups. Each Member State should adopt a NSCP for the financial disbursement of support from the SCF.

ETS2 operates similarly to the existing ETS1[3]. Under this cap-and-trade system, fossil fuel suppliers will be required to monitor, report and purchase emission allowances for their emissions. While suppliers are the main compliance entity, concerns include that the ETS2 price will be passed down to end consumers. Vulnerable groups, with limited access to efficient and decarbonised buildings and transport, are expected to be affected the most.

The SCF is an EU fund earmarked to address the social impacts of ETS2. A maximum of €65 billion from ETS2 from 1 January 2026 to 31 December 2032 will be made available for the Fund,[4] and will be sourced by revenues from ETS2.[5] NSCPs define measures that will be supported by the SCF: it will be directed to support vulnerable households, vulnerable micro-enterprises and vulnerable transport users. Member States should support the SCF amount by their own contributions of at least 25% of the total NSCP cost. This brings the total available support for instruments and measures through the NSCP to €86.7 billion supplied from both the SCF and from national contributions.

[1] ETS2: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2023.130.01.0134.01.ENG Consolidated version: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02003L0087-20240301
[2] SCF Regulation: https://eur-lex.europa.eu/eli/reg/2023/955/oj/eng
[3] Major industries: power generation, energy intensive manufacturing, aviation and maritime.
[4] In case of derogation 30k in Directive (EU) 2023/959, if the ETS2 is postponed for a year until 1 January 2028, the maximum amount of the SCF can be reduced to €54.6 billion.
[5] ETS1 revenues should be used for disbursements of the first years of the SCF, while ETS2 is still not traded.

This report aims to contribute to effective implementation of the EU's clean heat transition by informing Member States on what uses of their SCF would be most effective and how best to support vulnerable households, and advises avoiding polluting heating systems. It also seeks to increase societal support for clean and renewable heating through well-planned public spending of revenues from ETS2.

The research maps financial needs for clean heating transitions in low-income households, assesses the adequacy of NSCPs for supporting the switch to clean and renewable heating within buildings hosting vulnerable households, identifies funding gaps as well as best practices, and proposes recommendations for smarter usage of the SCF and ETS2 revenues. By focusing on five countries – Bulgaria, Germany, Italy, Poland and Romania – the project provides valuable information for policy and funding decisions that accelerate clean, fair heating transitions across Europe. These countries represent around 45% of the EU population, diverse geographic circumstances, and archetypal socioeconomic profiles.

This report focuses on the following topics:

- First, it examines the **capital investment needs** and the **resulting benefits** associated with providing **clean and renewable heating to vulnerable households**. This includes estimating the required CAPEX and assessing the extent to which such investments can reduce energy bills and greenhouse gas (GHG) emissions. For this analysis, **the clean heating transition implies a shift to either heat pumps or district heating, accompanied by improved building insulation**. This definition narrows the scope and sets a clear direction for the conclusions and policy support discussed in this report.

- Second, it assesses the **quality of NSCPs**, exploring whether, and to what degree, these plans **support the shift to clean and renewable heating for vulnerable households**.

- Finally, the report rounds off its analysis with a **structured assessment of NSCP** quality across the five countries, translating its findings into a set of **targeted recommendations** on both overarching and country-specific levels. These recommendations explain how these plans can be strengthened to deliver a genuine transition to clean and renewable heating for vulnerable households.

METHODOLOGY

INVESTMENT NEEDS AND BENEFITS

The calculation of potential GHG emissions reductions from replacing heating systems in buildings occupied by vulnerable households follows a stepwise approach that connects information on the building stock, household energy use and technology-specific emissions factors with scenario assumptions on system replacement.

The starting point is the residential building stock in each country, expressed in terms of total floor area. This provides the scale against which energy demand for space heating is estimated. To anchor the analysis in observed data, statistical sources are used to determine the actual energy consumption of residential buildings. These figures, typically expressed in terajoules or comparable energy units, are converted into a form that allows comparison with modelled estimates of heating demand. Where relevant, differences between statistical data and modelled totals are noted to ensure transparency.

Once the overall heating demand of the residential sector is established, the analysis focuses on buildings occupied by vulnerable households. These households are identified as a subset of buildings within the total stock, and their heating demand is derived proportionally from national energy use data. Current energy consumption is allocated across different fuels and technologies, including coal, wood, oil, natural gas, district heating and electricity. For each energy carrier, a greenhouse gas emission factor is applied, expressed in kilograms of carbon dioxide per unit of final energy. This produces a baseline profile of GHG emissions from heating in buildings occupied by vulnerable households, referred to as the “before” scenario.

The next stage introduces the replacement scenario. A defined share of heating systems in buildings occupied by vulnerable households are assumed to be replaced, reducing the reliance on high-emission fuels and technologies. The shift in the energy mix alters the GHG intensity of heating demand, generating a new “after” profile of emissions. This analysis was repeated multiple times under varying assumptions to quantify the spread of results.

The final step of the methodology is the calculation of emissions reductions. The difference in emissions between the “before” and the “after” scenarios represents the GHG savings. These are reported both as absolute quantities, in megatonnes of carbon dioxide, and, where data allow, as a share of total emissions from the residential building stock. Presenting the results in this way makes it possible to assess both the direct climate benefits for vulnerable households and the significance of these savings within the broader context of national building sector decarbonisation – these are fundamental inputs for the next part of the report, concerning NSCP benchmarking.

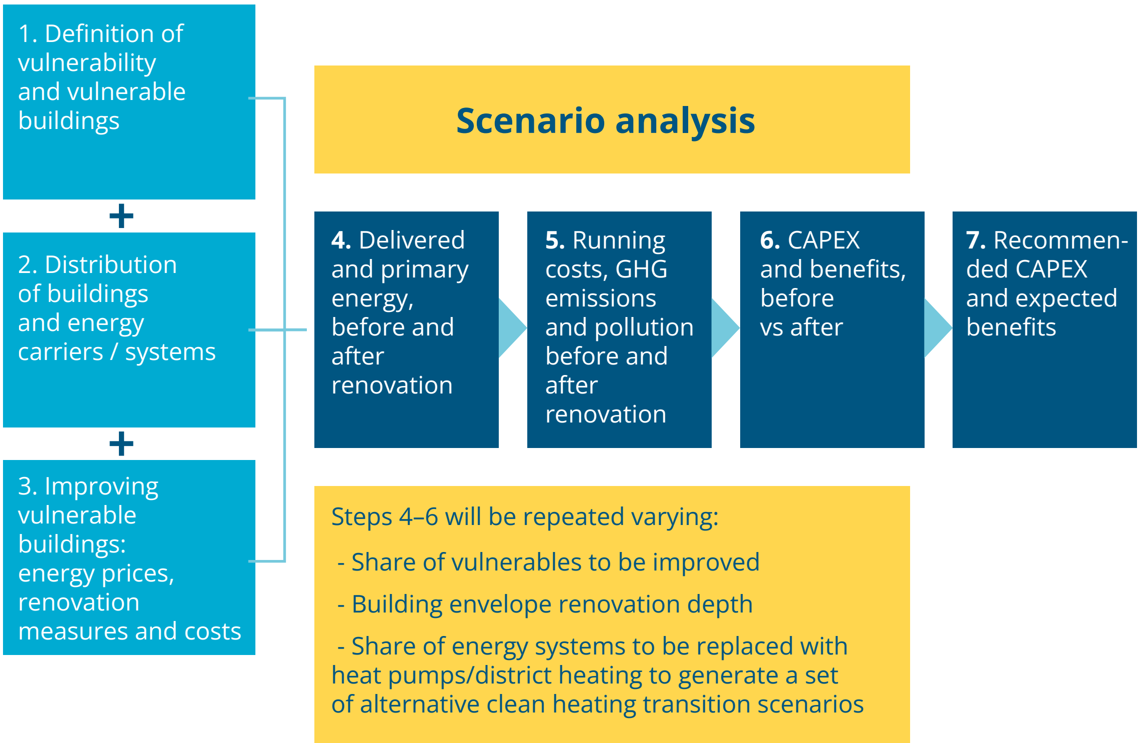

Figure 1: Diagram representing the methodology followed

Inputs, assumptions and variables

The analysis relies on three types of inputs: confirmed inputs, assumptions and variables. Together these provide a transparent basis for the results.

- **Confirmed inputs** are observed or reliably documented values that ground the analysis in real-world evidence, such as the gas price in Germany.
- **Assumptions** are used where confirmed inputs are missing or incomplete, filling data gaps and completing a workable baseline with judgements grounded in the expertise of the researchers. An example of an assumption is that vulnerable households rely on electric boilers for hot water rather than heat pumps. The most important assumptions are listed below.
- **Variables** are parameters deliberately allowed to change to test "what-if" questions, build scenarios, and assess how sensitive the outcomes are to different conditions. Examples of variables include renovation rates and heat pump uptake rates.

Energy flow

Figure 2 provides an illustrative explanation of the energy flow, as considered in this report.

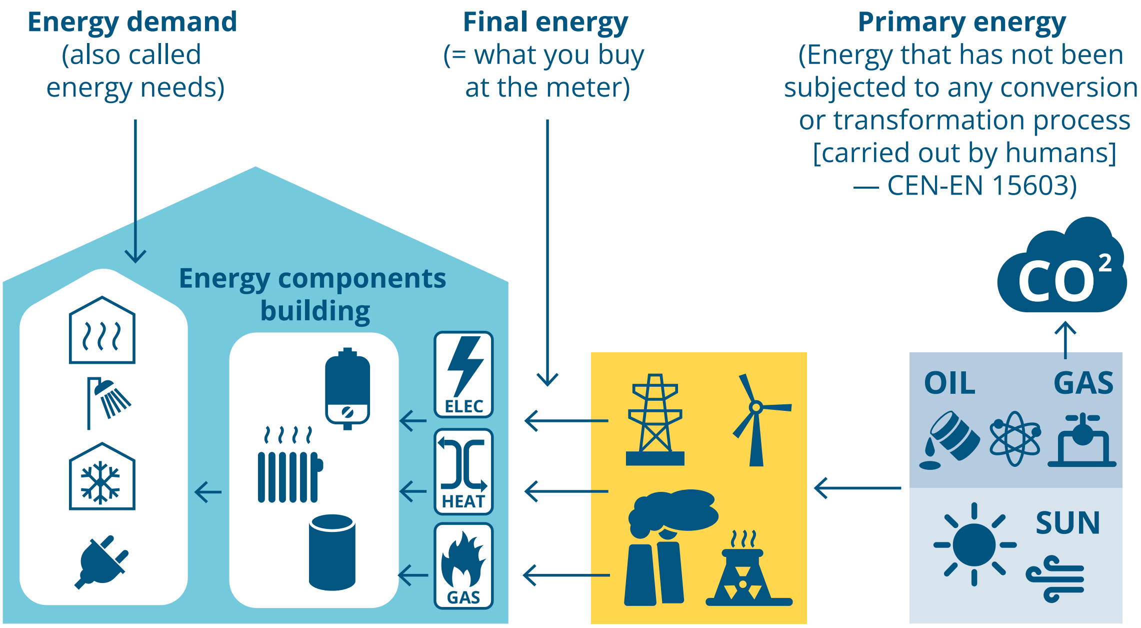

Figure 2: Different denominations of energy

QUALITY OF NATIONAL SOCIAL CLIMATE PLANS

The quality of the NSCPs is analysed along two main dimensions:

- Relevance of the plans
- Allocation of resources

National Social Climate Plan relevance

The NSCPs are assessed to determine whether, and how effectively, they cover the following key dimensions:

1. **Target vulnerable households**
2. **Specify building-related measures**, examining if actions like insulation upgrades or heating system replacements are described in sufficient detail
3. **Achieve substantial energy performance gains**
4. **Ensure monitoring and evaluation**, by foreseeing monitoring and evaluation indicators, concrete KPIs, quantitative targets, timelines and reporting
5. **Deploy a diverse portfolio of measures and investments**
6. **Consider socioeconomic conditions**, such as household location in urban or rural areas, and socially vulnerable groups according to non-economic criteria (e.g. elderly, people with disabilities, single parents, tenure status)

An NSCP is policy-relevant if it clearly lays out its content and main components (inputs, assumptions, results), and makes these elements easy to implement through clear guidance.

The relevance of the NSCPs is assessed against the dimensions listed above. Depending on the level of its detail, clarity of its main components, and actionable guidance provided, each dimension can be classified as **HIGH**, **MODERATE** or **LOW**.

To deliver these ratings (in particular for indicators 1, 5 and 6), a qualitative consideration of each national investment and measure will be considered, by using the underlying principles affecting the vulnerability of households.

From a **financial perspective**, vulnerability is typically rooted in a low income and a lack of resources to invest in energy efficiency upgrades, resulting in limited creditworthiness and higher perceived risk among conventional lenders. Public support schemes, therefore, need to provide tailor-made financial and enabling tools, such as upfront grants for heating system replacements, deep renovation, or guarantee mechanisms that help mobilise private finance.

Sociodemographic characteristics are key lenses for designing policies to support vulnerable households in the heating transition.[6] The urban–rural distribution of the population is an important consideration in designing well-targeted policies.[7] Household composition, including gender or age aspects, is another important demographic factor. For instance, it is observed that single-parent households led by women are more likely to struggle to pay energy bills;[8] while younger people seem to be more willing to financially engage in energy efficiency improvements than their elderly counterparts.[9] At the same time, tenure status – whether homes are owner-occupied or rented – largely shapes the capacity and the incentives of households for energy efficiency improvements.

Sociobehavioural factors strongly influence whether households decide to pursue long-term solutions to reduce energy poverty.[10] Education level, trust in institutions, and social cohesion may affect willingness to invest.[11] Clearly communicating the health and well-being benefits of tackling poor indoor conditions can be a decisive trigger for households to opt for deep renovations.[12]

Allocation of resources to vulnerable households

To assess this dimension, the funding earmarked in each NSCP for energy efficiency improvements in buildings used by vulnerable households is benchmarked against the investment needs calculated in the previous sections of the report.

After the investment schemes are reviewed, only investments relevant to the energy efficiency scenarios analysed in the report are retained for further analysis. Relevant investments include those targeted at enabling buildings hosting vulnerable households to decarbonise their heating. Where a scheme covers more than just these buildings or goes beyond enabling heating decarbonisation, only a proportion of the investment is considered. For instance, if a scheme targets the entire building stock, the applicable share equals the proportion of buildings used by vulnerable households within the total building stock.

Finally, drawing on the investment needs and benefits analysis, the share of vulnerable households reachable with clean and renewable heating solutions within the NSCP budget is calculated.

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[6] https://www.bpie.eu/publication/policy-packages-socially-just-epbd/
[7] https://www.bpie.eu/publication/policy-packages-socially-just-epbd/
[8] Ibid.
[9] https://www.socialenergyplayers.eu/wp-content/uploads/2022/09/POWERUP_D3.1_Final.pdf
[10] https://www.economics-sociology.eu/files/6l_1299_Streimikiene.pdf
[11] https://www.socialenergyplayers.eu/wp-content/uploads/2022/09/POWERUP_D3.1_Final.pdf
[12] https://storage.googleapis.com/jnl-up-j-bc-files/journals/1/articles/304/6478806b3020c.pdf

INVESTMENT NEEDS AND BENEFITS

STEP 1. DEFINITION OF VULNERABILITY AND VULNERABLE HOUSING

As its starting point, the analysis focuses on establishing the share of buildings hosting vulnerable households in the total residential building stock in each country. For this purpose, the average of the following two indicators is used:

- Inability to keep the home adequately warm
- Housing cost overburden, quantified as the share of households for which housing costs account for more than 40% of disposable income[13]

Table 1 presents the country-level results on the share of vulnerable households, while Figure 3 provides details on the indicators mentioned above.

	Bulgaria	Germany	Italy	Poland	Romania
Share of buildings used by vulnerable households	14%	9%	7%	4%	8%
Vulnerable households floor area [million m²]	32.3	310.7	174.5	40.8	38.2

Table 1: Share of buildings used by vulnerable households and their floor area, per country

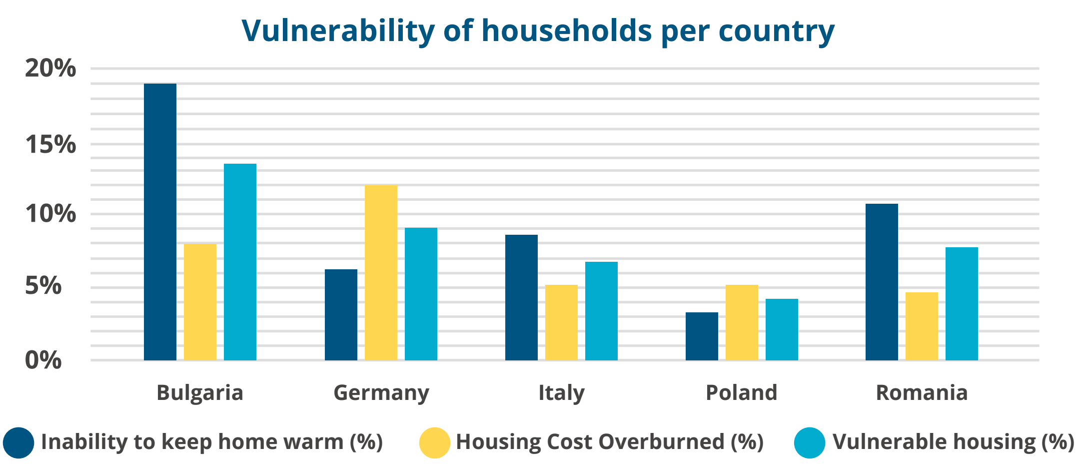


Figure 3: Share of households affected by different vulnerability indicators

[13] Although Eurostat includes overcrowding as one of the housing indicators, this indicator has been omitted from the analysis since it is not directly influenced by clean heating transition investments.

STEP 2. DISTRIBUTION OF BUILDINGS AND ENERGY CARRIERS

The second step brings forward two main distributions that drive the remaining analysis:

- **Distribution of the building stock across annual delivered energy consumption**, showing how many homes fall into each consumption band, using the vertical axis to show useful floor area.
- **Distribution of energy delivered by different energy carriers across annual delivered energy consumption**, using the vertical axis to report energy delivered.

The former is drawn from national EPC databases and supporting reports, while the latter is calculated based on Eurostat energy balances on delivered energy consumption in households, per energy carrier. Examples of the two distributions can be found in Figure 4. Once the distributions have been established, buildings used by vulnerable households are assumed to be concentrated in the right-hand tail of each distribution. This assumption allows for the establishment of a benchmark of energy consumption for buildings expressed as the delivered energy per m^2 of floor area above which resident households are considered to be vulnerable. In other words, any household with delivered energy consumption above this benchmark is classified as vulnerable in the analysis.

	Bulgaria	Germany	Italy	Poland	Romania
Energy-consumption benchmark for buildings hosting vulnerable households (kWh/m²/year)	101	273	170	422	253

Table 2: Benchmarks for energy-consumption level above which buildings are seen as hosting vulnerable households

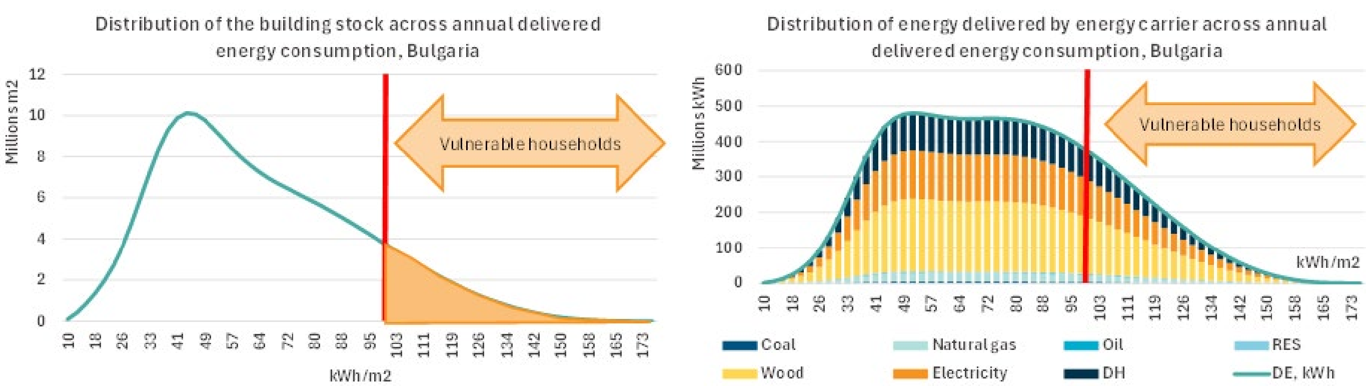


Figure 4: Example of distributions with energy-consumption benchmarks for buildings hosting vulnerable households

Applying these benchmarks to the various distributions allows the volume of energy delivered to vulnerable households by energy carriers to be estimated. The overview of delivered energy used by vulnerable households, by energy carrier, is provided in Figure 5.

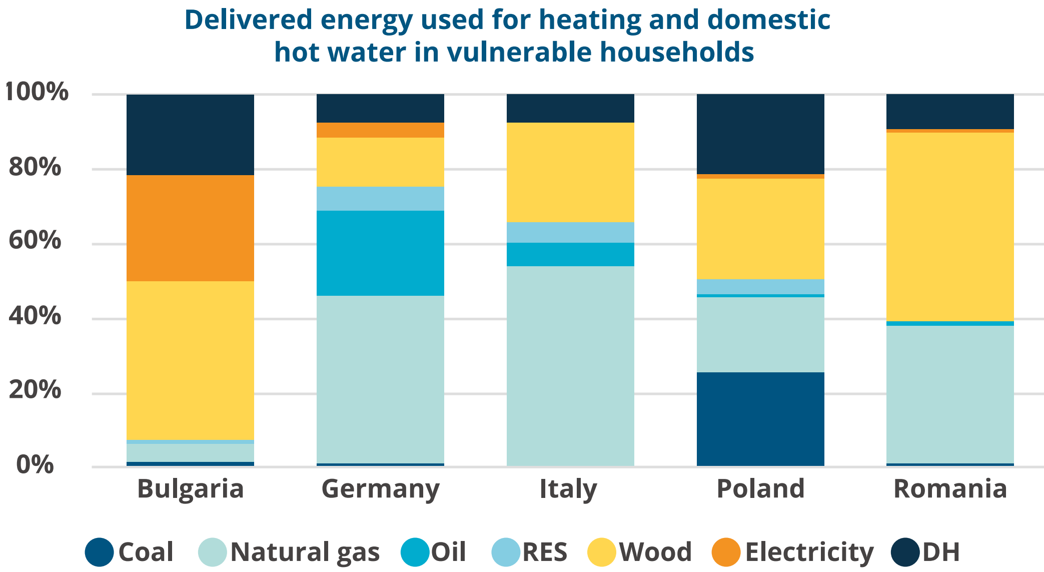


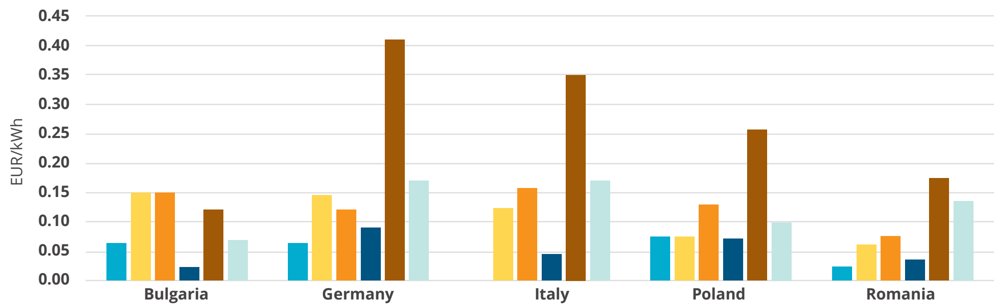
Figure 5: Delivered energy used for heating and domestic hot water in vulnerable households

STEP 3. HOW BUILDINGS USED BY VULNERABLE HOUSEHOLDS COULD BE IMPROVED

Energy prices

Delivered energy prices directly affect household energy bills. As such, they are an important input for analysing the financial effect of the clean heating transition on vulnerable households.

Prices per energy carrier for each target country are obtained from different national energy providers and presented in Figure 6.[14]



	Bulgaria	Germany	Italy	Poland	Romania
Coal	0.06	0.06	0.00	0.08	0.02
Natural gas	0.15	0.15	0.12	0.08	0.06
Oil	0.15	0.12	0.16	0.13	0.08
Wood	0.03	0.09	0.04	0.07	0.04
Electricity	0.12	0.41	0.35	0.26	0.17
DH	0.07	0.17	0.17	0.10	0.14

Coal Natural gas Oil Wood Electricity DH

Figure 6: Prices of delivered energy in EUR/kWh

[14] Prices for energy sources not used by the building stock according to EUROSTAT (e.g. coal in Italy) show a price of 0, as they were irrelevant for the purpose of the modelling work.

Combining the prices of delivered energy (Figure 6) and the final energy consumption of vulnerable households (Figure 7) makes it possible to determine their average pre-intervention energy price. Since the clean heating transition is defined as a switch to either heat pumps or district heating, it would be useful to compare a) the average pre-intervention energy price for vulnerable households price with b) the district heating price and COP-adjusted electricity price (used by heat pumps).

Heat pumps deliver multiple units of useful heat for each unit of electricity consumed by the device. The ratio between the two different units is captured by the coefficient of performance (COP). To reflect the efficiency gain achieved only from switching the heating system, without any improvement to the building envelope, the electricity price per kWh is divided by the COP to derive a COP-adjusted energy price. This can then be meaningfully compared with the average pre-intervention energy price for vulnerable households.[15]

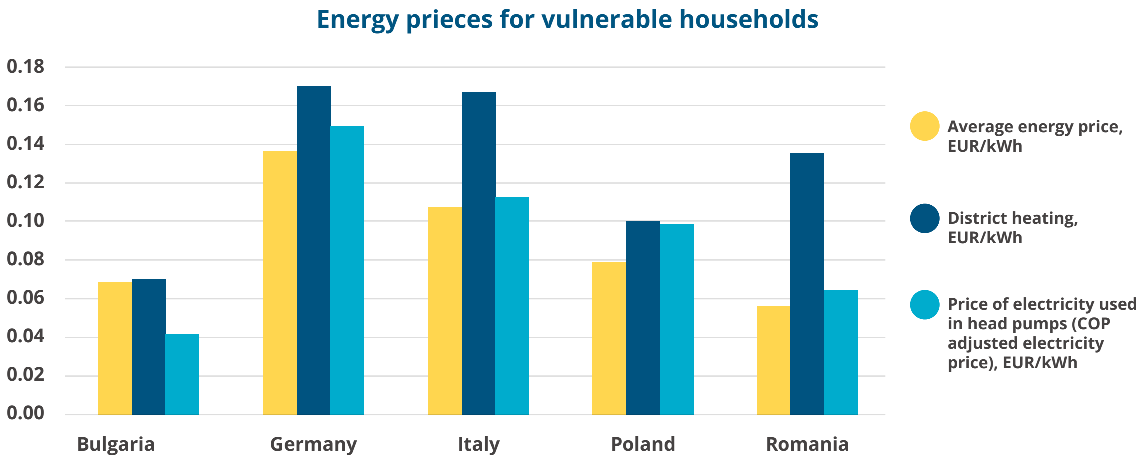


Figure 7: Average delivered energy price for vulnerable households, for the current energy mix, in EUR/kWh

Results showed that shifting buildings hosting vulnerable households from their current energy mix to district heating or heat pumps will need to be complemented with building insulation to avoid increases in the price for delivered energy, in all cases apart from switching to heat pumps in Bulgaria. While in Italy, Poland and Romania both district heating and COP-adjusted electricity prices are higher, in Bulgaria and Germany these clean-heating options are slightly lower or higher but still close to the current average energy price for vulnerable households.

This suggests that to ease the financial burden on vulnerable households, changing the heating system and energy carrier requires a comprehensive approach which includes investment in insulation. Meaningful reduction in energy bills for vulnerable households would also require lowering their energy demand so they join the mainstream of occupants. This can for instance be done by improving the thermal performance of the building envelope.

Another important conclusion would be that, for the same level of building envelope interventions, switching to heat pumps or district heating would yield shorter payback return periods in Bulgaria and Germany than in Romania.

[15] District heating is already priced per kWh of heat delivered, so no COP adjustment is needed.

Energy efficiency improvement definition

Building on the previous conclusions (see 'Energy prices' section, above), the energy efficiency improvement of buildings occupied by vulnerable households used for this analysis includes both a) building envelope improvements, via increased insulation levels, and b) heating system upgrades by replacing the existing fossil-fuel energy systems by either air-to-air heat pumps or district heating.

Therefore, for this analysis, a vulnerable household is renovated if it is either:

- Insulated and its energy system is replaced with an air-to-air heat pump, or
- Insulated and its energy system is replaced with a district heating connection.

Also, it is assumed that vulnerable households do not already use heat pumps, i.e., the electricity they use for heating is either for electric heaters or electric boilers.

Energy efficiency scenarios

Building on how energy efficiency improvement is defined, energy efficiency scenarios can be derived by varying the:

- Share of buildings occupied by vulnerable households which are to be improved – Variable 1
- Depth of the building envelope's renovation – Variable 2
- Share of energy systems to be replaced with heat pumps – Variable 3
- Share of energy systems to be replaced with district heating – Variable 4

Variable 4 is not an independent variable in the strict sense, as its value is fully determined once Variable 3 is specified, as illustrated in Table 3. For the sake of simplicity, each of the variables is assigned a limited set of predetermined values, presented below.

VARIABLE	POSSIBLE VALUES					
Variable 1: Share of buildings occupied by vulnerable households to be renovated	20%	40%	60%	80%	100%	-
Variable 2: Insulation thickness, cm	5	10	15	23	30	-
Variable 3: Share of replaced systems converted to heat pumps	0%	20%	40%	60%	80%	100%
Variable 4: Share of replaced systems converted to district heating	= 1 – Variable 3					

Table 3: Predetermined values of variables to define energy efficiency scenarios for vulnerable households

An illustrative scenario would for example involve renovating 20% of buildings used by vulnerable households by adding 10 cm of insulation, while replacing the existing fossil-fuel heating systems so that 40% are converted to heat pumps and the remaining 60% to district heating.

Given the large number of potential scenarios, the following sections do not report every individual scenario and its outcome (e.g., reduction in GHG emissions), but instead present a range of possible values. The ranges show the minimum and maximum values that can be obtained with different scenarios, with all others lying in between these. All scenarios, and thus their outcomes, are treated as equally probable; in other words, no single scenario is considered more likely than the others.

Insulation costs

The insulation prices used in this analysis are drawn from the EU H2020 EASI ZERO project, which analysed insulation costs per square metre of wall for several countries and for different insulation thicknesses.

The reported price therefore includes both a) a fixed price component, such as the price of preparatory and other works that does not depend on insulation thickness, and b) a variable price component that increases with the thickness of the insulation layer.

Insulation prices for different project countries and insulation thicknesses can be found in Figure 8. Insulation prices obtained for Poland were used as a proxy for Romania.

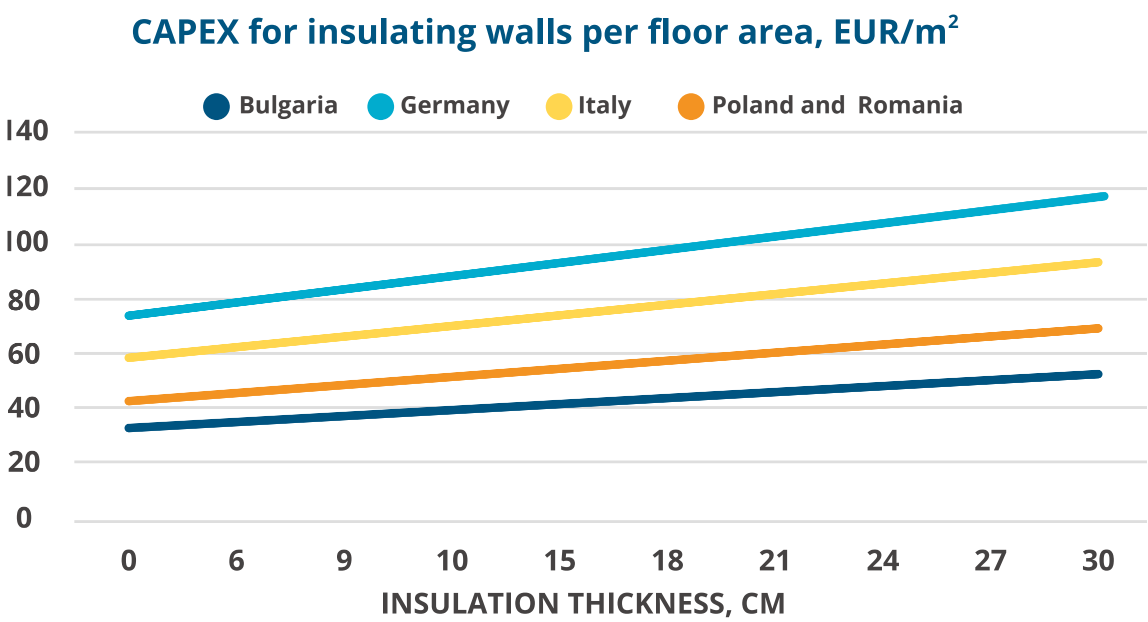


Figure 8: CAPEX for insulating walls per unit of floor area [EUR/m²] per cm of insulation layer

Another relevant input from the EASI ZERo project is the estimation of national energy savings in residential buildings achievable if the building stock is insulated using different insulation thicknesses.[16] These results, illustrated in Figure 9, are used directly for the countries covered, while the curve derived for Poland is applied as a proxy for Romania.

[16] Considering the insulation material to have thermal conductivity of 0.03 W/mK.

An important finding for the project countries is that both investment needs and energy savings are closely linked to the chosen level of insulation, i.e. the renovation depth. However, once the insulation layer exceeds around 15 cm, CAPEX increases more quickly than the associated energy savings, establishing a key threshold for the economic analysis and for interpreting the results discussed in the following chapters.

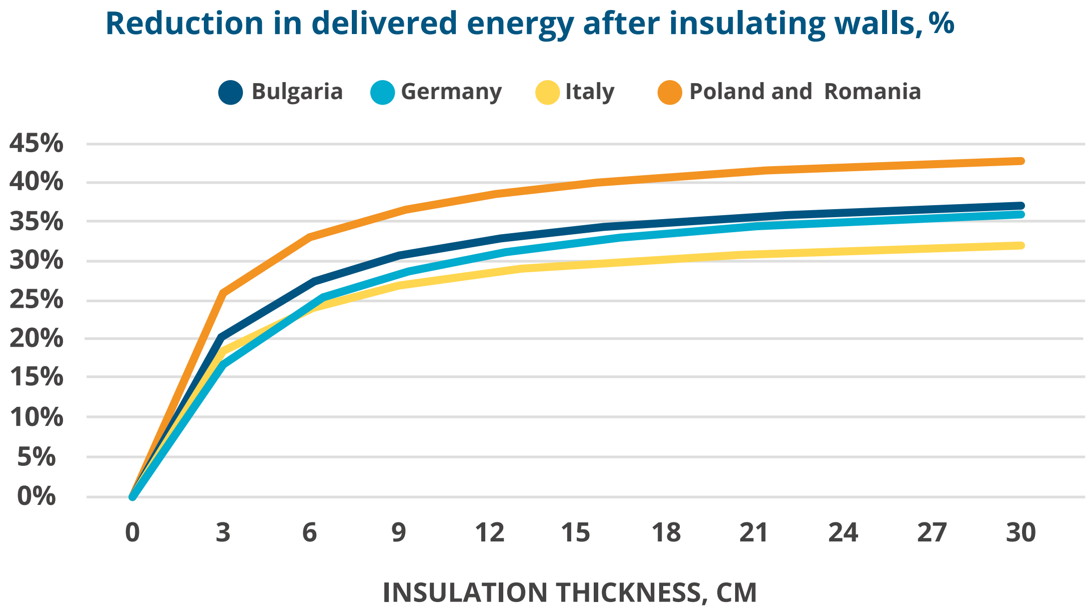


Figure 9: Reduction in final energy consumption for heating per cm of insulation layer of walls

Heating system replacement costs

The replacement costs for heating systems were obtained through market research for each of the target countries. These costs are provided in Figure 10 as CAPEX in EUR/kW for heat pump installation and EUR/connection for district heating implementation.

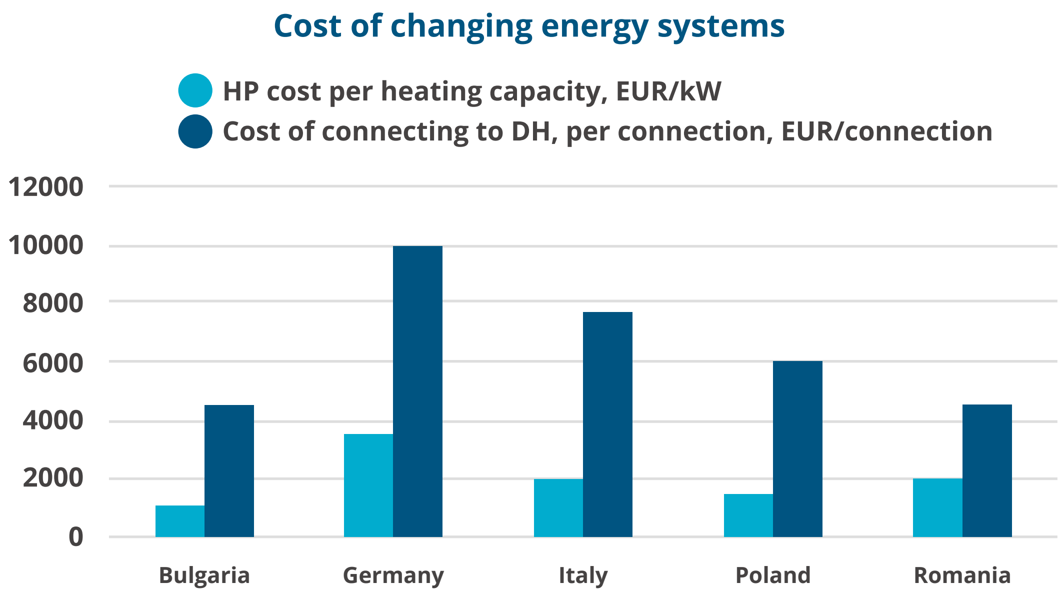


Figure 10: CAPEX for heat pump heating capacity (in EUR/kW) and per connection to a district heating network (per household)

The figures show that installing a heat pump in Italy costs around EUR 2,000 per kW provided, while a connection to district heating costs around EUR 8,000. A significant difference between countries is also visible, with the kW of heat pump heating capacity and connection cost to a district heating network being 3.2 and 2.2 times more expensive in Germany than in Bulgaria, respectively.

STEP 4. SCENARIO RESULTS ON DELIVERED AND PRIMARY ENERGY

Delivered energy

The immediate effect of an improvement in energy efficiency is a reduction in energy needs – and, consequently, in delivered energy. This reduction is primarily driven by the combination of the insulation thickness and the share of energy systems replaced with heat pumps.

Possible relative reductions in delivered energy, corresponding to all combinations of insulation and energy system replacements, are presented as ranges in Figure 11. The negative values (between -20% and -70%) indicate that, depending on the combination of insulation depth and switch to heat pumps or district heating, renovated buildings occupied by vulnerable households could roughly halve their delivered energy use. In some cases, the delivered energy can be cut by up to two-thirds.

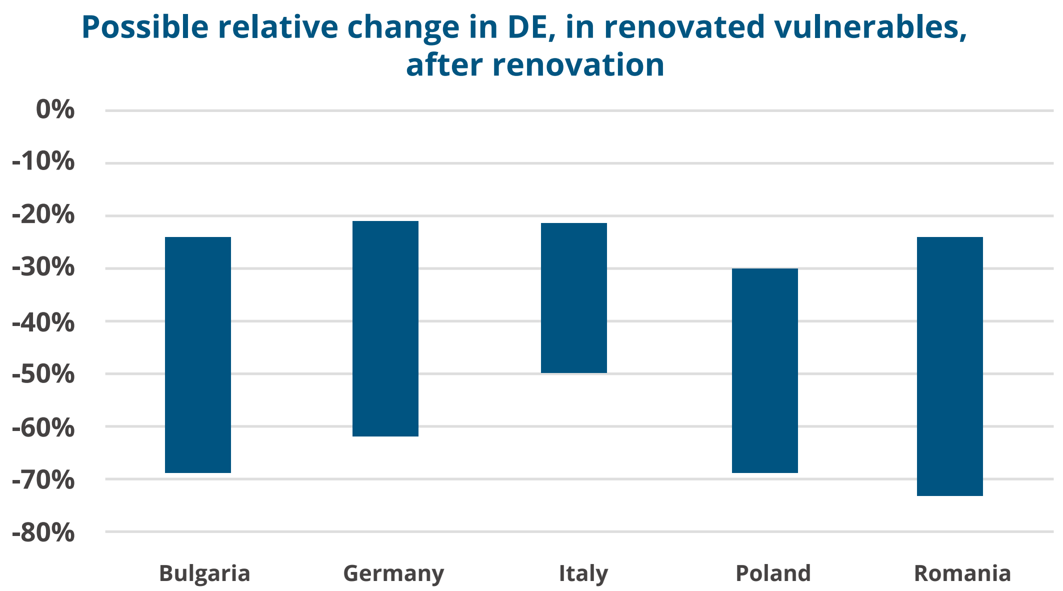


Figure 11: Possible relative change in delivered energy due to energy efficiency measures in buildings occupied by vulnerable households

Across all countries, the largest drops in delivered energy are achieved when 30 cm of insulation is combined with a full switch to heat pumps. Conversely, in every country, the smallest reductions occur when only 5 cm of insulation is installed and all systems are converted to district heating. The identification of the optimal investment positioned between these two boundary cases is developed in the subsequent chapters.

Primary energy

To assess how energy efficiency measures affect primary energy use, it is necessary to account both for the reduction in delivered energy at building level and for the associated upstream losses in the energy supply chain. These losses occur when primary energy is converted into delivered energy and may include both transformation and technology-related conversion losses.

Potential savings in primary energy can significantly differ among countries, depending on their energy mix for electricity and district heating production. In the target countries, most electricity and district heating are generated:

- with energy losses (primary to delivered) that range from 25% to 75%; and
- from solid fuels (such as coal), natural gas, RES, and nuclear energy

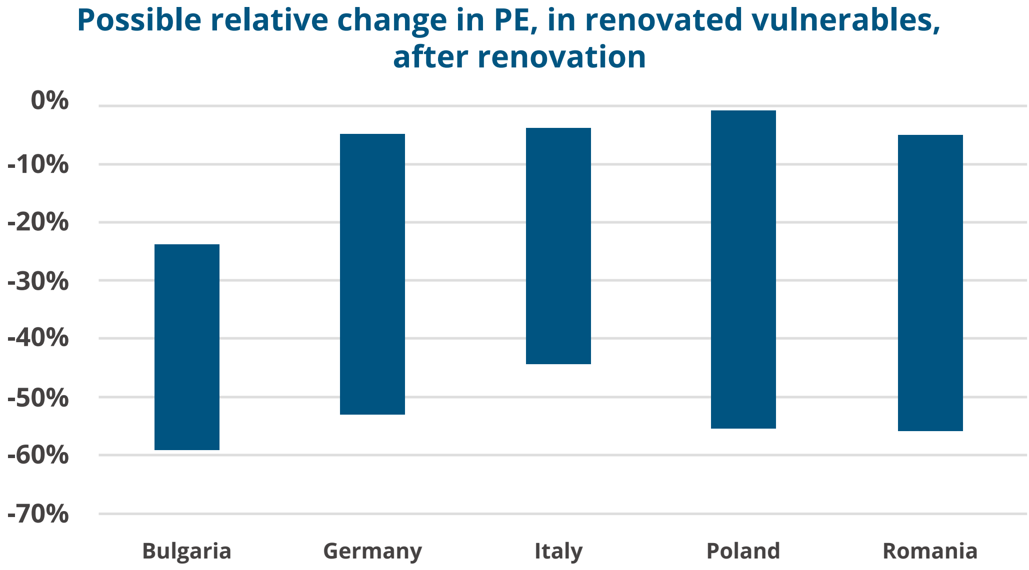


Figure 12: Possible relative change in primary energy due to energy efficiency measures in buildings hosting vulnerable households

In Figure 12, each bar indicates a range showing how much primary energy used by vulnerable households could decrease, expressed as a percentage compared with current levels. Depending on the energy efficiency package applied, vulnerable households could cut their primary energy demand by about one-fifth to well over half, with the largest potential reductions visible in Bulgaria, Poland and Romania.

Reductions in primary energy follow the same logic as for delivered energy. The most substantial savings are obtained when 30 cm of insulation is paired with a complete transition to heat pumps. On the other hand, the combination of just 5 cm of insulation and exclusive reliance on district heating delivers the lowest primary energy reductions. As above, optimal investments are identified in the subsequent chapters.

Differences in heating technologies before and after renovation can lead to significant variations between primary energy and delivered energy across countries. When renovations involve a shift from fossil-fuel heating systems to electrified solutions (such as heat pumps), the gap between primary energy and delivered energy depends strongly on the primary energy factor of electricity (which reflects the electricity generation mix) and district heating production.

STEP 5. SCENARIO RESULTS ON RUNNING COSTS, GREENHOUSE GAS EMISSIONS, POLLUTION AND WIDER BENEFITS

Running costs

Running costs are derived from the prices of delivered energy, i.e., the tariffs that appear on household energy bills, as presented in Figure 13. Figure 13 shows the impact on running costs of all possible energy efficiency scenarios for each of the target countries.

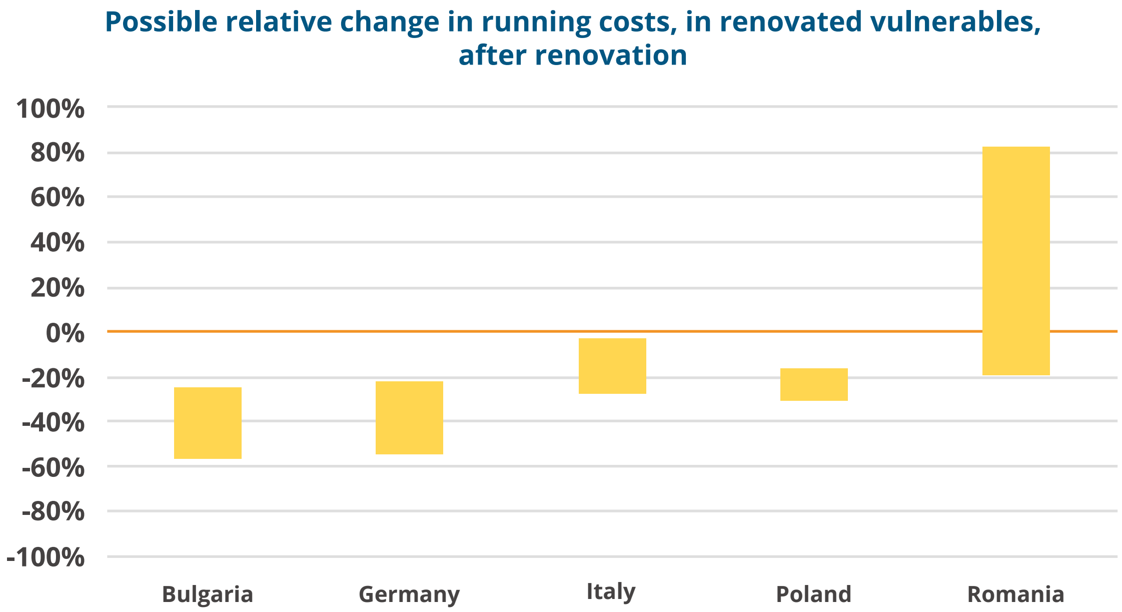


Figure 13: Possible relative change in running costs, in renovated homes of vulnerable households

In Figure 13, bars below zero show potential reductions, while bars above zero indicate a potential increase in running costs. In Bulgaria, Germany, Italy and Poland, the energy efficiency packages bring reductions in running costs of roughly 25–55%, meaning that vulnerable households would substantially reduce their annual energy costs.

Romania stands out as an exception: under scenarios with low insulation levels and a full replacement of existing systems by district heating, running costs could increase by around 80%. This substantial rise is directly linked to district heating tariffs in Romania being markedly higher than the current average energy price paid by vulnerable households, as illustrated Figure 6. The Romanian energy mix for vulnerable households is strongly reliant on wood and natural gas, as illustrated in Figure 5.

Pollution

As with the GHG assessment, the pollution analysis builds on primary energy results combined with pollutant emission factors. These factors indicate the quantity of pollutants released per unit of energy supplied by each energy carrier and are expressed in g/GJ.

The pollutant emission factors applied in this study are shown in Table 4.

	Coal	Natural gas	Oil	RES	Wood
PM2.5	220	0.89	3	0.00	60

Table 4: Pollutant emission factors, per energy carrier

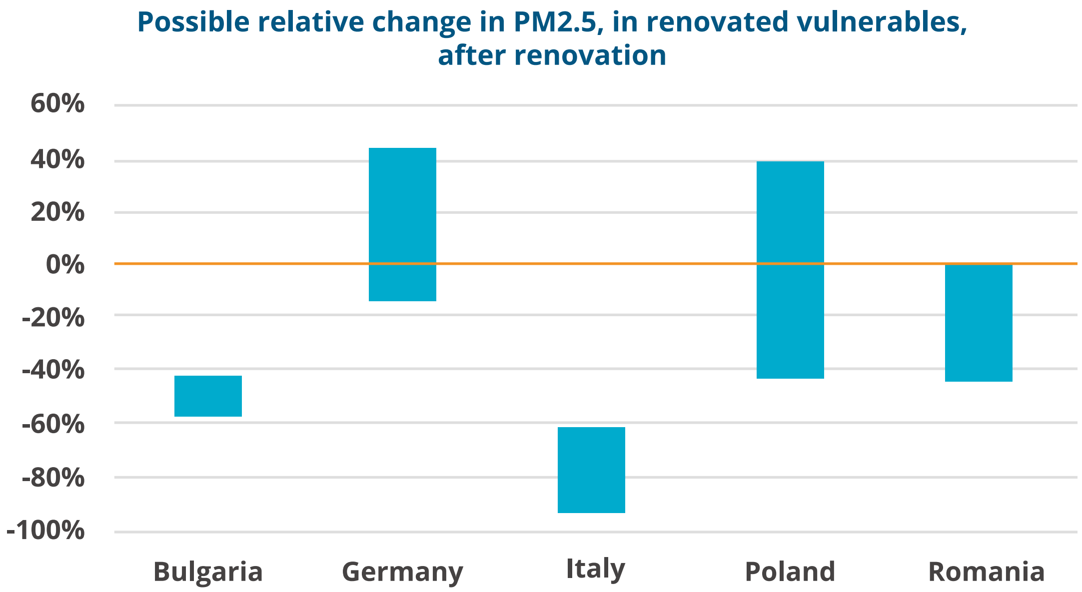


Figure 14: Possible relative change in pollution (PM2.5) in renovated buildings occupied by vulnerable households

Figure 15 shows the modelled percentage change in PM2.5 emissions for renovated vulnerable households. Values below the horizontal zero line indicate reductions in PM2.5, while values above indicate increases.

Bulgaria, Italy and Romania all experience substantial reductions in practically all scenarios, with Italy showing the largest drop at around 90%, followed by Bulgaria at roughly 50% and Romania at around 45%. These results clearly indicate that energy efficiency improvements can significantly cut fine particulate emissions for vulnerable households in these countries.

By contrast, depending on the energy efficiency pathway, pollution in Germany and Poland could either decrease or increase (reflecting the high share of coal in electricity and district heating generation). In the less favourable cases, pollution in Germany and Poland could rise by up to around 40%, indicating that avoiding an increase in PM2.5 emissions for vulnerable households may require a careful selection of energy efficiency measures.

Health benefits

There are certain health benefits that arise from lowering air pollution emissions. These benefits were quantified and monetised then added to reductions in running costs to assess the overall economic feasibility for each energy efficiency scenario.

The assessment of health benefits builds on the estimated reductions in pollution, focusing on the avoided health damage associated with each tonne of reduced PM2.5 emissions. The monetisation of this avoided damage follows the Value of a Life-Year (VOLY) methodology, which, in brief, a) estimates the number of potential years of life lost due to pollution, and b) multiplies years lost by the value of one life year. Such approach leads to monetised health benefits per reduced PM2.5, as presented in Table 5.

	Bulgaria	Germany	Italy	Poland	Romania
Health benefits (EUR per tonne of reduced PM2.5)	86,179	208,400	190,131	133,951	83,171

Table 5: Health benefits per reduced PM2.5

Greenhouse gas emissions

Once primary energy use is being assessed and combined with CO_2 emissions per energy carrier, it is possible to quantify the GHG emissions reductions associated with the switch to clean heating in buildings hosting vulnerable households.

Emission factors per energy carrier are shown in Table A-1 (see Annex). Where relevant, these factors reflect national differences for the same carrier. For example, due to variations in coal quality, coal emits around 0.34 kg CO_2 per kWh in Italy and 0.43 kg CO_2 per kWh in Germany.

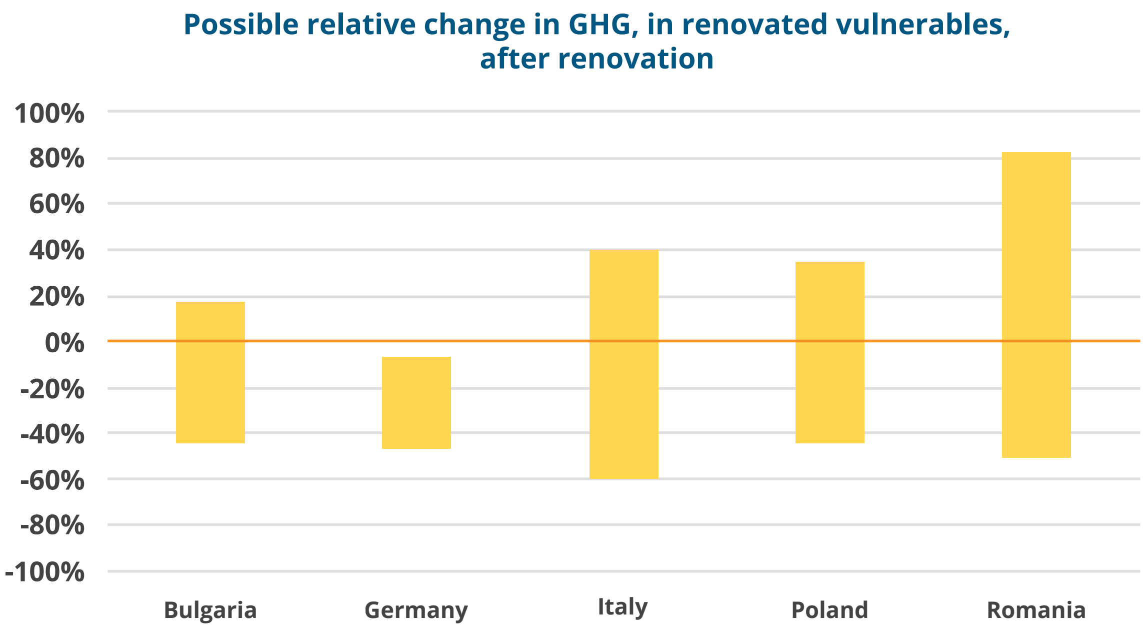


Figure 15: Possible relative change in GHG emissions in renovated buildings hosting vulnerable households

The possible relative change in GHG emissions is shown in Figure 14. Negative bar values indicate GHG emissions reductions, whereas positive values point to an increase in emissions.

In Germany and Bulgaria, most scenario combinations deliver substantial GHG reductions, reaching up to around 50% below current levels. By contrast, in Italy, Poland, and particularly Romania, certain scenarios can lead to higher emissions, with increases of up to roughly 40% in Italy and Poland and as much as 80% in Romania.

STEP 6. OPTIMAL SCENARIO SELECTION

Different energy efficiency scenarios come with varying investment needs and with distinct types and levels of benefits. For instance, while it is straightforward that more insulation means higher investments on insulation materials, it may be less intuitive that it can simultaneously reduce the required investment in heat pumps by lowering the heating loads. Also, energy bills do not drop in a linear fashion with every additional centimetre of insulation,[17] which requires careful consideration when designing the optimal energy efficiency scenario.

While for each country included in this study a large number of energy efficiency scenarios were analysed, only a small subset may be suitable for implementation. The scenarios proposed for implementation, here referred to as optimal scenarios, are selected based on their ability to simultaneously provide:

- The lowest payback periods
- A reduction in air pollution (i.e., reduced PM2.5 emissions)
- A reduction in greenhouse gas emissions

As shown in past steps, in each country, an increase in renovation depth results in:

- Increased CAPEX
- Increased monetary savings (i.e., via a decrease in running costs and increase in monetised health benefits)

The comparison of CAPEX with the savings and health benefits shows the payback period of each scenario. This is the indicator used for the selection of optimal scenarios.

[17] As explained in section Step 3

STEP 7. CAPEX, BENEFITS AND PAYBACK PERIODS

After examining CAPEX and benefits, it became possible to determine payback periods for each of 30 energy efficiency scenarios within a single national context. As previously outlined, these scenarios combine varying insulation thicknesses with different shares of replacing existing energy systems with heat pumps or district heating.

The following section therefore sets out the CAPEX requirements and resulting payback periods across countries and scenarios, before narrowing down to the scenarios with the shortest payback periods. In each table, these scenarios are marked in green.

Bulgaria

		Share of systems replaced with heat pumps and district heating (top) CAPEX in EUR/m² (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	70	72	74	77	79	**82**
	10	73	75	76	**78**	**79**	**81**
	15	77	79	80	**81**	**82**	**83**
	22.5	83	84	85	86	**87**	**88**
	30	88	89	90	91	92	**93**

Table 6: CAPEX for different energy efficiency scenarios per m² of floor area – Bulgaria

In the case of Bulgaria, CAPEX values range from 70–82 EUR/m² for 5 cm of insulation, while at 30 cm they rise to 88–93 EUR/m². Optimal energy efficiency packages in Bulgaria require around 80–90 EUR/m².

		Share of systems replaced with heat pumps and district heating (top) Years (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	21	19	18	16	16	**15**
	10	18	17	16	**15**	**14**	**14**
	15	18	16	16	**15**	**14**	**13**
	22.5	18	17	16	15	**14**	**14**
	30	19	18	17	16	15	**14**

Table 7: Payback periods for different energy efficiency scenarios – Bulgaria

Payback periods range from 13 to 21 years, with an average of around 16 years. The most favourable investments, offering payback periods of around 14 years, are associated with packages delivering deeper renovation.

Germany

In Germany, average CAPEX comes to roughly 280 EUR/m², with individual values ranging from around 230–450 EUR/m². Optimal energy efficiency packages in Germany require between 130–260 EUR/m².

		Share of systems replaced with heat pumps and district heating (top) CAPEX in EUR/m² (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	121	187	253	319	385	451
	10	**128**	187	247	306	365	424
	15	**138**	**193**	249	304	360	415
	22.5	**150**	**203**	257	310	363	416
	30	**162**	**214**	**266**	318	370	422

Table 8: CAPEX for different energy efficiency scenarios per m² of floor area – Germany

Across all scenarios, the payback period ranges from 11 to 59 years, with an average of around 25 years. The most attractive combinations – yielding paybacks of roughly 11–15 years – are those with more than 15 cm of insulation and a high share of district heating.

		Share of systems replaced with heat pumps and district heating (top) Years (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	20	29	37	45	52	59
	10	**13**	18	24	28	33	38
	15	**11**	**16**	20	24	28	31
	22.5	**11**	**15**	19	22	25	29
	30	**12**	**15**	18	22	25	28

Table 9: Payback periods for different energy efficiency scenarios – Germany

Italy

In Italy, average CAPEX is about 185 EUR/m², with individual scenarios ranging from roughly 90–270 EUR/m². Optimal energy efficiency packages require between 130–230 EUR/m².

		Share of systems replaced with heat pumps and district heating (top) CAPEX in EUR/m² (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	91	126	161	197	232	267
	10	97	129	**162**	194	227	259
	15	105	**136**	**167**	**198**	229	260
	22.5	114	**145**	**175**	**205**	**236**	266
	30	124	**154**	**184**	**214**	244	273

Table 10: CAPEX for different energy efficiency scenarios per m² of floor area – Italy

Across all scenarios in Italy, the payback period ranges from about 23–51 years, with an average of roughly 34 years. Paybacks of around 30 years are the most feasible ones, combining insulation levels above 15 cm with a similar share of district and heat pump heating systems.

		Share of systems replaced with heat pumps and district heating (top) CAPEX in EUR/m² (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	34	40	44	47	49	51
	10	25	30	**33**	36	39	41
	15	23	**27**	**30**	**33**	36	38
	22.5	23	**27**	**30**	**33**	**35**	37
	30	24	**27**	**30**	**33**	35	37

Table 11: Payback periods for different energy efficiency scenarios – Italy

Poland

In Poland, CAPEX ranges from about 66 –214 EUR/m², with an average close to 141 EUR/m². Optimal energy efficiency packages require between 130–210 EUR/m².

		Share of systems replaced with heat pumps and district heating (top) CAPEX in EUR/m² (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	66	95	125	155	184	214
	10	70	97	123	150	176	**202**
	15	76	101	126	**151**	**175**	**200**
	22.5	83	107	**131**	**155**	**179**	**203**
	30	90	113	**137**	**160**	**184**	**207**

Table 12: CAPEX for different energy efficiency scenarios per m² of floor area – Poland

Payback periods for energy efficiency improvements average around 13 years, but span a wide range from roughly 8 years up to 62 years depending on the scenario. Optimal energy efficiency scenarios in Poland may pay back the investments in around 9 years.

		Share of systems replaced with heat pumps and district heating (top) Years (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
Insulation thickness (cm)	5	no monetary savings	no monetary savings	62	23	16	13
	10	no monetary savings	23	15	12	11	**10**
	15	21	13	11	**10**	**9**	**9**
	22.5	15	11	**10**	**9**	**8**	**8**
	30	13	11	**9**	**9**	**8**	**8**

Table 13: Payback periods for different energy efficiency scenarios – Poland

Romania

Insulation thickness (cm)		Share of systems replaced with heat pumps and district heating (top) CAPEX in EUR/m² (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
	5	67	101	135	170	204	238
	10	70	101	132	163	194	225
	15	74	104	133	162	191	**220**
	22.5	80	108	136	164	192	**220**
	30	85	113	140	168	195	**223**

Table 14: CAPEX for different energy efficiency scenarios per m² of floor area – Romania

In Romania, the average investment cost is around 150 EUR/m², with scenarios spanning roughly from 67–240 EUR/m². Optimal energy efficiency packages require around 220 EUR/m².

Insulation thickness (cm)		Share of systems replaced with heat pumps and district heating (top) Years (below)					
		HP 0% DH 100%	HP 20% DH 80%	HP 40% DH 60%	HP 60% DH 40%	HP 80% DH 20%	HP 100% DH 0%
	5	Without monetary savings				Without monetary savings	153
	10					647	76
	15					160	**59**
	22.5					112	**52**
	30					98	**50**

Table 15: Payback periods for different energy efficiency scenarios – Romania

Payback period in Romania is the longest among all the countries analysed. The shortest payback times, of about 50 years, are achieved under highly ambitious and deep energy efficiency packages.

IMPACTS OF OPTIMAL INVESTMENTS

Building on the optimal investment packages identified in the previous section, this part of the report shifts the focus to their outcomes. It examines how the optimal energy efficiency options affect delivered energy, running costs, greenhouse gas emissions and air pollution, and discusses the implications of these impacts.

Impacts on delivered energy

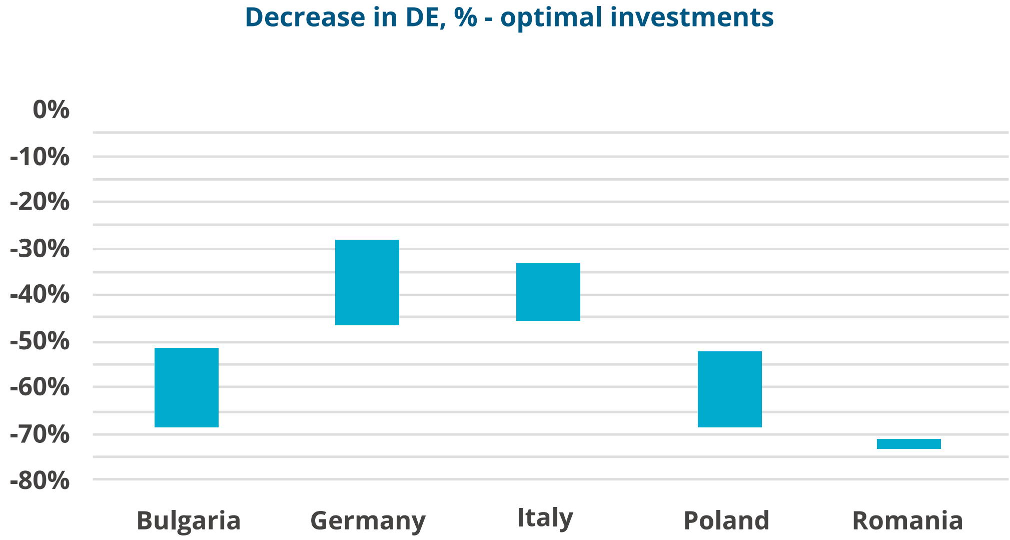


Figure 16: Impacts of optimal investments on delivered energy

The graph illustrates that optimal investment scenarios cut delivered energy in all five countries, though the scale of savings varies considerably.

The pattern suggests that the optimal packages deliver the strongest energy savings in Romania, Bulgaria and Poland, while the reduction is more moderate in Germany and Italy. Romania achieves the steepest decline, at around 72–73%, with Bulgaria and Poland following at roughly 53–55%. In Germany and Italy, reductions are more modest but still meaningful, in the order of 30–35%, with Germany performing slightly better than Italy.

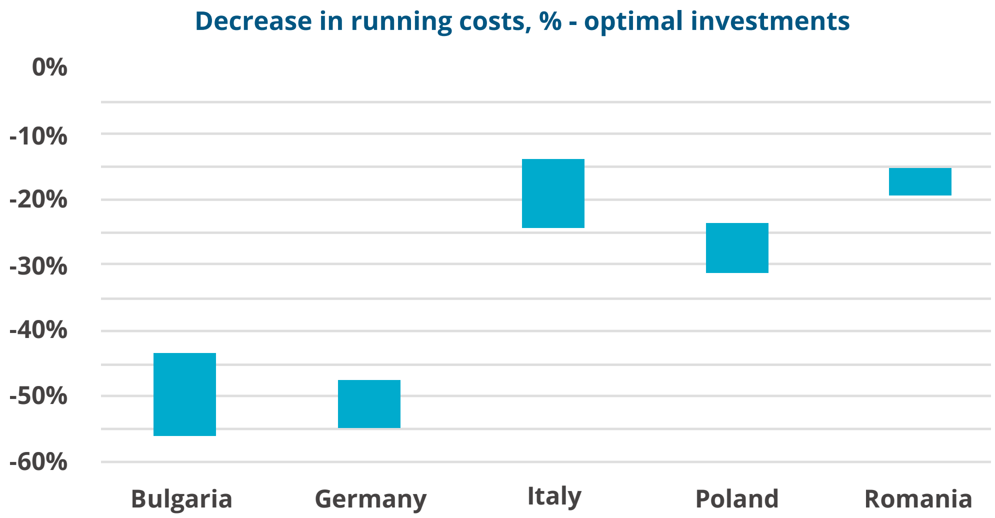


Figure 17: Impacts of optimal investments on running costs

Optimal energy efficiency scenarios reduce running costs for vulnerable households in all countries, although the scale of the reductions differs considerably. Overall, the pattern suggests that the optimal packages deliver the strongest operating cost relief in Bulgaria and Germany, whereas the effect is more limited in Romania and, to a lesser extent, in Italy and Poland.

Bulgaria and Germany experience the largest running cost reductions, at roughly 45–55% while Poland follows with more moderate reductions of around 25–30%. Italy and Romania see the smallest drop, at only about 15–25% and 15%–20%, respectively.

Impacts on greenhouse gas emissions

Regarding GHG emissions, the optimal energy efficiency of buildings occupied by vulnerable households delivers reductions in all five countries. Overall, the climate benefits of the optimal packages are most obvious in Romania, Bulgaria and Poland, and somewhat weaker in Germany and Italy.

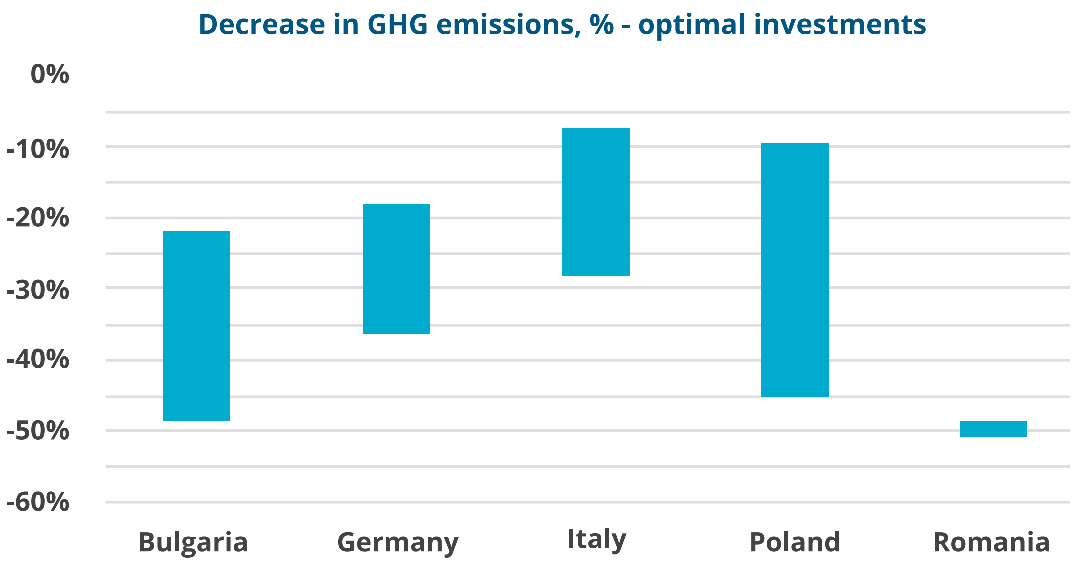


Figure 18: Impacts of optimal investments on GHG emissions

Romania is the top performer, with GHG emissions falling by around 50% under the optimal scenario. In Bulgaria and Poland, some scenarios achieve similarly strong reductions of about 45%, while some other scenarios are less effective, bringing reductions of 25% and 10%, respectively. Germany shows a more moderate but still meaningful decline of around 25%. Italy is the weakest performer in relative terms, with reductions ranging only between 5–25% across analysed energy efficiency scenarios.

Impacts on pollution

Optimal energy efficiency packages deliver particularly strong air-quality benefits in Italy, and to a lesser extent in Poland and Bulgaria, whereas gains in Germany remain modest.

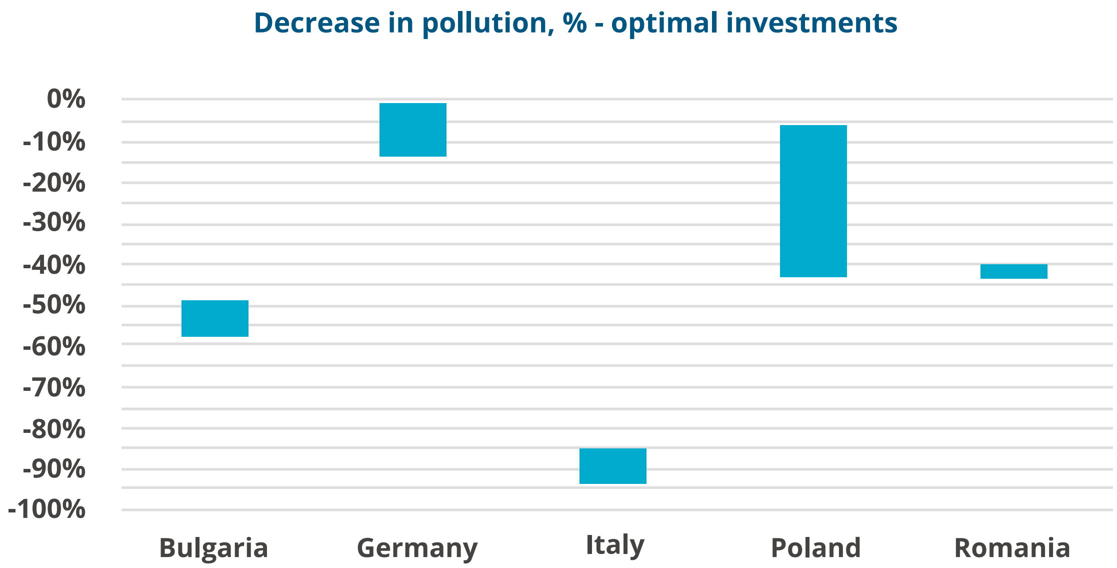


Figure 19: Impacts of optimal investments on pollution

In terms of air pollution reductions, Italy stands out, with emissions dropping by around 90–95%, signalling an almost complete phase-out of the most polluting systems. Bulgaria sees a more moderate yet still substantial decline of about 50–60%, while Romania and the best-performing Polish scenarios deliver reductions of roughly 40%. At the other end, the least effective Polish options and all scenarios modelled for Germany achieve modest pollution reductions of around 10%, making these the weakest performers.

QUALITY OF NATIONAL SOCIAL CLIMATE PLANS

National Social Climate Plans

According to the Social Climate Fund Regulation, each Member State should submit its NSCP to the European Commission by 30 June 2025.[18]

The SCP should include various measures and investments that target vulnerable groups including support to vulnerable groups through building renovations, in particular, vulnerable people living in worst-performing buildings, support to affordable energy-efficient housing, including social housing, and provide information and awareness-raising on measures and investments.[19]

'Measures' are actions or structural changes that lead to policy improvement with significant lasting impact, as one of the following: measures based on reforms and commitments in the National Energy and Climate Plans (NECPs),[20] remedies for areas of insufficient ambition in NECPs, measures different from investments (such as those tackling information, education, awareness, behavioural changes). While 'investments' are expenditure on financial activities and assets, they have lasting impacts on social and economic resilience and on sustainability.[21]

Overall, SCPs must be structured along three areas: buildings, road transport, and temporary direct income support. Each of the components should include measures and investment descriptions, milestones, targets and timelines, as well as financing and cost information. Member States should allocate contributions to buildings and road transport, fitting their national situation. The temporary direct income support, on the other hand, is optional and is capped at 37.5% of the total estimated costs of the plan. Moreover, within the plan, technical assistance actions may be included, aiming to effectively administer and implement the measures and investments, which are capped at the limit of 2.5% of the total estimated costs of the plan.[22]

The review covers four initial draft NSCPs, available at the time of writing the report: Bulgaria, Italy, Poland and Romania. The German draft NSCP had not yet been published and is excluded from the analysis. The table below lists the publication dates of the draft NSCPs analysed in this report and includes links where they can be downloaded.

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[18] Nonetheless, Member States have experienced some delays in submission of the SCP, with only Sweden's SCP approved in January 2026, which effectively delays first disbursement of the SCF financial support.

[19] The complete list of measures in Article 8, https://eur-lex.europa.eu/eli/reg/2023/955/oj/eng.

[20] The National Energy and Climate Plan (NECP), pursuant to Regulation (EU) 2018/1999, is the key governance and planning tool for the energy and climate transition of Member States. NSCPs and NECPs, and other planning instruments such as NBRPs, should be consistent according to Regulation (EU) 2023/955 Article 6.

[21] Commission Notice – Guidance on the Social Climate Plans (C/2025/1597)

[22] For more details on each component, see: Commission Notice – Guidance on the Social Climate Plans (C/2025/1597)

Country	Published	Link
Bulgaria	20 June 2025	https://www.strategy.bg/bg/public-consultations/11203
Italy	29 May 2025	https://www.mase.gov.it/portale/piano-sociale-per-il-clima
Poland	27 May 2025	https://www.funduszeunijne.gov.pl/strony/o-funduszach/spoleczny-fundusz-klimatyczny/plan/
Romania	3 November 2025	https://mfe.gov.ro/wp-content/uploads/2025/10/c0860c510d1424f56ff1b4c0147ac9bd.pdf

Table 16: Publication dates and sources for analysed NSCPs

BULGARIA

Investment schemes

Bulgaria's draft SCP building component contributions amount to EUR 1.499 billion, which is 45.1% of the Plan's total budget of EUR 3.326 billion. Vulnerable households are defined as either 'households in energy poverty' (in cases where the household's monthly income is lower than the official poverty line after deduction of the typical energy consumption of their dwelling); or those households severely affected by the impacts of carbon pricing under ETS2.

The building component includes three investment schemes linked to vulnerable households.

Investment scheme 1 (K1. A.I1): Renovation of multifamily residential building to support energy-poor and vulnerable households

This investment scheme funds, among other things, the renovations, energy efficiency measures related to the heating system, and the use of renewable energy for multifamily buildings with a significant share of vulnerable households targeting worst-performing buildings (lowest classes E, F and G). Conditional to support is the 30% reduction in primary energy consumption. It has specific stages including technical preparation, identification and selection at local level, and investment for the efficiency works. The grant support will amount to 100%.

Investment scheme 2 (K1. B.I2): Energy communities supporting energy poverty

The investment scheme includes funding for the installation of rooftop photovoltaic, solar-thermal or photovoltaic thermal panels on public, single-family and multi-family buildings. The energy community should include at least 30% vulnerable and energy-poor households, and 30% of energy generated should be directed towards energy-poor households at a price lower than the regular market price. Municipalities take a leading role in the implementation of the scheme.

Investment scheme 3 (K1. A.I3): "Warm Home" programme

The "Warm Home" investment scheme funds energy performance improvements of single-family buildings occupied by vulnerable households through building envelope interventions and heating system replacement. Municipal authorities will play a central role in implementation and will be supported by technical assistance for collecting applications and assessing eligibility.

National Social Climate Plan relevance

Relevance of the NSCPs for different report dimensions is classified as below:

Targeting vulnerable households – HIGH

All three of Bulgaria's draft SCP investment schemes include a clear indication of how they will target vulnerable households and how many vulnerable households are expected to be supported by each investment. The draft plan gives an important role to local authorities and municipalities in implementing the schemes, which gives an opportunity for better local targeting of initiatives.

Specifying building-related measures – HIGH

This scores highly as these are centred on a suite of concrete interventions involving comprehensive thermal renovations, the installation of heat pumps, and the provision of energy-efficient cooking appliances. The plan is further bolstered by clear, quantified targets that define the expected number of buildings to be covered and heat pumps to be installed, alongside rigorous projections for energy savings and the reduction of CO_2 emissions.

Achieving substantial energy performance gains – MODERATE

One of the three investment schemes provides an indication of envisaged total energy savings (Investment scheme 3), and one of installed generation capacity (Investment scheme 2). Eligibility criteria for projects to achieve a certain reduction in primary energy consumption are included in one scheme (Investment scheme 1), although at a modest 30%, which does not correspond to deep renovations. Targeting of the worst-performing buildings is envisaged within one investment scheme (Investment scheme 1).

Ensuring monitoring and evaluation – MODERATE

The plan provides clear numerical targets for emissions and building counts, alongside defined implementation timelines. Responsible authorities for each measure are clearly identified to ensure accountability. However, the framework lacks depth in social distribution monitoring; and more specifically, there is limited detail on how the plan will track the participation and outcomes of vulnerable households within the broader energy efficiency schemes. While the necessary components for a monitoring framework are present, they are not yet deeply elaborated enough to capture long-term social impacts.

Deploying a diverse portfolio of measures and investments – MODERATE

Only investment schemes are included, while measures are not part of the draft plan. Investment schemes are exclusively in the form of grants. Each investment scheme offers a packaged solution, in the form of a staged approach across schemes to their initiatives starting from scoping and technical evaluation of buildings to project implementation and evaluation. There is a lack of specific instruments promoting structural changes beyond direct energy performance improvement schemes, such as training programmes or the establishment of advisory services like one-stop-shops.

Considering socioeconomic conditions – LOW to MODERATE

The draft plan covers multiple residential building types: multifamily (Investment schemes 1 and 2), single family (Investment schemes 3 and 2) and public buildings (Investment scheme 2). There is a lack of specific support for socially vulnerable groups, such as the elderly or people with disabilities. However, the draft plan indicates that this will be pursued in future versions. Housing tenure is not considered within the plan.

The draft plan specifies that households in energy poverty rely on low-quality fuels, which cause indoor and outdoor pollution, and mentions that measures under an investment aim to reduce the use of these fuels (K1. A.I3). Although they may be covered indirectly, air quality improvements and associated health benefits may deserve amore explicit link.

Allocation of resources

The amounts destined for each of the different investment schemes supporting buildings and vulnerable households are summarised in Table 17.

NSCP budget line	NSCP measure	NSCP budget (EUR)	Budget share applicable to vulnerable households		NSCP budget for improving vulnerable households (EUR)
K1. A.I1	Renovation of multifamily residential building to support energy-poor and vulnerable households	826.6 million	Fully relevant	100%	826.6 million
K1. B.I2	Energy communities supporting energy poverty	333.3 million	Not relevant	0%	0
K1. A.I3	“Warm Home” programme	200 million	Fully relevant	100%	200 million
	TOTAL	**1.36 billion**	**-**	**76%**	**1.027 billion**

Table 17: NSCP budget allocated to vulnerable households – Bulgaria

In total, a budget of around EUR 1.027 billion has been foreseen for renovating buildings occupied by vulnerable households and deploying clean and renewable heating in Bulgaria.

BULGARIA	Optimal CAPEX	Floor area of buildings occupied by vulnerable households	CAPEX required for renovating all buildings occupied by vulnerable households	CAPEX available from the NSCP	Share of buildings occupied by vulnerable households to be renovated	Average share of buildings occupied by vulnerable households to be renovated
Minimum	78 EUR/m²	32.3 million m²	EUR 2.55 billion	EUR 1.027 billion	40%	**37%**
Maximum	93 EUR/m²		EUR 2.99 billion		34%	

Table 18: Share of vulnerable households able to be renovated with the NSCP budget – Bulgaria

At the minimum CAPEX of 78 EUR/m², renovating the full 32.3 million m² of vulnerable floor area would require around EUR 2.55 billion. With about EUR 1.027 billion available in the NSCP, this translates into roughly 40% of buildings used by vulnerable households being upgraded. At the maximum CAPEX level of 93 EUR/m², the same budget can only cover around 34% of buildings used by vulnerable households, as higher unit CAPEX reduces the total area that can be renovated.

Based on the optimal CAPEX analysis and the planned NSCP budget, the NSCP is expected to renovate around 37% of vulnerable Bulgarian households and support their switch to clean, renewable heating.

ITALY

Investment schemes

Italy's draft SCP building component contribution is EUR 4.420 billion, amounting to 51% of the total draft SCP. The definition of vulnerable household in the draft plan directly quotes the definition provided by SCP regulation, without additional specifications. The buildings component includes five measures and investment schemes relating to vulnerable households:

Investment scheme 1 (A.1) Home Energy Tutor (TED), consultancy help desk, will provide training courses aimed at making available professional tutors to raise awareness, guide and advise vulnerable households about their energy poverty and potential opportunities to improve energy efficiency. The programme aims to ensure there is at least one help desk available per province (107 provinces across 20 regions), using the opportunity to connect with local communities and build trust.

Investment scheme 2 (M.2) Energy retrofitting of public housing aims at funding interventions reducing final energy consumption in public residential buildings (social housing inhabited by vulnerable households). It targets energy efficiency upgrades in the worst-performing buildings, energy classes F and G, with a minimum 30% reduction in non-renewable primary energy. The support covers interventions such as wall insulation, building automation systems, solar energy installations and heat pumps. The grant will cover 100% or up to 65% of eligible measures, based on the type of procedure (first-come, first-served or tender procedure).

Investment scheme 3 (M.3) Energy retrofitting of properties owned by vulnerable families in private housing aims to support households with the "economic situation indicator" (ISEE)[23] of up to EUR 20,000 to finance 100% of works on energy efficiency upgrades similar to M.2. The intervention should achieve a non-renewable primary energy reduction of at least 30%, targeting measures that include thermal insulation of the envelope and the replacement of heating systems with high-efficiency heat pumps or biomass generators.

Investment scheme 5 (M.5) Income support for the installation of PV and heat pumps supports capital financing of 100% of expenses. It will benefit individuals with ISEE <EUR 15,000 or households with ISEE <EUR 30,000 with at least four dependent children.

Investment scheme 6 (S.6) ESCO energy credit card for vulnerable families scheme works through providing ESCO credit cards to individuals residing in public housing, complementary to M.2.

National Social Climate Plan relevance

Italy's draft NSCP relevance is classified as below:

Targeting vulnerable households – MODERATE to HIGH

Vulnerable households are not yet clearly defined in the assessed draft SCP, although a link to the ISEE indicator is present in certain measures (M.3, M.5). All relevant investments indicate the number of households which they will support.

Specifying building-related measures – HIGH

Technical specificity is a core strength of the plan, which outlines well-defined measures for structural and systemic improvements. These include comprehensive thermal envelope enhancements, the replacement of outdated heating systems and the integration of renewable energy sources, with a particular focus on rooftop photovoltaics. The plan also details energy performance upgrades and interventions facilitated by ESCOs. These technical actions are supported by clear financial allocations, structured implementation timelines, and specific definitions for the categories of buildings eligible for support.

Achieving substantial energy performance gains – MODERATE

One investment scheme provides the envisaged energy reduction target (M.2), while other substantial investments lack the opportunity to establish targets in terms of total energy savings or renewable energy generated (M.3, M.5). The investments improving energy efficiency indicate 30% non-renewable primary energy reduction as a baseline (M.2, M.3). Targeting of the worst-performing buildings is envisaged within two investment schemes (M.2, M.3).

[23] https://www.lavoro.gov.it/strumenti-e-servizi/isee/pagine/default

Monitoring and evaluation indicators – MODERATE

The plan successfully identifies financial allocations, implementation timelines, and intervention volumes such as the number of potentially eligible households. It also includes output indicators like the percentage of primary energy expected to be saved. Despite these metrics, the framework is limited by a primary focus on investment deployment and energy efficiency outputs. There are currently too few thorough indicators to measure the actual reduction in energy poverty, and the plan does not yet account for a robust, long-term evaluation of the results over time.

Deploying a diverse portfolio of measures and investments – MODERATE

The investment schemes are in the form of grants. Other financing instruments are not included. An innovative instrument, specifically mobilisation of grants to provide ESCO credits, is present (S.6). The training programme aiming to establish awareness and advisory services is present (A.1).

Considering socioeconomic conditions – MODERATE

The draft plan separates programmes for public buildings (M.2, S.6) and single-family houses (M.3) but does not consider privately-owned rental housing. There is a lack of specific support for socially vulnerable groups, such as the elderly or people with disabilities. There is a lack of geographic consideration within the draft plan.

The draft plan does not explicitly consider impacts on air quality within the building component.

Allocation of resources

The total amount of funding dedicated to renovating homes of vulnerable households is shown in Table 19.

NSCP budget line	NSCP measure	NSCP budget (EUR)	Budget share applicable to vulnerable households		NSCP budget for improving vulnerable households (EUR)
A.1	Home Energy Tutor	120 million	Not relevant	0%	0
M.2	Public residential energy retrofit	1.47 billion	Fully relevant	100%	1.47 billion
M.3	Energy retrofit for vulnerable households in private buildings	1.8 billion	Fully relevant	100%	1.8 billion
M.5	Energy income for the installation of PV systems and a heat pump	450 million	Fully relevant	100%	450 million
S.6	ESCO card scheme	630 million	Not relevant	0%	0
	TOTAL	**4.47 billion**		**83%**	**3.72 billion**

Table 19: NSCP budget allocated to homes of vulnerable households – Italy

As shown in Table 20, with minimum and maximum CAPEX levels set at 130 and 230 EUR/m², fully upgrading the 174.5 million m² of vulnerable floor area in Italy would require between EUR 22.7 billion and EUR 40 billion. By contrast, the Italian NSCP earmarks only EUR 3.72 billion for this purpose, meaning that supported energy efficiency measures can realistically cover just 9–16% of vulnerable households. On this basis, the average share of vulnerable households expected to benefit from NSCP-backed energy efficiency measures is estimated at around 13%.

ITALY	Optimal CAPEX	Buildings hosting vulnerable households floor area, million m²	CAPEX required for renovating all buildings occupied by vulnerable households	CAPEX available from the NSCP	Share of buildings occupied by vulnerable households to be renovated	Average share of buildings occupied by vulnerable households to be renovated
Minimum	130	174.5	EUR 22.7 billion	EUR 3.72 billion	16%	**13%**
Maximum	230		EUR 40.1 billion		9%	

Table 20: Share of vulnerable households able to be renovated with the NSCP budget – Italy

POLAND

Investment schemes

Vulnerable households in Poland's NSCP are defined based on the national definition of energy poverty, which is based on low incomes, high energy costs and low building energy efficiency.

Investment scheme 1 (C1.A.I1) "Clean Air" Programme supports the replacement of heat sources powered by fossil fuels and energy efficiency improvements of single-family residential buildings. The support is provided to owners or co-owners of such buildings. Subsidised projects should achieve a 40% reduction in energy consumption, while gas heating systems are not eligible for financing. The average subsidy rate is envisaged to be PLN 60,000 (around EUR 14,000). As part of the financing programme, operators should identify households in or at risk of energy poverty and provide them with sufficient advice. The Programme is explicitly aiming to improve air quality and lead to a reduction in air pollutants.

Investment scheme 2 (C1.B.I2) Social and Municipal Housing Construction Programme supports the supply of energy-efficient housing for low-income households via the construction of new multifamily residential buildings and repurposing existing ones through non-repayable grants. The resulting buildings should generate no more than 52 kWh/m²/year of non-renewable energy demand.

Investment scheme 4 (C1.C.I4) Supported and Training Housing Programme is an innovative investment scheme that aims to create efficient "supported housing" through renovation and efficiency measures. This initiative aims to close the social gap in vulnerable households, by supporting social services for people with disabilities, people experiencing homelessness, and people leaving foster care.

Investment scheme 5 (C1.D.I5) Training Programme for Social Welfare Staff on Support for Energy-Poor Households aims to train social welfare system employees (social assistance institution workers) to work with vulnerable households facing energy poverty, providing advice on possible ways of improving the energy efficiency of their homes.

Investment scheme 6 (C1.A.I6) Investments under the regional component – Supporting Building Renovation supports energy efficiency measures, such as thermal modernisation and system energy interventions, in municipal housing in socioeconomically challenged areas.

Investment scheme 7 (C1.D.I7) Investments under the regional component – Educational and energy/climate advisory activities is part of the support for a network of climate advisers employed by local government units: the investment scheme finances the employment of advisers and the creation of advisory services in local governments. Among the services, the activities include assistance in obtaining funds for the implementation of air quality improvements, as well as information on anti-smog initiatives.

Investment scheme 8 (C1.C.I8) Pilot Programme – Energy Communities investment scheme supports low-income households in accessing affordable renewable energy via energy communities. This will include help with documentation, renovation of buildings (which includes insulation and heating system upgrades), generation of renewable energy, energy storage, and educational activities.

National Social Climate Plan relevance

Relevance of the NSCPs for different report dimensions is classified as below:

Targeting vulnerable households – MODERATE

The draft plan refers to vulnerable households. However, some investment schemes fail to clearly explain the expected impact of investment on vulnerable households. For instance, one scheme does not show how the measure will specifically prioritise vulnerable households (C1.D.I7), while another lacks an indication of how many vulnerable households will be supported from the measure (C1.A.I1).

The draft plan gives an important role to local authorities and municipalities in implementing the schemes, which gives an opportunity for better local targeting of initiatives.

Specificity of building-related measures – HIGH

The building component (C1) is technically robust and its measures are highly detailed, thus adhering to the Energy Efficiency First principle24 in alignment with EU decarbonisation goals. The plan outlines specific interventions including insulation and thermal modernisation, heat source replacement with an emphasis on electrification and heat pumps, and ventilation upgrades. Beyond physical works, it incorporates renewable energy integration, regional renovation and energy efficiency schemes, and the establishment of advisory networks. This comprehensive approach covers both social and municipal housing, ensuring a wide technical scope for building improvements.

[24] As defined in Article 2, point (18), of Regulation (EU) 2018/1999

Achieving substantial energy performance gains – MODERATE

Some investment schemes provide requirements for energy reduction and installed energy capacity. For instance, there are specifications that some projects must achieve a 40% reduction in energy consumption (C1.A.I1), and an indication of the performance level of the building after the construction or renovation (I.2). However, other investments, while being similar in scope and covering energy efficiency improvements of buildings, lack such requirements (C1.A.I6).

Except for C1.C.I8, none of the investments provide total levels of energy reduced or new capacity installed from the suggested measures.

Monitoring and evaluation indicators – LOW to MODERATE

The plan focuses on standard budgetary and environmental metrics, including clear budget allocations, emissions reduction projections, and milestones that satisfy NSCF requirements. Nevertheless, the framework lacks joint KPIs that link funding directly to energy efficiency outcomes. Another flaw is that there is no specific indicator to track the "level of exit" from energy poverty, with the plan offering limited information regarding reporting frequency or the granular tracking of progress at the level of the individual beneficiary.

Deploying a diverse portfolio of measures and investments – MODERATE to HIGH

The draft plan deploys a varied toolbox of support, including direct finance for building performance upgrades, training activities, tailored advisory services, and support for establishing energy communities. Nonetheless, most investment schemes are designed in the form of grant instruments, with one notable exception in which support also takes the form of tax relief or concessional loans.

Considering socioeconomic conditions – HIGH

The draft package considers both urban and rural contexts, with some schemes (such as C1.A.I6) designed specifically for rural areas. Different building typologies are also reflected, including single family homes (C1.A.I1), multifamily buildings (C1.B.I2) and socially supported housing (C1.C.I4). In parallel, several schemes (notably C1.C.I4, C1.D.I5 and C1.A.I6) provide targeted support for socially vulnerable groups, including people with disabilities and the elderly (C1.A.I4), and women who are at risk of social exclusion (C1.A.I6), and for actors working directly with them. Finally, the plan foresees instruments aimed at building owners (for example, under C1.A.I1) but does not yet spell out how support will extend to rented dwellings.

The plan proactively integrates air quality considerations in some specific investments, including with measures explicitly aiming to improve air quality (C1.A.I7), alignment with the National Air Protection Program (C1.A.I1 and C1.A.I7), and a direct objective to implement the Ambient Air Quality Directive (C1.A.I7).

Allocation of resources

NSCP budget line	NSCP measure	NSCP budget (EUR)	Budget share applicable to vulnerable households		NSCP budget for improving vulnerable households (EUR)
C1.A.I1	"Clean Air" Programme	3.1 billion	Proportional to the share of vulnerable households	4%	124 million
C1.B.I2	Social and Municipal Housing Construction Programme	1.4 billion	Not relevant	0%	0
C1.C.I4	Supported and Training Housing Programme	95.5 million	Fully relevant	100%	95.5 million
C1.D.I5	Training Programme for Social Welfare Staff on Support for Energy-Poor Households	8 million	Not relevant	0%	0
C1.A.I6	Investments under the regional component – supporting building renovation	743 million	Fully relevant	100%	743 million
C1.D.I7	Investments under the regional component – educational and energy/climate advisory activities	57.2 million	Not relevant	0%	0
C1.C.I8	Pilot Programme – Energy Communities	69.3 million	Fully relevant	100%	69.3 million
	TOTAL	**5.49 billion**		**19%**	**1.03 billion**

Table 21: NSCP budget allocated to vulnerable households – Poland

POLAND	Optimal CAPEX, EUR/m2	Buildings hosting vulnerable households floor area, million m²	CAPEX required for renovating all buildings occupied by vulnerable households	CAPEX available from the NSCP	Share of buildings occupied by vulnerable households to be renovated	Average share of buildings occupied by vulnerable households to be renovated
Minimum	130	40.8	EUR 5.3 billion	EUR 1.03 billion	19%	**16%**
Maximum	230		EUR 8.6 billion		12%	

Table 22: Share of vulnerable households able to be renovated with the NSCP budget – Poland

In Poland, at the lower CAPEX assumption of 130 EUR/m², the available funding could, in principle, renovate 19% of vulnerable floor area. Under the higher CAPEX level of 210 EUR/m², the same budget would be sufficient to upgrade around 12% of the floor area used by vulnerable households. Taken together, these cost assumptions translate into an average NSCP-supported renovation rate of approximately 16% of buildings hosting vulnerable households.

ROMANIA

Investment schemes

Vulnerable households are identified in Romania's NSCP based on household income, expenditure on energy, and housing conditions. The plan includes three investment schemes targeting vulnerable households.

Investment scheme 1 (I.1) Improving the energy performance of multi-family buildings in urban areas through thermal renovation measures and energy audits supports energy efficiency works (including audits and renovations) in multi-family buildings of vulnerable households in urban areas. The measures will prioritise buildings heated with natural gas.

Investment scheme 2 (I.2) Financial support for the installation of heat pumps, photovoltaic panels and storage capacities in a multi-family residential building will support households with a package of integrated heat pumps, photovoltaic panels and energy storage solutions promoting buildings' self-sufficiency. The measures target residential buildings supplied by individual gas systems, district heating and biomass.

Investment scheme 3 (I.3) Improving energy performance and decarbonising single-family buildings for households in energy poverty in rural areas supports energy efficiency works (including energy audits, renovations and renewable systems) in single-family buildings occupied by vulnerable households. The energy efficiency measures should achieve a minimum reduction of 30% in primary energy consumption, equipping buildings with 3 kW of energy generation and 5 kWh of storage capacity. The support is provided as a grant.

National Social Climate Plan relevance

Romania's draft NSCP is at the early stages of development and provides very limited details. This allows for partial assessment but not for conclusive remarks. Therefore, some indicators are classified as "not applicable" below.

Relevance of the NSCPs for different report dimensions is classified as below:

- **Targeting vulnerable households – NOT APPLICABLE**

  All investment schemes mention vulnerable households as a target. Municipalities that are considered more "vulnerable" (not specifying how, but presumably through socioeconomic indicators) are given priority by awarding them extra points in their proposals for energy performance grants on energy poor rural areas (I.3) which is a great addition to ensure a just transition.

- **Specificity of building-related measures – LOW to MODERATE**

  On the one hand, the plan defines specific energy efficiency actions such as thermal insulation, window replacement and heating system upgrades, with an explicit emphasis on the decarbonisation of heating through heat pumps and renewables-based systems. Furthermore, the plan provides quantified energy efficiency ambitions as well as investment allocations for residential buildings. On the other hand, the plan as it stands lacks the details required for specific implementation standards across different building types.

- **Achieving substantial energy performance gains – NOT APPLICABLE**

  I.3 includes minimum energy savings and energy generation capacity values to achieve. This can be replicated to other investments. However, the plan lacks sufficient detail to make a conclusive assessment of performance gains.

- **Monitoring and evaluation indicators – LOW**

  On the positive side, the plan mentions that an impact assessment on vulnerable households was conducted, analysing indicators such as household income, energy expenditure and housing condition. However, on the negative side, there is very little elaboration on KPIs related to the actual reduction of energy poverty, with the evaluation methodology of the impact assessment itself not explained.

- **Deploying a diverse portfolio of measures and investments – NOT APPLICABLE**

  Only investment schemes are included, and measures are not a part of the draft plan. Investment schemes are exclusively in the form of grants. There is a lack of specific instruments promoting structural changes, such as trainings or provision of advisory services. However, the schemes seem to be designed as packaged solutions.

- **Considering socioeconomic conditions – NOT APPLICABLE**

  The package distinguishes between the areas in which buildings are located, in particular between urban (I.1) and rural areas (I.3), and considers the distribution of the building stock between various building types, such as multifamily buildings (I.1) and single-family buildings (I.3). The package does not mention dedicated support for socially vulnerable groups, such as people with disabilities. The package does not include tenure consideration.

The draft plan doesn't directly mention or specify the impact on air quality in the building component. Nonetheless, the draft mentions that households in energy poverty rely on inefficient wood-burning systems, which may indicate a potential link to air quality improvements in future iterations of the plan.

Allocation of resources

In its NSCP, Romania only provides the total amount of money allocated to building-related measures. For this analysis, we are assuming that the total amount will be used for improving residential buildings only.

NSCP budget for improving the residential building stock	Budget share applicable to buildings occupied by vulnerable households		NSCP budget for improving buildings occupied by vulnerable households
EUR 3.44 billion	Proportional to the share of vulnerable households	8%	EUR 0.28 billion

Table 23: NSCP budget allocated to vulnerable households – Romania

In the case of Romania, the NSCP budget falls short of the investment needed to renovate all or even a significant share of the buildings occupied by vulnerable households.

Optimal CAPEX, EUR/m²	Buildings hosting vulnerable households floor area, million m²	CAPEX required for renovating all buildings occupied by vulnerable households	CAPEX available from the NSCP	Share of buildings occupied by vulnerable households to be renovated
220	38.2	EUR 8.4 billion	EUR 0.28 billion	**3%**

Table 24: Share of vulnerable households able to be renovated with the NSCP budget – Romania

At the given CAPEX of 220 EUR/m², the full 38.2 million m² of vulnerable floor area would require about EUR 8.4 billion, while only EUR 0.28 billion is available. As a result, the NSCP budget can cover only around 3% of vulnerable households in Romania.

GOOD PRACTICE

Measures supporting vulnerable households in renovating their buildings may be separated into a) financial support measures, targeting financial obstacles, and b) advisory support measures that target sociodemographic and sociobehavioural barriers. When combined, these two avenues can be shaped into comprehensive measures and integrated programmes maximizing efficiency to address vulnerable households. An illustration of what constitutes a comprehensive measure is provided in Table 25.

Comprehensive measure	**Financial support**	Grants and subsidies
		Low or zero-interest loans
		Blended finance
		Tax incentives
		Energy performance contracts
		On-bill schemes
	Advisory support	Information programmes
		One-stop-shops
		Split incentive solutions
		Free energy audits (or renovation passports)

Table 25: Comprehensive measure elements

Financial support

Financial support is an effective way to address economic barriers, such as upfront costs, for energy efficiency improvements and heating system replacements. It should be carefully designed to make it accessible to vulnerable households, including sufficient information and technical assistance, or combining with other financial support measures to create a complete product.

Grants and subsidies are among the most powerful tools to support low-income households in the clean heating transition. They lower up-front costs for renovation and new heating or cooling systems, and performance-based schemes can directly reward higher savings. The grants and subsidies should be shaped to include vulnerable households through proactive targeting and measures supplemented with guidance and technical advice. France's MaPrimeRénov' programme, launched in 2020 with a focus on the lowest-income groups and later expanded to other segments, is an example of a comprehensive grant programme which combines numerous schemes. Under this programme, the support level is adapted to household income and potential energy savings (favouring deeper renovations); very-low-income households can see up to 90% of energy efficiency upgrade costs covered. Moreover, support from the energy auditor is included within the scope.[25] Additionally, Slovenia's 2023 ZERO500 programme provided targeted support for 426 low-income households suffering from energy poverty with grants covering 100% of expenses for energy efficiency works (with a limit of EUR 9,620). It was supplemented with energy consultations from advisory network Ensvet.[26]

Low or zero-interest products can further unlock private investment. Credit and loans typically target middle to higher-income groups; however, loans with low or no interest rates can be used to engage lower-income households. Nonetheless, to ensure access to vulnerable household groups, credit risks should be further mitigated by a combination of other measures (e.g. EPCs and ESCOs, mentioned below). The Belgian ECORENO credit, for instance, offers affordable funding for insulation, heating upgrades and other works, with interest rates tailored to household income and family situation (e.g. single parent status, number of dependants).

Blended finance combines grants and loans. The Home Energy Scotland Grant and Loan Scheme helps to close funding gaps with homeowner grants, interest-free loans or a combination of both, while supporting energy efficiency and clean heating solutions. The grants and loans reach up to £7,500 and the Scheme also includes uplift for households in rural areas.

Tax incentives, available through various forms of tax credits, deductions or adapted VAT rates, can generate economic incentives for energy efficiency measures. Various forms have already been used by Member States to stimulate energy efficiency in the past.[27] As illustrated by Italy's Ecobonus, tax deductions can be used to stimulate investments in insulation, replacement of heating systems and solar installations. The Ecobonus provides a tax deduction of up to 50%, with the possibility to split the reduction into equal annual instalments over 10 years. The scheme has been active since 2007, and has seen many changes over time.[28] Historically, it had higher rates of tax deductions, and deductions could also take the form of a credit transfer to a bank or contractor that carried out energy efficiency improvements, giving households lower tax liabilities and easier access to the scheme.[29] In practice tax incentives have limitations in reaching vulnerable households and are often used by higher-income households, therefore they should always be used alongside other types of incentives.

[25] https://www.maprimerenov.gouv.fr/ Note: The MaPrimeRénov' programme is frequently restructured and changed.
[26] https://www.ekosklad.si/prebivalstvo/novica/na-eko-skladu-spodbude-za-reevanje-energetske-revine
https://www.astrid-online.it/static/upload/swd-/swd-on-national-long-term-renovation-strategies.pdf
[27] SWD (2022) 375 final: Analysis of the national long-term renovation strategies
[28] https://www.elettroclick.com/en/blog/building-bonuses-complete-guide-elettroclick/ecobonus-2025-complete-guide
[29] https://link.springer.com/chapter/10.1007/978-3-031-35684-1_9

Energy performance contracts are financing models in which an ESCO finances and implements an energy-saving or renewable project and is repaid from the verified savings or energy revenues. In shared-savings energy performance contracts, which are well suited for vulnerable households, much of the financial risk is shifted away from the end-user. The Latvian Building Energy Efficiency Facility (LABEEF) illustrates this approach by providing long-term finance for deep-renovation energy performance contracts, while backing contracts between ESCOs and commercial banks, reducing financial risks for ESCOs.

On-bill schemes are performance-based models in which the utility pre-finances energy efficiency works, and the household repays through its energy bill. Mobilising such schemes can be an effective way to resolve other issues beyond high upfront costs, such as credit capacity and loan securitisation issues, split incentives and mobilisation of private capital.[30] The How$mart programme in the United States applies this approach to insulation, heating, cooling and lighting upgrades, where the utility company (Midwest Energy) bears the upfront costs, and repayments are spread over up to 15 years capped at 90% of the expected energy savings. The 90% cap gives a safety margin for customers in case savings are lower than expected. It is also a good way to tackle the split-incentive issue, as the measure is tied to the energy bill rather than the tenant.[31]

Advisory support

Advisory support measures are essential to ensure that vulnerable households can take part in the transition. They include information campaigns, one-stop-shops, energy efficiency advice and tools to tackle split incentives, and they directly address sociodemographic and sociobehavioural barriers.

Targeted information programmes raise awareness of the benefits of renovation and decarbonisation of heating, and of available support. When tailored for specific groups, they can be important for building social trust and relationships with vulnerable households. Information and awareness programmes targeting vulnerable households might focus on the benefits most likely to appeal to them, such as lower energy bills and improved health[32] from better indoor environmental quality. The Belgian "Klimaatmobiel" renovation caravan is a mobile one-stop-shop that visits neighbourhoods, offers tailored advice and, as of 2025, has already assisted 1766 households with advice, of which 43% have gone on to renovate.[33] The direct engagement it offers makes the initiative particularly accessible.

One-stop-shops provide hands-on assistance along the whole renovation journey, from outreach and technical diagnosis to funding applications and follow-up. The Opengela network in Spain, built around neighbourhood offices, focuses on vulnerable districts and can cover up to 80% of energy efficiency upgrade costs for low-income households, with the rest as a long-term loan over 30 years. The first Opengela pilot was located in Otxarkoaga district, where most multifamily properties are owned by the municipality and allocated as social housing – a high percentage of people are socially excluded and the dwellings have poor build quality. In all, 238 apartments in 15 condominiums were renovated based on the criteria of vulnerability, rental housing status, and homeowner needs.[34]

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30 https://www.bpie.eu/wp-content/uploads/2021/04/06259-RenOnBill-policy-briefing_70_FINAL.pdf

31 Luis Mundaca, Sarah Kloke, 2018, On-Bill Financing Programs to Support Low-Carbon Energy Technologies: An Agent-Oriented Assessment, Review of Policy Research, Volume 35, Number 4 (2018)

32 BPIE, 2024, Healthy Buildings Barometer 2024

33 BPIE, 2025, Delivering the EPBD: A guide towards better, affordable and more resilient buildings for all in Europe

34 MRI, BPIE, 2024, Inventory of resource centre models and typologies: Unlocking the potential of community-driven models to drive residential renovation; BPIE, 2025, Enabling financing for neighbourhood renovations; BPIE, 2025, Delivering the EPBD: A guide towards better, affordable and more resilient buildings for all in Europe

Dedicated **split incentives solutions.** Whenever there is a misalignment between the party bearing the costs of energy efficiency works and the party that benefits split incentives occur, which can be a market barrier to energy efficiency measures or a switch in the heating system. This is usually the case in rental housing. Addressing the barrier through effective measures is important, whether by splitting costs and benefits in a balanced way, or with other schemes such as on-bill financing.[35] **'Troisième ligne de quittance' provision in French legislation** allows the landlord to carry out energy efficiency work with the consent of the tenant, and request a monthly contribution from the tenant to recover part of the investment costs to proven energy efficiency improvements for the tenant. The contribution is capped at 50% of estimated energy savings. The actual work must be accompanied by energy performance contracting, which guarantees that the tenant will see savings.[36]

Finally, providing a **free energy audit of the house (or a renovation passport)** can make information on the performance of the building and on the potential for energy efficiency improvement more accessible to vulnerable households. In Flanders, Belgium, vulnerable households qualify for a free energy scan of their homes, which paves the way for further improvement offers.[37] Establishing national renovation passport frameworks[38] and providing them for vulnerable households can ensure household access to a building-specific roadmap that sequences interventions over time in line with the needs and financial capacity of the owner or occupier, thereby making deep renovation more manageable. This can also unlock private actors' engagement in renovation, e.g. ESCOs can take up contracts more easily where building diagnosis is available.

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[35] SWD (2022) 375 final: Analysis of the national long-term renovation strategies
[36] Navigating Energy Renovations in Rented Properties: Tackling the Split Incentive Dilemma, 2024, International Union of Property Owners
[37] https://www.astrid-online.it/static/upload/swd-/swd-on-national-long-term-renovation-strategies.pdf; https://www.ca-res.eu/fileadmin/cares/PublicArea/Joint_workshop_presentations/Session_6_Energy_Poverty_-_Best_practice_Flanders__BE_.pdf
[38] As required, pursuant to Directive (EU) 2024/1275, Article 12

NATIONAL SOCIAL CLIMATE PLAN OVERVIEW

Table 26 provides an overview of NSCPs across six dimensions of relevance.

	BULGARIA	ITALY	POLAND	ROMANIA
Targeting vulnerable households	**HIGH**	**MODERATE** to **HIGH**	**MODERATE**	**NOT APPLICABLE**
Specifying building-related measures	**HIGH**	**HIGH**	**HIGH**	**LOW** to **MODERATE**
Achieving substantial energy performance gains	**MODERATE**	**MODERATE**	**MODERATE**	**NOT APPLICABLE**
Ensuring monitoring and evaluation	**MODERATE**	**MODERATE**	**LOW** to **MODERATE**	**LOW**
Deploying a diverse portfolio of measures and investments	**MODERATE**	**MODERATE**	**MODERATE** to **HIGH**	**NOT APPLICABLE**
Considering socioeconomic conditions	**LOW** to **MODERATE**	**MODERATE**	**HIGH**	**NOT APPLICABLE**
Share of buildings occupied by vulnerable households to be renovated	**37%**	**13%**	**16%**	**3%**

Table 26: Overview of NSCPs' relevance dimensions

As can be seen in the overview, Bulgaria combines strong targeting of vulnerable households with ambitious energy savings and highly detailed building measures. It may be able to renovate about 37% of its vulnerable households, far above the other countries.

Italy targets vulnerable households moderately to highly effectively and uses highly detailed building measures, but its overall ambition is lower, with energy efficiency improvements foreseen for around 13% of vulnerable households.

Poland is moderately effective on targeting and energy savings and excels in reflecting socioeconomic conditions. It plans to renovate roughly 16% of vulnerable households, in between Bulgaria and Italy.

Romania outlines basic details of measures and monitoring, yet lacks a clear framework for vulnerable households, resulting in a very low planned energy efficiency improvement share of about 3%.

Recommendations for Member States

Member States included in the analysis are progressing to develop NSCPs that can help a part of their vulnerable households, but more work is required. The approach to establishing the plans is diverse – while some schemes are detailed and clearly address targets, others lack completeness.

Recommendation: Member States should continue to pursue completeness of plans, with granular policies and measures that address vulnerable households as a whole as well as their specific subgroups (defined by geographic area or sociobehavioural indicator). The improvements to the Plans can be made before Member States submit them to the European Commission.[39]

Member States include schemes targeted at specific building types and locations. This is a positive approach that will ensure tailored solutions.

Recommendation: Member States should consider structural measures such as policy and legal changes within their NSCPs, in coordination with the transposition and implementation of Energy Performance of Buildings Directive requirements. They should also consider more diverse financial instruments, such as loans to incentivise financial institutions to support the vulnerable.

Member States include an explicit energy performance improvement requirement for intervention measures (e.g. investment should achieve 30% primary energy reduction). This is a positive approach, but it should be upscaled and developed.

Recommendation: Some investment schemes still lack a link to performance indicators. Requiring bottom-line performance improvements (both in terms of energy efficiency and renewable energy generation) for all possible investment schemes will ensure that interventions lead to substantial long-term gains and solutions to social aspects.

Recommendation: A tiered approach for energy performance can be established more proactively and in more detail within the plans, where higher performance gains are rewarded with more financial support. This can be supplemented by a tiered approach for social indicators with higher support for more vulnerable people (e.g. support level linked to income level); schemes should provide sufficient technical support to ensure that no one is left behind.

[39] Moreover, according to Regulation (EU) 2023/955, Article 18, Member States can amend Plans, if they need to be significantly adjusted.

Member States allocate to municipalities the central implementing role in many initiatives. This is a positive approach that will support the applicability and implementation of measures, as well as increasing connections and building trust with local communities.

Recommendation: Increasing the responsibility of sub-national administrations will result in higher human resource needs for ensuring the successful implementation of the respective schemes. Municipalities with limited capacities might not be successful in designing appropriate actions, and therefore will have lower-quality funding applications. This can lead to wealthier municipalities receiving better support while vulnerable municipalities lag behind. Allocating sufficient resources and establishing municipal and local one-stop-shops for energy efficiency can be a good way to address the capacity gap.

Analysed Member States – especially Italy, Poland and Romania – may benefit from targeting a higher portion of vulnerable households. The minimum national contributions of 25% of the estimated total cost of the NSCP, as required by SCF regulation, are a good start – nonetheless, to structurally address the issue, further dedicated funding is needed.[40]

Recommendation: Member States should mobilise more ETS revenues beyond the minimum required in the SCF regulation to provide a long-term solution for vulnerable households and emissions.

Recommendation: Further data on building stock and buildings occupied by vulnerable households should be continuously pursued to ensure better targeting. Member States should thoroughly transpose and implement provisions from the Energy Performance of Buildings Directive related to data, including Article 22 on establishing a national database for building performance. The NSCP data and information on buildings should be compatible with the National Building Renovation Plans, for which a draft was due 31 December 2025 and a final version is expected by 31 December 2026. Member States' buildings component in their SCPs is solely focused on the investment schemes, lacking structural measures.[41] Almost all of the investment schemes are exclusively grants, and NSCPs lack consideration of other financial instruments.

Analysed Member States lack an explicit link (except Poland) to the air quality improvements. No analysed draft plan includes specific data on the impact of investments on air quality improvement and pollutant reduction (such as PM 2.5 and PM 10) – which showcases a genuine quantitative gap.

Recommendation: Member States should pursue the evaluation of pollutant reduction from investments. This will unlock a better understanding of the NSCP impact beyond energy and climate, and the quantification of health and wellbeing benefits from the specific investments.

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[40] https://eur-lex.europa.eu/eli/reg/2023/955/oj/eng Article 15

[41] Commission Notice Guidance on the Social Climate Plans (C/2025/1597) defines measures as actions or structural changes that lead to policy improvement with significant lasting impact, as one of the following: measures based on reforms and commitments in the National Energy and Climate Plans (NECP), remedies for areas of insufficient ambition in the NECP, measures different from investments (such as those tackling information, education, awareness, behavioural changes).

COUNTRY-SPECIFIC RECOMMENDATIONS

Bulgaria

On **clarity of targeting**, an explicit prioritisation hierarchy should be introduced to ensure that the most vulnerable households are identified and supported first.

Concerning **specificity of building-related measures**, intervention packages should be prioritised over isolated actions, making deeper and more comprehensive renovations more attractive to undertake.

For **support mechanisms**, grant levels need to be clearly defined in line with different vulnerability levels. In addition, technical assistance should be strengthened to provide building users with clear, practical guidance on how to access and benefit from NSCP funds to improve their home's energy performance.

With regard to **integration with social policy**, stronger referral mechanisms between social services and renovation programme actors should be established to accelerate the identification of eligible households and facilitate timely renovation works.

Finally, with respect to **monitoring and evaluation indicators**, clear indicators and monitoring frameworks should be set up to assess the effectiveness of the NSCP in addressing energy vulnerability.

Recommendations on effectiveness of measures: Certain investment schemes (K1. A.I1 and K1. B.I2) can benefit from higher values for support provision. These investments include requirements for the minimum energy savings that should be achieved (Investment 1 requires a 30% reduction in primary energy consumption) and energy generated for buildings occupied by vulnerable households (30% of energy generated should be directed to energy-poor households) as criteria. This is a positive addition; however, the values included are comparatively low. To incentivise deeper renovation and more support for vulnerable households, higher values can be considered or tiered support can be provided.

Italy

On **clarity of targeting**, vulnerability criteria should be harmonised across all measures to ensure consistent prioritisation, with aligned eligibility thresholds and clearly defined vulnerability tiers. The connection to the ISEE indicator (M.3, M.5) can be scaled to other measures (M.2) to ensure better focus on vulnerable households.

For **specificity of building-related measures**, standardised energy efficiency packages for buildings hosting vulnerable households should be developed to simplify implementation and make renovation processes more efficient for contractors.

Concerning **support mechanisms**, explicit and differentiated grant levels should be introduced to improve transparency and encourage deeper, long-lasting energy efficiency interventions.

Regarding **integration with social policy**, data-sharing frameworks should be enabled to allow authorities, welfare institutions and contractors to exchange information on eligibility and grants.

On **monitoring and evaluation indicators**, output indicators should be introduced to track the effectiveness of measures addressing vulnerability, such as the percentage of beneficiaries who exit vulnerability status.

For **effectiveness of measures**, renovation depth can be incentivised by increasing the requirement for the primary energy reduction beyond 30%, and by using a tiered approach with more funding for deeper renovations (M.2). Moreover, renovation depth can be applied to other schemes (it is only present in M.2).

Poland

Concerning **clarity of targeting**, a unified vulnerability definition should be applied consistently across renovation and income support measures. Additionally, automatic prioritisation of income support beneficiaries for renovation measures should be established to ensure that those qualified to receive energy bill relief can benefit.

In terms of **specificity of building-related measures**, the creation of simplified, standardised energy efficiency packages with full grant coverage for the lowest-income households to reduce administrative and technical complexity is recommended, as it would provide relief faster to those most in need.

On **support mechanisms**, vulnerability tiers to streamline applicant access need to be defined, and bureaucratic procedures for applicants should be clarified with a guide or a map to help them navigate their renovation path.

With respect to **integration with social policy**, coordination between renovation programme enactors and social assistance centres needs to be formalised, and a mechanism to systematically screen eligible households for renovation support should be established (this is not yet formally defined in the draft NSCP).

With regard to **monitoring and evaluation indicators**, a minimum renovation performance threshold to better assess the effectiveness of the implemented renovation measures would increase rigour and provide valuable feedback for future endeavours.

Recommendations on **effectiveness of measures**:

- I.5 specifies the training of professionals should be done over two days; however, this would benefit from the inclusion of follow-up training activities and refreshers to trained people to ensure continued educational support.
- I.8 would be improved with an indication of the amount of energy generated through energy communities dedicated to vulnerable households, similar to Investment 2 in Bulgaria's draft SCP.

Romania

In terms of **clarity of targeting**, a precise definition of vulnerable households should be established and be used for eligibility purposes in all the measures, as a conceptual definition does not suffice. Also, the introduction of prioritisation rules within renovation programmes to maximise their impact in tackling vulnerability would be useful. The lack of clear targeting for vulnerable households in the NSCP (thus assuming equal distribution of its funds across the whole residential building stock) means it is only on course to renovate 3% of the vulnerable household building stock, which is very low.

With regards to the **specificity of building-related measures**, clear requirements should be set for minimum renovation depth and efficiency gains (such as capacity of installed heating systems) to maximise their impact.

On **support mechanisms**, the integration of technical assistance for vulnerable households would be very helpful to them, but it is lacking in the current draft.

For **integration with social policy**, coordination with social welfare institutions should be formalised in order to quickly identify potential beneficiaries; and cross-stakeholder data-sharing frameworks should be enabled to allow for faster administrative processing of funding.

Finally, on **monitoring and evaluation indicator**s, introducing KPIs would allow the effect of the implemented measures on tackling vulnerability to be measured, and for the success of the interventions to be determined.

CONCLUSIONS AND EU-LEVEL RECOMMENDATIONS

THE ETS2 AND SCF ARE IMPORTANT ELEMENTS OF THE SOCIALLY FAIR DECARBONISATION OF EUROPE'S BUILDING STOCK. WHILE THEIR ORIGINAL INTENT WAS DECARBONISATION, THEIR IMPLEMENTATION IS COMING AT A TURNING POINT IN EUROPEAN AND GLOBAL POLICY.

In the last five years, the EU has been exposed to two major energy crises. The Russian invasion of Ukraine in 2022 saw record energy prices for the EU, especially for fossil fuels. The US and Israel's war on Iran in 2026 reaffirmed the EU's vulnerability to international fossil energy imports, even after numerous actions had been taken to mitigate the former crisis. The two crises affected European industry, transport and households. The buildings hosting vulnerable households in energy poverty – often the worst-performing buildings – are the most exposed to energy crises. It is clear that the transition towards better-performing buildings relying on clean heat should happen now, or Europe will pay more later. Preserving the ETS2 coupled with the SCF is essential for energy security.[42]

In the AccelerateEU Communication, the European Commission called on Member States to protect consumers from price shocks through various measures, including supporting heat pump installations and building renovations.[43] It highlighted that Member States should make use of the EIB's ETS2 Frontloading Facility (which none of them have yet done) for accelerating such measures, and reiterated the need for Member States to consider SCF allocations to protect vulnerable groups.[44] This analysis is therefore a timely input to help assess whether focus countries' draft NSCPs reach this objective, and how they could be further improved.

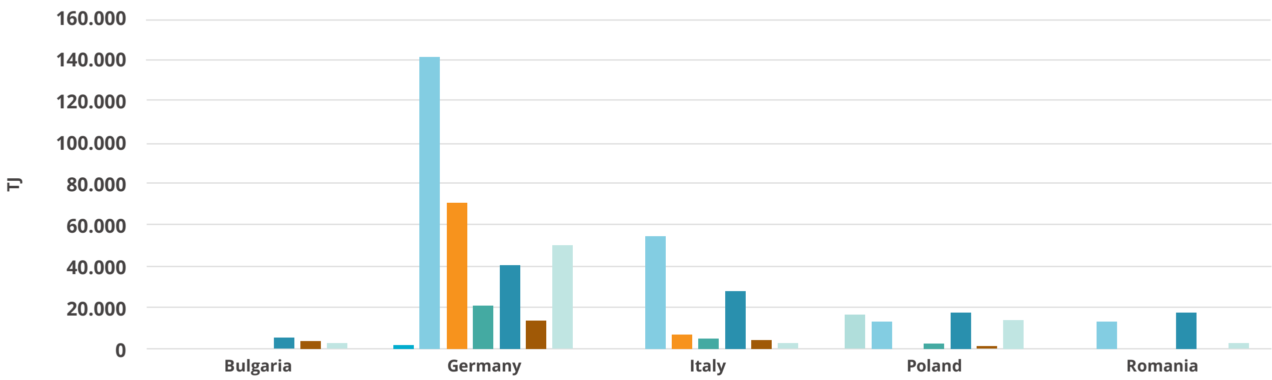
Moreover, energy prices are closely tied to housing affordability and the cost-of-living crisis, which are issues of European relevance. In the European Affordable Housing Plan, published in December 2025, the European Commission clearly indicated that energy costs constitute a major share of households' living costs, and that additional investments should be mobilised through the Social Climate Fund towards affordable and sustainable housing.

[42] https://www.ecb.europa.eu/press/blog/date/2026/html/ecb.blog20260407~dfa96b8bfc.en.html
[43] https://energy.ec.europa.eu/document/download/870a9953-098f-43a4-8081-157762a85da9_en?filename=Annex.pdf
[44] https://energy.ec.europa.eu/document/download/7fac9eea-5717-4182-a368-bd68c427ff4c_en?filename=Communication.pdf

EU policymakers are advised to:

- Ensure that the ETS2 framework is protected against any further delay, postponement or lowering of ambition, in view of the postponement of ETS2 until 2028, and the upcoming comprehensive review of the ETS and Market Stability Reserve in 2026.
- Support the implementation of relevant elements of the Fit-for-55 package, such as the Energy Performance of Buildings Directive, Ambient Air Quality Directive, Energy Efficiency Directive and Renewable Energy Directive.
- Use the upcoming initiative on heating and electrification to further support the transition away from fossil-fuel heating in buildings for all societal groups, especially vulnerable households.
- Negotiate the next Multiannual Financial Framework that can direct more money towards supporting decarbonisation for vulnerable households and work together with NSCPs, for example by creating a dedicated Heating and Cooling Facility.

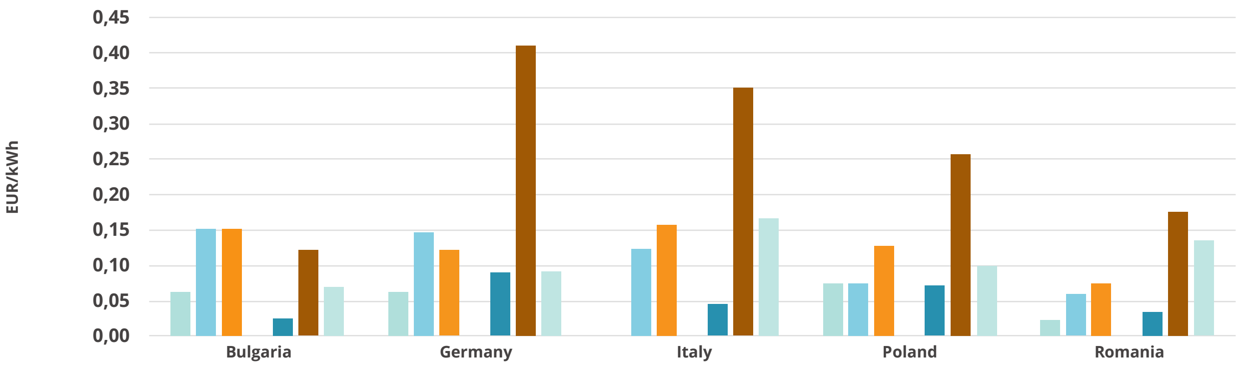
ANNEX



	Bulgaria	Germany	Italy	Poland	Romania
Coal	136,38	2.285,72	0,00	16.815,50	274,67
Natural gas	651,32	142.088,01	54.610,05	13.300,19	13.045,28
Oil	8,52	71.699,57	6.632,74	554,35	315,34
RES	138,06	21.111,99	5.013,37	2.748,85	3,00
Wood	5.604,12	40.711,55	28.217,45	17.845,42	17.898,07
Electricity	3.748,35	13.641,07	4.148,17	746,72	193,92
DH	2.892,72	24.592,42	2.925,98	14.446,33	3.455,03

Coal · Natural gas · Oil · RES · Wood · Electricity · DH

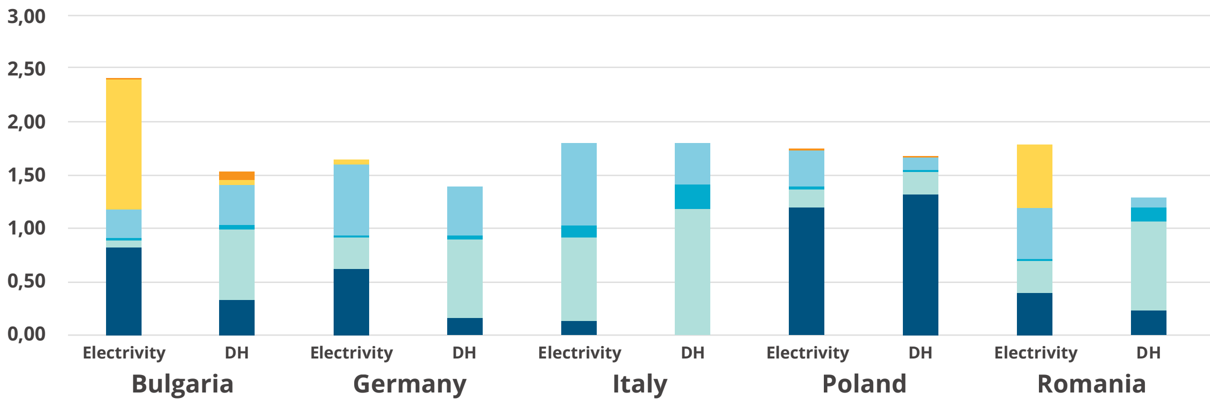
Figure A – 1: Delivered energy to vulnerable households



	Bulgaria	Germany	Italy	Poland	Romania
Coal	0,06	0,06	0,00	0,08	0,02
Natural gas	0,15	0,15	0,12	0,08	0,06
Oil	0,15	0,12	0,16	0,13	0,08
RES	0,00	0,00	0,00	0,00	0,00
Wood	0,03	0,09	0,04	0,07	0,04
Electricity	0,12	0,41	0,35	0,26	0,17
DH	0,07	0,09	0,17	0,10	0,15

Coal · Natural gas · Oil · RES · Wood · Electricity · DH

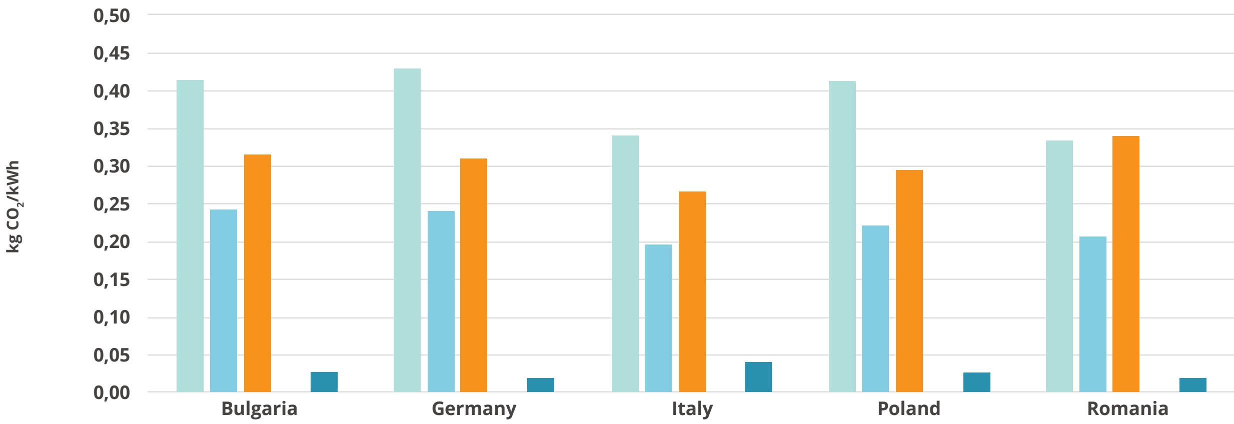
Figure A – 2: Prices of delivered energy, per kWh



	Bulgaria Electrivity	Bulgaria DH	Germany Electrivity	Germany DH	Italy Electrivity	Italy DH	Poland Electrivity	Poland DH	Romania Electrivity	Romania DH
Heat	0,00	0,08	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Nuclear	1,21	0,05	0,04	0,00	0,00	0,00	0,00	0,00	0,58	0,00
RES	0,28	0,37	0,66	0,46	0,78	0,32	0,34	0,11	0,50	0,10
Oil	0,01	0,04	0,02	0,03	0,11	0,22	0,02	0,02	0,01	0,13
Natural gas	0,07	0,66	0,29	0,74	0,77	0,18	0,18	0,21	0,30	0,84
Coal	0,82	0,33	0,63	0,16	0,14	0,00	0,19	1,32	0,40	0,23

Coal Natural gas Oil RES Nuclear Heat

Figure A – 3: Primary energy conversion factors for electricity and district heating production



	Bulgaria	Germany	Italy	Poland	Romania
Cool	0,41	0,43	0,34	0,41	0,33
Natural gas	0,24	0,24	0,20	0,22	0,21
Oil	0,32	0,31	0,27	0,30	0,34
RES	0,00	0,00	0,00	0,00	0,00
Wood	0,03	0,02	0,04	0,03	0,02

Coal Natural gas Oil RES Wood

Figure A – 4: CO_2 emissions per energy carrier

Pollutant emission factors, g/GJ	Coal	Natural gas	Oil	Wood
PM2.5	220	0.9	3.0	60
PM10	240	0.9	3.0	60

Table A – 1: Pollutant emission factors per energy carrier

Data sources

In order to prepare this report, a large number of sources were consulted and used as inputs for the numerous calculations performed to determine the scenario outcomes. As they have been extensively applied across the project (and thus cannot be exclusively attributed to any specific part of it), the main sources are listed below.

- Eurostat
- Hotmaps building stock database
- EASI ZERo working files data (insulation materials data, primary energy factors, emissions factors)

Also, the sources used to determine energy prices for the scenario calculations are presented in the following table, per target country. Proxies were used in some cases when data from one country was not available.

Country	Sources
BULGARIA	https://www.nsi.bg/
	https://tradingeconomics.com
	https://toplo.bg
	EASI ZERo metadata
GERMANY	https://www.heizbrikett.de
	EASI ZERo metadata
ITALY	https://www.aimag.it
	EASI ZERo metadata
POLAND	http://www.cena-pradu.pl
	EASI ZERo metadata
ROMANIA	https://carbuni-brichete.ro
	https://www.eon.ro
	https://ecombustibil.ro
	https://vandlemndefoc.ro
	https://economisi.ro
	https://www.libertatea.ro

Table 27. Data sources used to determine energy prices for the target countries

Last but not least, any other source consulted to carry out this project that has already been mentioned in the sections above is not repeated here. This is the case for sources supporting analysis of the results, for example.

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