Priority measures for energy efficiency in buildings

Discussion paper on energy poverty, energy sufficiency and deep renovation in the Western Balkans

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Executive summary

Energy efficiency is one of the most effective and affordable ways to reduce energy use, strengthen energy security and improve well-being. In the Western Balkans it is also an essential social policy. Buildings account for more than 40% of final energy consumption[1] and much of the housing stock, both old and new, is poorly insulated, inefficient and reliant on outdated heating systems.

The region's energy intensity remains around three times higher than the European Union average even though per capita consumption is significantly lower, showing that energy waste rather than energy use is the core challenge.[2]

Three priority interventions are needed to both achieve climate goals and deliver increased well-being for the region's population. The first is addressing energy poverty. Around 20% of the population lives at risk of poverty and many households cannot maintain adequate warmth.[3] Existing subsidies are poorly targeted, with the wealthiest fifth of households receiving a larger share of benefits than the poorest fifth of households.[4]

The second priority is embedding energy sufficiency in policy design. Efficiency alone will not reduce absolute demand, because rebound effects can eliminate more than half of expected savings. The Western Balkans are particularly vulnerable to this effect given low baseline consumption and comparatively low energy prices. Sustained sufficiency measures, combined with clear communication, can normalise energy saving and ensure that efficiency improvements are not cancelled out by replicating over-consumption as seen in the EU.

The third priority is deep renovation. Comprehensive upgrades to building envelopes and heating, cooling and lighting systems deliver transformative energy reductions. A study on multi-apartment buildings in Serbia shows that deep renovation can reduce heating demand by between 68 and 80%.[5] Renovation also improves comfort, lowers bills and creates local employment. Energy audits, coordinated decision-making in multi-apartment buildings and national programmes for worker reskilling are essential to scale these benefits.

[1] Energy Community Secretariat, Discussion Paper on Riding the Renovation wave in the Western Balkans Proposal for boosting energy efficiency in the residential building sector, Energy Community, 3, 2021.

[2] Sandra Esser, Sabrina Schulz, Ada Amon et al., High Carbon Lock-In Vs. Low Carbon Opportunity in The Western Balkans: Critical Investments and the EU Accession Process, E3G, 14, 2018.

[3] OECD, Social protection: Enabling the energy transition in the Western Balkans, In Energy Prices and Subsidies in the Western Balkans: Reforms for a Fair and Green Future, OECD Publishing, 2025.

[4] Ibid.

[5] Bojana Lević, Ljiljana Đukanović, Ana Radivojević et al., Potentials for a complex and integrated refurbishment of post-war housing stock of Serbia, Energy Efficiency, 16(8), 93, 2023.

Together, these priorities create a pathway for reducing energy demand, strengthening energy security, tackling inequality and advancing just climate action. The Western Balkans have the opportunity to pursue a development model that raises well-being without reproducing the high consumption patterns of other European economies. Although delivering this vision will require sustained political commitment, such a holistic approach to energy efficiency can improve the living standards of the region's population while remaining within planetary boundaries.

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Introduction

Energy efficiency, at its core, is about using less energy to achieve the same or better outcomes, making it one of the most effective, affordable, and immediate strategies for reducing energy consumption as well as climate and environmental impact. It is often referred to as the 'first fuel,'[6] representing the cleanest and cheapest source of energy – the one that does not need to be produced. For this reason, energy efficiency is 'the single largest measure to avoid energy demand' in the International Energy Agency's (IEA) Net Zero Emissions by 2050 Scenario.[7] As global energy demand continues to rise, improving efficiency is fundamental to enhancing energy security, strengthening economic resilience, and accelerating progress toward climate goals. Indeed, this is reflected by the 'energy efficiency first' principle, established by the EU's Energy Efficiency Directive, which highlights the need to consider energy efficiency across all relevant policy and investment decisions.[8]

Buildings are a strategic priority for energy-efficiency policy, accounting for roughly 30% of global final energy use and 26% of energy-related CO_2 emissions. That makes them among the largest single levers to reduce energy demand and emissions.[9] Beyond this, building upgrades can improve social outcomes by lowering household bills, reducing exposure to price shocks, and improving indoor comfort and health. Such outcomes are crucial for low-income and vulnerable households and can strengthen public support for the wider green transition. Despite its clear benefits, energy efficiency in buildings remains far below its potential, with many regions still lagging in implementation and enforcement. A large number of existing buildings are poorly insulated and equipped with inefficient systems, yet retrofitting rates remain too slow to meet climate and energy targets.

These problems are especially acute in the Western Balkans, where building stock quality remains poor and presents a serious barrier to saving energy and advancing the well-being of residents. The building sector accounts for the largest portion of final energy consumption in the region, with residential buildings accounting for 30 to 60%, compared to 40% in the EU.[10] Many homes still rely on outdated heating systems and lack basic insulation or performance upgrades, leading to high energy losses.[11] Although the region's authorities have recognised the need for 'building renovation waves' and adopted energy-efficiency

[6] International Energy Agency, Energy Efficiency, 2024.

[7] Ibid.

[8] European Commission, Directive (EU) 2023/1791 of the European Parliament and of the Council of 13 September 2023 on energy efficiency and amending Regulation (EU) 2023/955, EUR-Lex, 2025.

[9] International Energy Agency, Buildings, 2023.

[10] Barbara Frey, The Energy Transition in the Western Balkans: The Status Quo, Major Challenges and How to Overcome them, 14, The Vienna Institute for International Economic Studies, 2024.

[11] Džana Kadrić, Amar Aganović, Ajdin Vatreš et al., Optimizing Investment-Efficient Renovation Strategy for Sustainable Building Stock: A case study of Bosnia and Herzegovina, Sustainable Cities and Society, 2025.

legislation in some places, implementation has been slow.[12] As a result, the vast potential for energy savings remains untapped, leaving many households facing a cycle of high bills, ill health and carbon-intensive heating. Focused intervention is needed to deliver the greatest improvements in building energy performance with measures ranging from low-cost behavioural and operational changes to targeted upgrades of insulation, heating systems, appliances and smart controls.

By optimising technologies, practices and systems across economic sectors, energy efficiency cuts waste, lowers costs and reduces greenhouse gas emissions while increasing human well-being. Crucially, however, all three aspects need to be considered in order to achieve the most optimal results. This discussion paper focuses on interventions in energy efficiency measures which should be considered a priority due to their effectiveness, combined with their good value for investment and their wider social benefits. It zooms in on the building sector in the Western Balkans through a holistic approach and systems thinking. By focusing on interventions that are both material and social, the brief provides a clear roadmap for reducing energy consumption, lowering household costs, improving comfort, and supporting broader climate and energy security goals in the Western Balkans. In doing so, it identifies three priority areas for national and international policymakers, from both the technical and the social perspective: tackling energy poverty, centring energy sufficiency in policy design and advancing deep renovation.

Photo: rb.fzz, Flickr,CC BY-NC-SA 2.0

[12] Energy Community Secretariat, Discussion Paper on Riding the Renovation wave in the Western Balkans Proposal for boosting energy efficiency in the residential building sector, 2021.

Background: energy efficiency in the EU and in the Western Balkans

Globally, energy efficiency improvements are significantly lacking, with efficiency gains in 2025 (measured through changes in primary energy intensity) in major economies such as the United States and the EU projected to slow to below 1% annually. This is far below both the long-term average of around 2% between 2010 and 2019 and the COP28 target of a 4% annual improvement needed to stay aligned with global climate goals.[13] A recent report from the International Energy Agency identifies four main factors preventing meaningful progress on energy efficiency:[14]

1. **Industry is responsible for roughly two-thirds of global growth in final energy demand, undermining efficiency advances in other sectors.** Industrial energy intensity has improved by less than 0.5% per year in recent years, while energy use has continued to rise.
2. **Regulation has not kept pace with technology.** Many products on the market perform far below the most efficient models available because minimum performance standards have not been regularly updated.
3. **Demand for cooling is rapidly growing.** As the climate is warming, air conditioners are driving up electricity consumption at one of the fastest rates of any building sector end use.
4. **Electricity demand is rising faster than renewable energy supply.** This has pushed primary energy demand upward, leading to an increase in fossil fuel generation and slowing progress on energy intensity improvements.

Despite the slowing progress, the EU's action on energy efficiency has been considered a success story, particularly thanks to key legislation such as the Energy Efficiency Directive, the Energy Performance of Buildings Directive, and the Ecodesign and Energy Labelling Regulations.[15] Between 2013 and 2023, primary energy consumption in the EU decreased by 12.6%.[16] Yet to continue this trend and to achieve meaningful progress in energy efficiency, what is needed are not only technological advancements, but also changes to energy systems and the ways energy is being used, in order to tackle the uncontrolled growth in energy demand. Technological improvements in energy efficiency alone are not only lacking but also insufficient to achieve the global need to tackle the climate crisis.

Zooming in on the Western Balkans and the buildings sector, a particularly relevant factor is the growing demand for cooling. As the Western Balkans is a region highly vulnerable to the climate crisis, with the

[13] International Energy Community, Executive summary – Energy Efficiency 2025, 2025.

[14] Ibid.

[15] The Coalition for Energy Savings, Energy Efficiency Delivers: Turning Policy into Impact, 2025.

[16] Eurostat, Energy efficiency statistics, 2025.

intensity and frequency of heat waves increasing,[17] the demand for cooling can be expected to play a substantial role in the future.

Moreover, as a region with a highly inefficient building stock, as well as relatively low energy prices and per capita energy consumption, it will also be particularly vulnerable to the rebound effect (see the box below) if technological improvements in energy efficiency are not implemented through a holistic approach. The following subsection describes the building sector in the Western Balkans, highlighting how energy efficiency improvements could have a significant positive impact on energy poverty, living standards, and health and well-being.

Rebound effect

Rebound effect refers to the phenomenon where improved energy efficiency leads to smaller energy savings than would result from the energy efficiency measures alone. It refers to a range of consumer and market practices that lead to an increase in energy use due to, in effect, a decrease in price per unit of energy services.[18] In other words, achieved savings in energy use may be significantly smaller than forecasted reductions.[19]

Depending on the type of measure and scale of analysis, the increase in energy use as a result of the rebound effect may vary from being negligible to exceeding the levels before energy efficiency measures. This extreme form of rebound effect, where higher efficiency leads to an increase in resource consumption, is also known as the Jevons paradox. Recent evidence suggests that an economy-wide rebound effect can erode more than 50% of the energy savings expected from energy efficiency measures.[20]

[17] Claudio Belis, Djordje Djatkov, Srdan Dobricic et al., Status of Environment and Climate in the Western Balkans, Publications Office of the European Union, 2024.

[18] Lorna A. Greening, David L. Greene, Carmen Difiglio, Energy efficiency and consumption—the rebound effec—a survey, Energy Policy, 28(6-7), 389–401, 2000.

[19] Kenneth Gillingham, David Rapson, Gernot Wagner, The rebound effect and energy efficiency policy. Review of environmental economics and policy, 2016.

[20] Paul E. Brockway, Steve Sorrell, Gregor Semieniuk et al., Energy efficiency and economy-wide rebound effects: A review of the evidence and its implications, Renewable and Sustainable Energy Reviews, 141, 2021.

Buildings in the Western Balkans

The buildings sector in the Western Balkans is responsible for over 40% of overall energy consumption,[21] making it the largest final energy consumer.[22] Energy efficiency thus has significant potential in the region, with possible energy savings estimated up to 35% in households and 40% in the public sector,[23] yet the estimates vary, with some studies tracing the potential to be more than 50%.[24]

Globally, space heating is responsible for 12% of energy use and space cooling for 2% of energy use,[25] with cooling representing the fastest growing use of energy in buildings.[26] This is particularly relevant in the Western Balkans, where an increase in air conditioning has caused major power outages during the summer months.[27] Although cooling does not yet form a significant part of household energy consumption,[28] the trend is evidenced by a 400% increase in air-conditioning unit imports in Kosovo between 2019 and 2024, as well as by stress on regional electricity grids during recent heatwaves.[29] *Although formal regional projections for cooling energy demand remain limited in public datasets, official heating and cooling assessments are now being integrated into national energy planning frameworks to address this emerging challenge.*[30]

The most commonly used energy source in the residential sector is biomass, representing around 45% of consumption in 2020, and it supplies over 60% of heating energy across all countries in the region except Albania.[31]

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[21] Energy Community Secretariat, Discussion Paper on Riding the Renovation wave in the Western Balkans Proposal for boosting energy efficiency in the residential building sector, 3, 2021.

[22] Barbara Frey, The Energy Transition in the Western Balkans: The Status Quo, Major Challenges and How to Overcome them.

[23] Sandra Esser, Sabrina Schulz, Ada Amon et al., High Carbon Lock-In Vs. Low Carbon Opportunity in The Western Balkans: Critical Investments and the EU Accession Process, 22.

[24] Energy Community Secretariat, Discussion Paper on Riding the Renovation wave in the Western Balkans Proposal for boosting energy efficiency in the residential building sector, 4.

[25] Harry Kennard, Tadj Oreszczyn, Malcolm Mistry et al., Population-weighted degree-days: The global shift between heating and cooling, Energy and Buildings, 271, 2022.

[26] International Energy Agency, The Future of Cooling: Opportunities for energy-efficient air conditioning, 2018.

[27] Fatos Bytyci, Ivana Sekularac, Balkans' new love for air conditioning strains grid as temperatures soar, Reuters, 2024.

[28] RES Foundation, Tackling the immediate challenges of energy poverty in the Western Balkans: The possible role for the EU, Greens/EFA in the European Parliament, 28, 2023.

[29] Fatos Bytyci, Ivana Sekularac, Balkans' new love for air conditioning strains grid as temperatures soar.

[30] Energy Community, Momentum builds across the Western Balkans on heating and cooling decarbonization, with Montenegro joining the effort, 2025.

[31] RES Foundation, Tackling the immediate challenges of energy poverty in the Western Balkans: The possible role for the EU.

Despite low overall consumption per person, energy use per square metre remains high, spanning from around 169 kilowatt hours per square metre (kWh/m^2) in the residential sector in Montenegro[32] to above 200 kWh/m^2 in Bosnia and Herzegovina.[33] Energy productivity lags significantly behind the EU, with the Western Balkan countries reaching on average around 35% of the EU average, Albania reaching the highest energy productivity of almost 60% of the EU average, and Bosnia and Herzegovina and Kosovo the lowest of around 25% of the EU average.[34] Residents spend a significant share of their disposable income on electricity and heating bills and lack the resources to renovate, creating a cycle of high consumption, low comfort and persistent energy poverty. Such a context makes large-scale, long-term renovation not only necessary for achieving climate goals, but also central to improving the living standards and energy security in the region.

Multi-apartment buildings represent an important part of the housing stock, accounting for 43% of dwellings in Albania, 46% in Bosnia and Herzegovina, 23% in Kosovo (and 60% in Pristina), 42% in North Macedonia, 39% in Montenegro, and 27% in Serbia. On average, 39% of homes in the region are in multi-apartment buildings, while 61% are detached houses.[35] Yet residential buildings across the Western Balkans share a common legacy of neglect, and the deregulation of rapid urban development[36] is creating a new stock of low quality, poorly insulated housing. Older buildings have standardised designs with outdated heating systems that depend on solid fuels. Additional issues include a lack of clear ownership and management of the buildings as well as regulatory and legal barriers to building upgrades. Uncontrolled urban growth without proper spatial planning has privileged private investment in controversial new urban development[37] rather than strategic renovations of the existing building stock. Across the Western Balkans, most people living in multi-apartment buildings are also the owners of their flats, and collective decision-making on efficiency measures can be challenging.

Yet the Western Balkan countries have relatively low per capita emissions – at around a third of the EU average – whereas energy consumption per capita is about half of that in the EU.[38] The main issue is high energy intensity (three times as high as the EU average), mostly caused by the industrial sector, inefficient

[32] Ministry of Energy and Mining, Montenegro, National Energy and Climate Plan of Montenegro, Energy Community, 194, 2025.

[33] Energy Community Secretariat, Discussion Paper on Riding the Renovation wave in the Western Balkans Proposal for boosting energy efficiency in the residential building sector, 4; Data from: World Bank, Western Balkans: Directions for the Energy Sector, 2018. More recent data do not appear to be publicly available.

[34] Energy Community Secretariat, WB6 Energy Transition Tracker, 15, 2021.

[35] Energy Community Secretariat, Discussion Paper on Riding the Renovation wave in the Western Balkans Proposal for boosting energy efficiency in the residential building sector, 4.

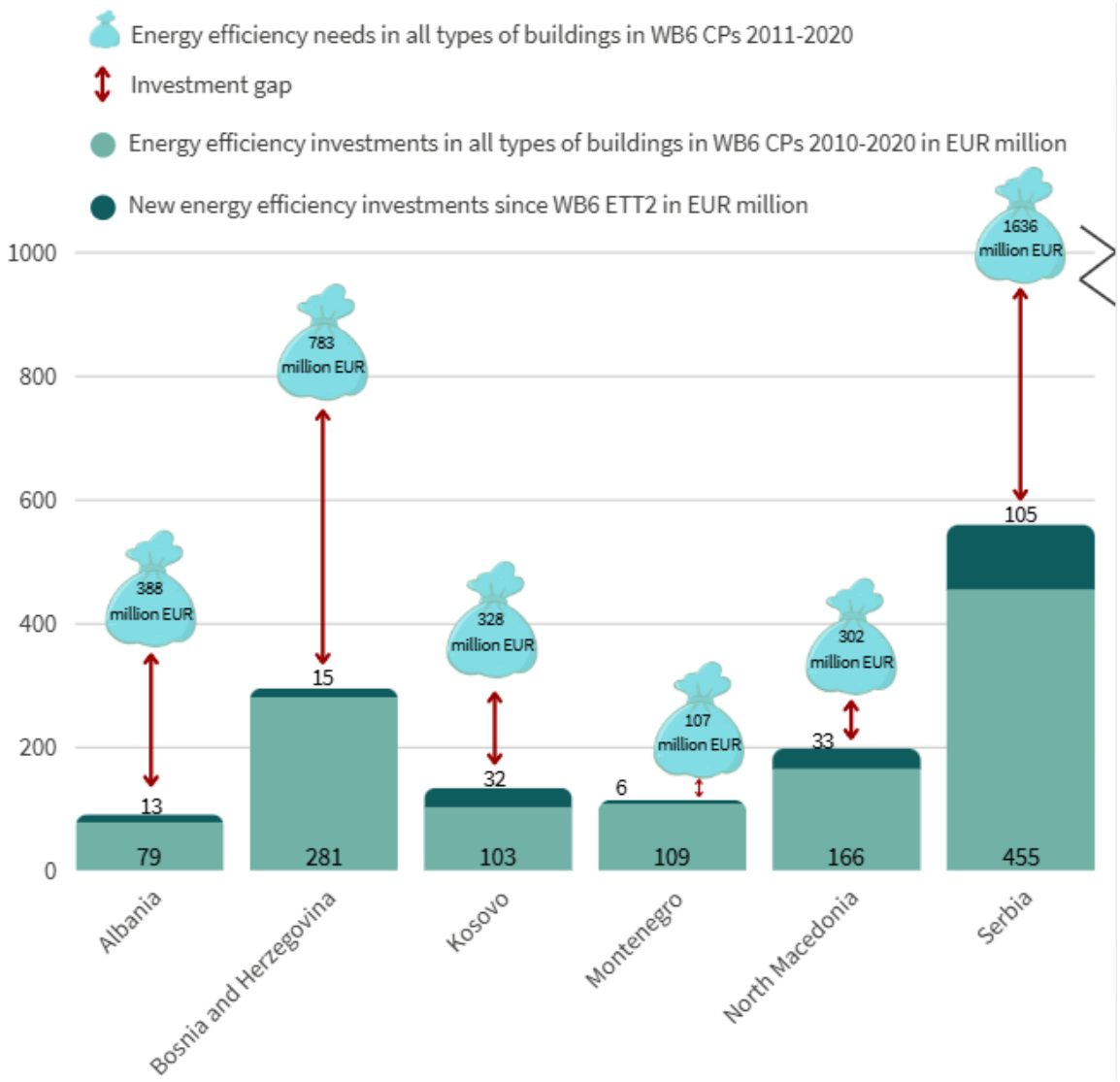
[36] Saša Jovanović, Western Balkan cities: Pressure with no release, CEE Bankwatch Network, 2024.

[37] Rui Alexandre Castanho, Luis Loures, Sergio Lousada et al., Uncontrolled urban growth in Western Balkans territories after the communist collapse—a review from the spatial planning perspective, Journal of Urban Development and Management, 1(2), 2022.

[38] Sandra Esser, Sabrina Schulz, Ada Amon et al., High Carbon Lock-In Vs. Low Carbon Opportunity in The Western Balkans: Critical Investments and the EU Accession Process, 14.

technology, the continuous use of lignite, and high energy losses.[39] While the investment gap remains significant (see Figure 1), regional analyses confirm very high untapped savings through energy efficiency, meaning large reductions in energy use are technically feasible and can be achieved with ambitious policies.[40]

Figure 1. Investment gap in energy efficiency in building programmes.[41]



The following section outlines three areas related to energy efficiency where policy intervention should be a priority in order to enable Western Balkan countries to improve the lives of their citizens as well as to leapfrog towards long-term sustainability.

[39] Ibid.

[40] Jas Singh, Dilip Limaye, Kathrin Hofe, Scaling Up Energy Efficiency in Buildings in the Western Balkans: Interim Report, World Bank, 2013.

[41] Energy Community Secretariat, WB6 Energy Transition Tracker, 16.

Three priority areas of intervention

This discussion paper defines three areas which should be considered a priority when it comes to energy efficiency in buildings. Outlining a holistic approach, it addresses not only the physical and material importance of deep renovation and insulation, but also the social aspects that include behavioural change through a focus on sufficiency and the emphasis on tackling energy poverty and creating jobs. Each priority area is followed by concrete and targeted priority actions.

The priority areas of intervention are tackling energy poverty, centring energy sufficiency and advancing deep renovation.

1. Energy poverty

Energy poverty is a pressing social and economic problem in the region: it undermines health and education outcomes, increases vulnerability to price shocks, and can even weaken public support for green transitions.[42] Energy efficiency in buildings is thus not only a part of climate action but also a social protection and public health measure.[43] In 2024, 23.2% of the population in the region lived with incomes below 60% of the national median after social transfers, placing them at risk of poverty.[44] Energy poverty adds to this vulnerability.

Given that many households in the Western Balkans warm their houses at least partially by using electrical resistance heaters, electricity prices can exacerbate energy poverty. Even with relatively low electricity tariffs, using 5,000 kWh a year (the typical consumption of a household in the region) amounts to 7.9% of GDP per capita, compared with an EU average of 4.5%.[45] As a result, many families struggle to heat their homes adequately, fall behind on utility payments, live in poor housing conditions, and are unable to renovate.

The share of households unable to keep their homes adequately warm is as high as 40% in Kosovo, 33% in North Macedonia, and around 10% both in Serbia and Montenegro,[46] while other sources estimate that as much as 40% of the population across the Western Balkan countries may suffer from energy poverty.[47] While definitions vary across the region, in the EU in 2022, the average share of people reporting they could not

[42] Syed Asad Hussain, Faran Razi, Kasun Hewage, K. et al., The perspective of energy poverty and 1st energy crisis of green transition, Energy, 275, 2023.

[43] RES Foundation, Tackling the immediate challenges of energy poverty in the Western Balkans: The possible role for the EU.

[44] OECD, Social protection: Enabling the energy transition in the Western Balkans, In Energy Prices and Subsidies in the Western Balkans: Reforms for a Fair and Green Future, 2025.

[45] Ibid.

[46] RES Foundation, Baseline analysis covering household heating options, expenditures and needs in the Western Balkans, 14, 2021.

[47] Sandra Esser, Sabrina Schulz, Ada Amon et al., High Carbon Lock-In Vs. Low Carbon Opportunity in The Western Balkans: Critical Investments and the EU Accession Process, 14.

keep their home adequately warm was about 9.3%,[48] underscoring how acute the problem is in parts of the Western Balkans (see Figure 2).

In other words, households in the Western Balkans suffer more from energy poverty than households in the EU, and they are paying a higher share of their GDP per capita for electricity, even though they use cheaper energy and less of it. The already dire situation would only be exacerbated if the prices of electricity increased to EU levels. If household electricity prices in the Western Balkans were adjusted to match the current EU average, annual electricity spending would rise to the equivalent of 18% of GDP per capita before taxes and levies, and roughly 23% if EU-level taxes were included.[49]

Current support measures are not well targeted, with government subsidies flowing to fossil-fuel-based sources of energy and households which are not necessarily vulnerable, limiting the fiscal space for more effective interventions. Because electricity price support is applied broadly and not targeted to the needs of the most vulnerable groups, the top 20% of households capture 26% of the benefit, while those who need it the most, the bottom 20%, receive only 14%.[50] Additionally, many affected households under-consume energy to save money, sometimes referred to as 'hidden' or 'self-restricted' energy poverty, meaning official spending-based metrics may understate unmet need and health risks. Empirical work demonstrates that low-income households deliberately limit their usage of energy services,[51] meaning that efficiency gains can potentially lead to a rebound effect.

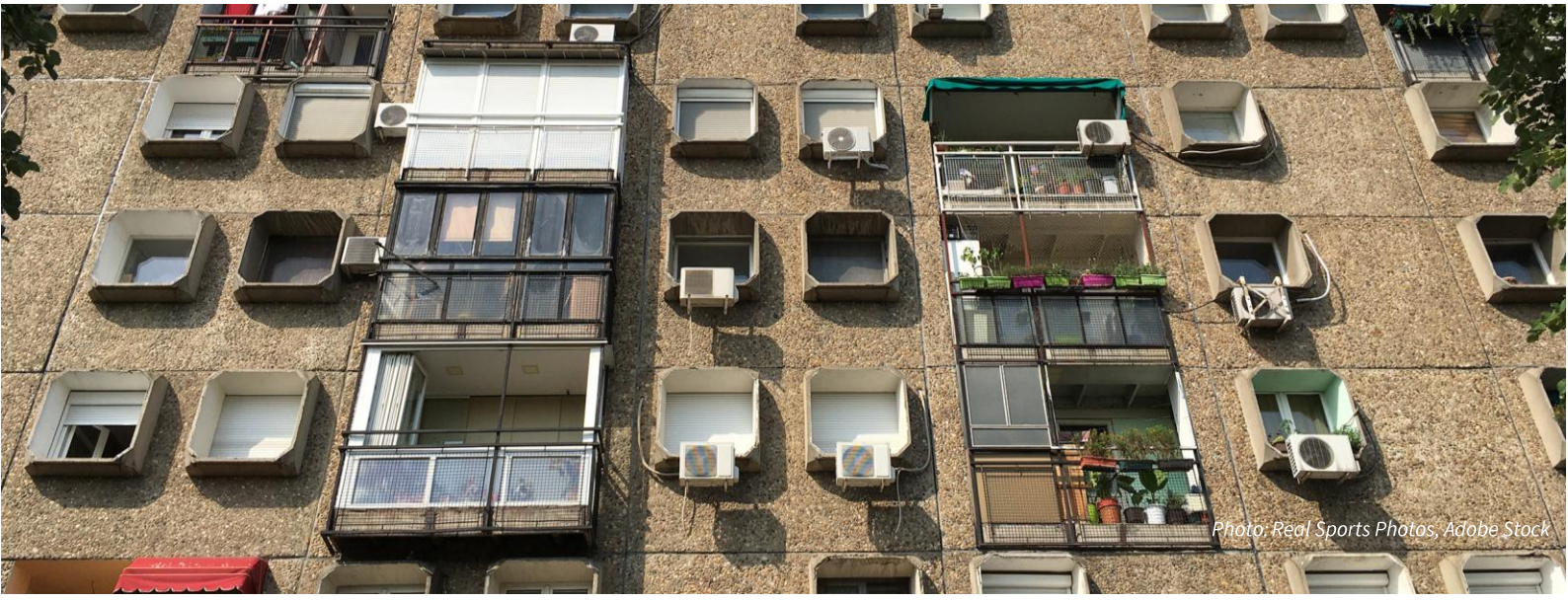


Photo: Real Sports Photos, Adobe Stock

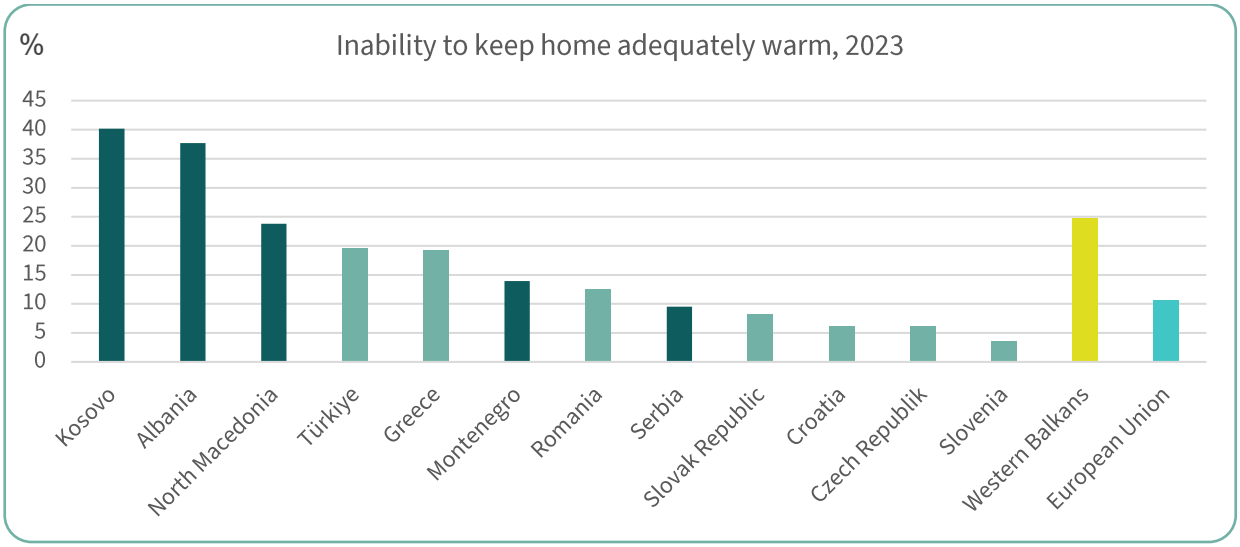
[48] Eurostat, 9% of EU population unable to keep home warm in 2022, 2023.

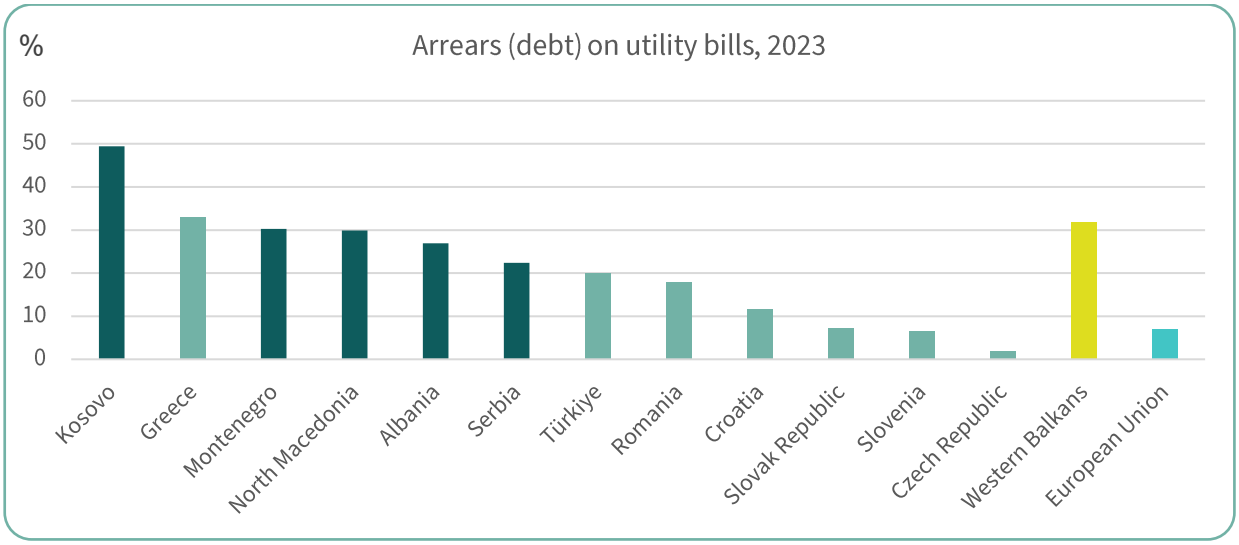
[49] OECD, Social protection: Enabling the energy transition in the Western Balkans, Energy Prices and Subsidies in the Western Balkans: Reforms for a Fair and Green Future.

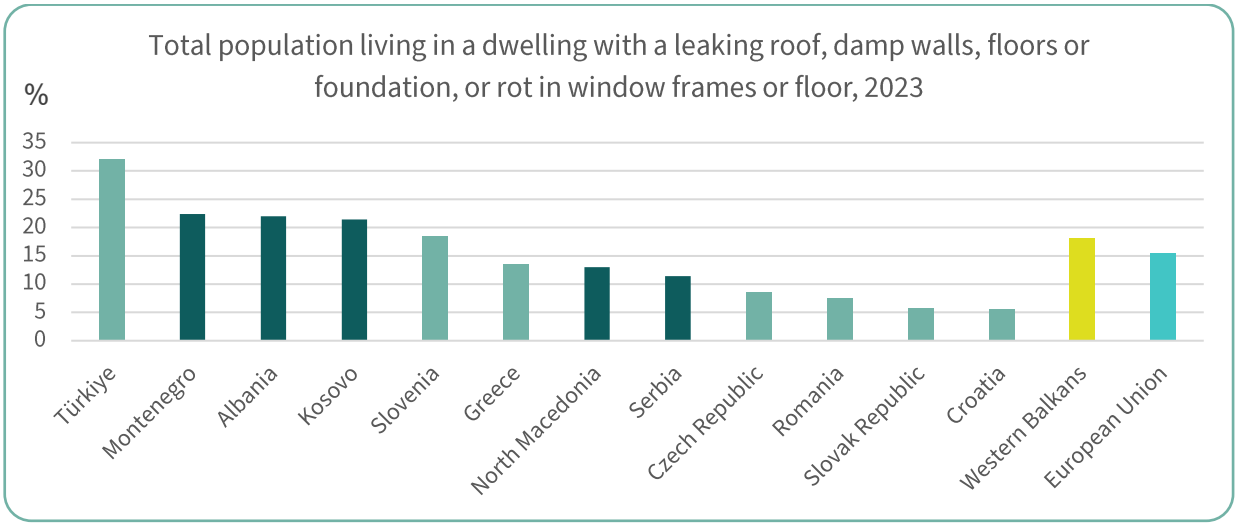
[50] Ibid.

[51] Shuchen Cong, Destenie Nock, Yueming Lucy Qiu et al., Unveiling hidden energy poverty using the energy equity gap, Nature Communications, 13(1), 2022.; Stefan Bouzarovski, Jurica Brajković, Slavica Robić et al., Energy poverty in the Energy Community region: Interrogating policy formulation and coverage, European Urban and Regional Studies, 31(2), 2024.

Figure 2. Subjective indicators of energy poverty in selected countries, including the Western Balkans and the EU average.[52]







[52] OECD, Social protection: Enabling the energy transition in the Western Balkans, Energy Prices and Subsidies in the Western Balkans: Reforms for a Fair and Green Future.

Priority actions on energy poverty

Robust diagnostics and definitions of energy poverty are needed for targeted financial support. Out of the Western Balkan countries, only North Macedonia has developed a methodology for measuring the level of energy poverty in line with EU standards and Energy Community obligations.[53] A clear definition must capture not only households' ability to afford adequate energy services and to access them reliably and safely, but also their ability to invest in improving the energy efficiency of their homes.[54]

As an inherently interdisciplinary issue, energy poverty needs to be tackled across sectors and ministries to address its root causes. When energy poverty is concentrated geographically or socially, oftentimes disproportionately affecting Roma communities,[55] a collective approach of refurbishing entire areas should be prioritised.

Investment in renovation should be prioritised as an energy poverty alleviation measure and as a systemic solution. Tariff relief and vouchers must be well-targeted and combined with structural measures such as long-term investments in building upgrades, clean heating, and local job creation. Well-designed investments in renovations can create local jobs and support economic resilience, meaning that energy efficiency measures can simultaneously tackle emissions, reduce household bills, and stimulate local labour markets if planned holistically.[56]

Photo: Canva

[53] Ministry of Energy, Mining and Mineral Resources of the Republic of North Macedonia, Energy Poverty Methodology – North Macedonia receives clear criteria for vulnerable households for the first time, 2025.

[54] Brenda Boardman, Fixing Fuel Poverty: Challenges and Solutions, Routledge, 2010.

[55] Stefan Bouzarovski, Robert Sarlamanov, Saska Petrova, The governance of energy poverty in Southeastern Europe, Institut Francais des Relations Internationales (IFRI), 2011.

[56] BPIE, Building Renovation: a kick-starter for the EU recovery, Renovate Europe, 2020.

2. Energy sufficiency

Energy sufficiency refers to deliberately reducing energy demand while ensuring that essential needs for comfort, health, mobility and well-being are met. The IPCC defines energy sufficiency as 'a set of measures and daily practices that avoid demand for energy, materials, land and water while delivering human well-being for all within planetary boundaries'.[57]

Energy sufficiency is the key to a more holistic and systemic approach to energy efficiency. Sufficiency-based interventions are low-cost, low-disruption and rapidly deployable, reducing energy demand in absolute terms alongside structural renovation and other efficiency measures.

What is more, sufficiency policies of saving energy have already been proven to bring concrete and significant results if strongly motivated, such as through the EU's voluntary gas demand reduction following Russia's invasion of Ukraine.[58] Similarly, in 2022, the regulatory bodies of Bosnia and Herzegovina, Kosovo and North Macedonia implemented block electricity tariffs where electricity prices varied across consumption tiers, meaning that households paid lower rates for smaller amounts of electricity consumed, while higher usage fell into more expensive blocks.[59] North Macedonia reported an initial 16% decrease in the use of the high tariff electricity with the introduction of block tariffs.[60]

Empirical studies show that a large share of expected energy savings from efficiency can be eroded by economy-wide rebounds. When services become cheaper, consumption tends to grow, and systemic responses can offset gains. A comprehensive global review from 2021 found that economy-wide rebound mechanisms typically erode more than 50% of the anticipated savings from efficiency improvements, and country-level household studies document measurable direct rebounds in heating, lighting and appliance use.[61] Policy design must therefore anticipate and limit rebounds through sufficiency measures that lock in reduced demand. While some increase in consumption might occur to tackle energy poverty, it should not lead to overconsumption that transgresses the limits of human health and well-being.

Global trends in energy growth make the focus on sufficiency ever more urgent. After a period of slower growth, global energy demand accelerated, rising by about 2.2% in 2024 – a rate well above the previous decade's trend – while electricity demand surged even faster.[62] Continuous economic growth is projected to push global energy use substantially higher during this century, driven by data centres, artificial

[57] IPCC, Summary for Policymakers. Climate Change 2022: Mitigation of Climate Change, Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, 2022.

[58] European Commission, REPowerEU - 3 years on, 2025.

[59] Energy Community Secretariat, Policy Guidelines on the energy demand reduction measures in the Energy Community Contracting Parties, 2023.

[60] Сакам Да Кажам, За 16,32 Отсто Намалена Потрошувачката На Скапа Струја Со Воведување На Блок Тарифите, 2022.

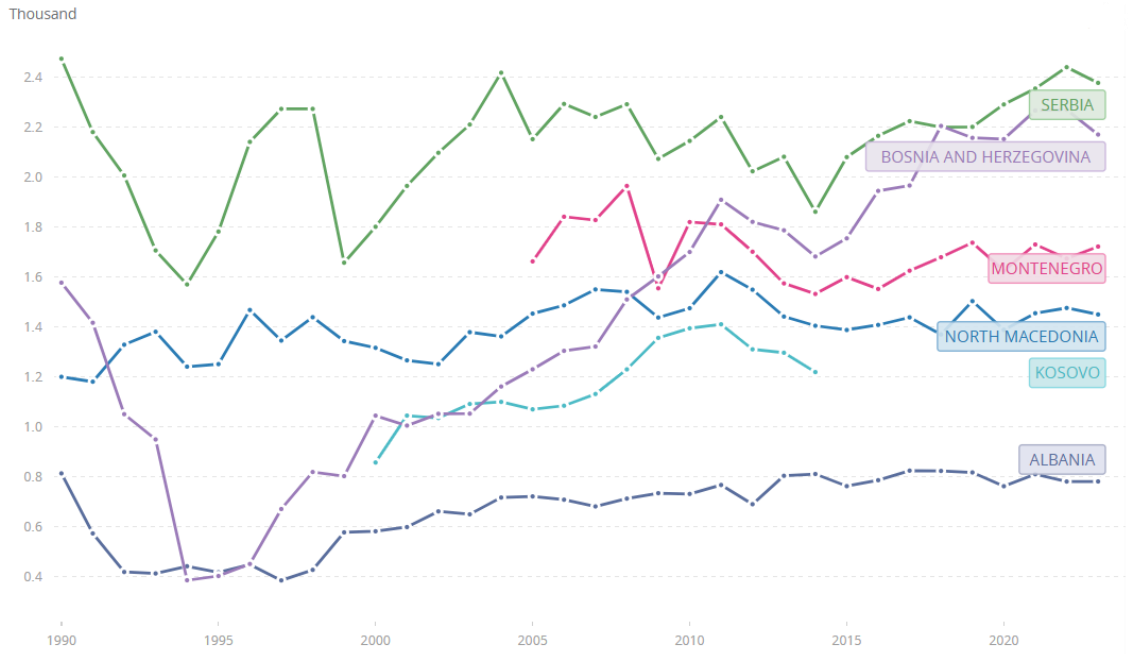
[61] Paul E. Brockway, Steve Sorrell, Gregor Semieniuk et al., Energy efficiency and economy-wide rebound effects: A review of the evidence and its implications, 141.

[62] International Energy Agency, Global Trends, Global Energy Review 2025, 2025.

intelligence and other high-energy technological developments, unless demand is actively constrained. Such dynamics mean that efficiency alone will struggle to reduce absolute global energy use and decarbonise the energy system.

In the Western Balkans, energy consumption per capita (total primary energy used in a country including all fuels and electricity, divided by population, and reported in kilograms of oil equivalent) remains lower than the EU average but vary significantly across the region. The world average is 1,853 kilograms of oil equivalent while the EU average is 2,777. Across the Western Balkan countries, Albania uses 781 kilograms of oil equivalent, Bosnia and Herzegovina 2,171, Kosovo 1,219,[63] Montenegro 1,722, North Macedonia 1,450 and Serbia 2,378[64] (see Figure 3).

Figure 3. Energy use (kg of oil equivalent per capita) in the Western Balkans between 1990 and 2023.[65]



Since the per-capita energy use in many Western Balkan countries remains well below the EU average, the countries need to close energy efficiency gaps without promoting energy-intensive consumption patterns. In other words, the Western Balkan countries should aim for a just, sufficiency-oriented pathway that raises well-being without replicating high-consumption models. High energy intensity is a reason for concern, as

[63] While data for other countries are from 2023, the latest available data for Kosovo are from 2014, meaning that the current figure is likely to be higher.

[64] International Energy Agency, Energy use (kg of oil equivalent per capita), World Bank Group, 2025.

[65] International Energy Agency, Energy use (kg of oil equivalent per capita) - North Macedonia, Serbia, Albania, Montenegro, Kosovo, Bosnia and Herzegovina, World Bank Group, 2025.

public buildings in the Western Balkans are expected to exceed double the EU requirements on energy consumption.[66]

Through the Energy Community Treaty, Western Balkan countries made a legal commitment to adopt core EU energy legislation, including energy efficiency directives and the 2010 Directive on energy performance in buildings.[67] Yet existing energy efficiency targets for 2030 include an increase in final energy consumption in all Western Balkan countries, with the exception of Bosnia and Herzegovina, where the final energy consumption is targeted to remain the same in 2030 as in 2020.[68] Instead, more attention needs to be paid to sufficiency measures that would normalise energy saving.

Crucially, many of these measures were established during the 2021-2023 energy crisis in the Western Balkans; in some countries, these included mandatory reductions in energy or heat consumption or reductions in lighting and room temperature in the public and commercial sectors.[69] An information campaign on energy saving was also a key measure in some countries, and a well-designed campaign would be of particular importance in order to change negative perceptions of energy savings that view it as connected to austerity, crisis or a conflict.

Examples from the EU also offer concrete energy sufficiency instruments that can be used by policymakers to reduce energy demand and promote energy saving.[70] These have included actions such as billing heating costs based on actual consumption as required under the Energy Efficiency Directive, which also applies to the Western Balkan countries under the Energy Community Treaty; campaigns on switching the lights off when not in use; or an electricity pricing methodology, where the unit cost of electricity increases based on consumption level.[71] Reductions could be even more significant, as studies show that individualised charging and metering could decrease energy consumption by 15 to 20% during the first two years of implementation.[72] Broader analysis by IEA notes that changing practices, such as lowering thermostat set points, reducing heating when unoccupied, or using ventilation instead of overcooling, represent one of the 'quickest and most cost-effective' paths to lower heating and cooling demand globally.[73]

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[66] Martin Serreqi, Ledjon Shahini, Unlocking the First Fuel: Energy Efficiency in Public Buildings Across the Western Balkans, Sustainability, 17(22), 2025.

[67] Energy Community, Energy Community acquis, 2025.

[68] Energy Community, Energy Community 2030 energy and climate targets, 2025.

[69] Energy Community Secretariat, Policy Guidelines on the energy demand reduction measures in the Energy Community Contracting Parties, 8, 2023.

[70] Lea Gynther, A Leap Beyond Efficiency - Energy Sufficiency Policies in Europe, 2024.

[71] Ibid., 3.

[72] Jon Teres-Zubiaga, Estibaliz Pérez-Iribarren, Iker González-Pino et al., Effects of individual metering and charging of heating and domestic hot water on energy consumption of buildings in temperate climates, Energy Conversion and Management, 171, 2018.

[73] International Energy Agency, Residential behaviour changes lead to a reduction in heating and cooling energy use by 2030, 2022.

In buildings, such changes in energy practices can be supplemented with smart controls when possible, which give residents control over their energy usage. Smart controls (e.g. 'smart thermostats' or occupancy-based heating controls) enable heating and cooling systems to match actual use rather than run constantly or inefficiently. A study of 54 residential units in high-rise buildings found that smart thermostats led residents to programme sensible schedules and resulted in significant energy savings compared with no scheduling.[74] Because smart controls rely on aligning heating/cooling supply with actual occupancy and use patterns, they maximise gains from any other efficiency measure such as deep renovation and avoid wasting heat in unoccupied rooms or during times when heating is not needed – a pressing issue in many multi-apartment buildings in the Western Balkans where heating in winter is automatic. For instance, a rollout of smart meters in Montenegro by the national transmission operator (CEDIS), financed by the European Bank for Reconstruction and Development, contributed to a significant reduction in distribution losses from 20.5% in 2010 to 10.1% in 2024 and lowered customers' outstanding debt from EUR 120 million to EUR 60 million.[75]

Priority actions on energy sufficiency

Priority actions need to focus on establishing regulatory sufficiency signals. These should focus on consumption ceilings or fiscal instruments that prevent price-driven increases in use and embedding sufficiency-oriented approaches in national energy and climate plans. Energy efficiency targets must be more ambitious in order to reflect that energy efficiency measures should lead to a decrease in energy usage.

Many of the sufficiency-oriented steps that have been tried in the Western Balkans should remain a norm rather than a crisis response, while centring energy justice, health, and well-being, and coupled with priority actions on energy poverty. Further actions should include measures such as standards on the size and performance of appliances and buildings or caps on indoor temperatures for non-residential spaces, both in terms of heating and cooling.

A key action is maintaining and advancing block energy tariffs, which need to be designed in a progressive manner to discourage overconsumption while offering low tariffs for basic energy usage needed for maintaining good health and well-being for households.

[74] Helen Stopps, Marianne F. Touchie, Residential smart thermostat use: An exploration of thermostat programming, environmental attitudes, and the influence of smart controls on energy savings, Energy and Buildings, 238, 2021.

[75] European Bank for Reconstruction and Development, Independent Evaluation Department, Transition through grit: Country-level evaluation: EBRD activities in Montenegro 2017-24, 40, 2025.

3. Deep renovation

A comprehensive renovation package, combining the insulation of walls, roofs, floors, pipes and basements with modern high-efficiency heating systems and rooftop photovoltaic (PV) system, consistently delivers transformative reductions in energy demand and emissions. A technical study on retrofitting multi-apartment buildings in Serbia showed that energy savings for heating can range from 68 to 80%.[76] Because renovated buildings retain performance improvements for decades, the benefits continue to accumulate long after initial investments, making deep renovation one of the most effective long-term climate and economic measures available to governments in the region. Most importantly, as the subsections below show, the most efficient improvements occur when renovations are done deeply, approached not through piecemeal initiatives, but through comprehensive measures that include improving the thermal envelope via envelope insulation, upgrading heating, cooling and lighting, and installing rooftop PV systems.

3.1 Improving the thermal envelope

Deep envelope insulation (walls, roofs, floors, windows, doors) yields the greatest, long-lasting savings. Energy loss in a building typically occurs 35% through the walls, 25% through windows and doors, a further 25% through the roof, and 15% through the floor.[77] The EU retrofit guidance shows that whole-envelope measures deliver more significant increases in energy savings compared with piecemeal fixes, with measured schemes commonly reporting 30 to 50% reductions in space-heating energy.[78]

Windows and doors are a major route for heat loss and for gains in airtightness, comfort and air quality. Replacing single-glazed frames with modern double- or triple-glazed units alongside proper sealing cuts heat losses dramatically and improves indoor comfort.[79]

3.2 Upgrading heating, cooling and lighting systems

Heating, cooling and lighting systems control indoor temperature, humidity, and air quality, and they are central to energy use as well as comfort, health and well-being in buildings.[80] These systems typically account for the majority of a building's energy consumption,[81] especially in climates with substantial

[76] Bojana Lević, Ljiljana Đukanović, Ana Radivojević et al., Potentials for a complex and integrated refurbishment of post-war housing stock of Serbia, 93.

[77] Veneta Yosifova, Methods and means for analyzing heat-loss in buildings for increasing their energy efficiency, Intelligent Systems and Applications. Advances in Intelligent Systems and Computing, 1252, Springer, 2021.

[78] Smart Cities Marketplace, Building Envelope Retrofit Solution Booklet, European Commission Directorate-General for Energy, 2023.

[79] Ryan Williams, Energy efficient windows and doors, Energy Saving Trust, 2025.

[80] Elvis Hadzikadic, Goran Cacic, Roadmap: Towards a nearly zero-energy pathway for the public buildings sector in the Balkans+ region, United Nations Development Programme, 2024.

[81] Tosin Michael Olatunde, Azubuike Chukwudi Okwandu, Dorcas Oluwajuwonlo Akande et al., Review of energy-efficient HVAC technologies for sustainable buildings, International Journal of Science and Technology Research Archive, 6(02), 2024.

heating needs, including the Western Balkans. Upgrading and optimising heating, cooling and lighting is therefore a key priority to reduce energy use, improve indoor comfort, and lower operational costs. Replacing old boilers and solid-fuel stoves, preferably with heat pump systems, significantly decreases energy use. Heat pumps can deliver three to five times as much useful heat per unit of electricity compared with conventional fossil gas boilers.[82] This makes them one of the most energy-efficient end-use solutions when electricity is decarbonised, although their success depends on good building fabric and appropriate sizing and controls.

In some regions in the Western Balkans, pairing inverted air conditioning units with rooftop PV systems has been shown to be the most feasible and sustainable heating option.[83] Many heat pumps are able to not only heat homes but also cool them.[84] Similarly, solar thermal systems for heating water are highly cost-effective. Depending on sizing and climate, solar thermal collectors can supply a large share of annual hot water demand in sunny and temperate climates, with some estimates showing as much as 97% of hot water needs in the summer.[85]

Efficient lighting is responsible for a smaller share of energy savings compared to heating, but it is still a meaningful measure, especially in public buildings. Though each individual light uses relatively little energy, the sheer number of lighting products installed means that lighting collectively ranks as the third largest source of energy demand, behind industrial components and heating.[86] Globally, efficiency progress in

Photo: Hseyin, Adobe Stock

[82] International Energy Agency, The Future of Heat Pumps, 2022.

[83] Vanja Djinlev, Analysis of alternatives to coal-based district heating for the Bitola region in North Macedonia, CEE Bankwatch Network & Eko-svest, 2, 2022.

[84] Ibid.

[85] Paolo Valdiserri, Evaluation and control of thermal losses and solar fraction in a hot water solar system, International Journal of Low-Carbon Technologies, 13(3), 2018.

[86] European Commission, Light Sources, 2023.

lighting was not sufficient to counter higher usage in 2022, leading to increased electricity demand. As a result, even with a cleaner electricity mix, CO_2 emissions from lighting saw a small increase that year.[87] Such trends again point to the importance of coupling energy efficiency measures with energy sufficiency.

In the EU, the Ecodesign for Sustainable Products Regulation, Energy Labelling Regulation, and Delegated Regulation on Energy Labelling of Light Sources set mandatory minimum energy performance standards for products sold in the EU, supporting the market for the most efficient LED lighting. While the latter two are part of the Energy Community Treaty, in the Western Balkans, implementation is still ongoing.[88]

Photo: Alekss, Adobe Stock

3.3 Supporting rooftop solar, prosumers and energy communities

The Western Balkans are experiencing a rapid expansion of solar power capacity, yet rooftop PV systems remain significantly underdeveloped, representing a major opportunity for the democratisation of energy production. The support for rooftop PV systems as part of deep renovation and a priority energy efficiency effort in the Western Balkans would not only contribute to decarbonising the energy supply, but also to reducing losses from transmission and distribution by producing electricity near or at the point of consumption. This proximity helps maximise the impact of energy efficiency measures since much of the electricity demand remains on-site.

[87] International Energy Agency, Lighting, 2023.

[88] Energy Community Secretariat, Annual Implementation Report 2025, 2025.

More focus should be placed on rooftop PV systems as they can avoid conflict with the local communities, especially over agricultural land, while giving citizens greater control over their own energy production. By November 2025, Serbia reported 5,832 prosumers, most of which were households, with a total installed capacity of over 120.38 megawatts (MW), representing a 61% increase from the previous year.[89] A recent study estimates the technical potential of rooftop PV systems in Serbia to be 41.1 gigawatts (GW) of installed capacity, possibly meeting a substantial share of national electricity demand.[90] The data estimating the overall potential of rooftop PV systems are missing for other Western Balkan countries, but for North Macedonia it was estimated that within the legal limitations for prosumers, the potential is at least 1.2 GW of installed capacity.[91] Properly estimating this prospect, coupled with supporting prosumers, is a crucial first step in developing priority energy efficiency measures.

Beyond climate gains, energy communities and prosumers using rooftop solar systems can both democratise energy production and serve as a powerful tool for social equity and energy poverty reduction. An EU Joint Research Centre review finds that energy communities have a demonstrable potential to alleviate energy poverty, for instance by lowering bills for communities or supplying social housing with low-cost power, but that deliberate design is required to ensure inclusion of low-income households.[92] In the Western Balkans, where prosumer numbers remain low but growing, community energy schemes offer a route to combine social objectives with decarbonisation.

The growing trend underscores the potential for roof-level PV to transform consumers into small-scale producers, lowering their electricity bills, protecting them from volatile energy markets, and increasing their energy security and autonomy. When structured inclusively, rooftop solar systems and community energy schemes can prioritise low-income and vulnerable households, turning renewable energy into a social good rather than a luxury. This has the potential to increase overall support for decarbonisation efforts and climate action.

[89] RES Serbia, RES Serbia Analysis: In one year, the number of prosumers in Serbia increased by 61%, 2025.

[90] Dejan Doljak, Ilija Batas Bjelić, Aleksandar Dedinec, Geospatial estimation of rooftop solar photovoltaic technical potential in Serbia, Journal of the Geographical Institute "Jovan Cvijic", SASA, 2025.

[91] Eko-svest, Анализа на можностите за инсталирање на фотоволтаични електрани на домовите во кичевскиот регион, 2020.

[92] G. Koukoufikis, H. Schockaert, D. Paci et al., Energy Communities and Energy Poverty: The Role of Energy Communities in Alleviating Energy Poverty, Energy Poverty Advisory Hub, European Commission, 2023.

Priority actions on deep renovation

Without a coordinated framework, retrofit efforts can stall or fail. Multi-apartment buildings typically involve collective decision-making, making planned coordination and a clear framework for governance structures and cost sharing crucial. For the same building types, a template renovation plan could be created as a technical support measure which would ensure that they are all renovated according to the same standards.

For the renovation itself, an energy audit and technical assessment of a building must be a first step to establish priority actions and the feasibility of installing rooftop PV systems, solar thermal systems, heat pumps or other technologies. Building envelopes and insulation should always come before upgrading the heating and cooling system. Heating systems which are sized for higher loads than actually needed (e.g. because insulation was not present when they were originally sized), are less efficient.[93] Moreover, fitting temperature controls and smart meters can additionally advance energy sufficiency efforts.

Deep renovation is also a significant opportunity for advancing the just transition by reskilling workers, which should be a central part of the holistic approach towards energy efficiency. Targeted national reskilling programmes are needed to ensure that deep renovation works are of high quality and advance the social position of the affected workers. The rollout of the reskilling measures should be done as on-the-job training in this case. It is also crucial that a competitive salary is ensured to prevent reskilled workers from moving abroad where their newly acquired skills can earn them a better living.

Although a legal framework for prosumers and energy communities exists in all Western Balkan countries, with the EU legal framework incorporated into the Energy Community,[94] full legal recognition of prosumer rights and energy community structures, including market participation and by-laws enabling community generation, is still in progress and differs between jurisdictions.[95] Advancing the legal status of energy communities and prosumers is a priority action for energy efficiency as well as energy justice more broadly.

[93] George Bennett, Cliff Elwell, Effect of boiler oversizing on efficiency: a dynamic simulation study, Building Services Engineering Research and Technology, 41(6), 2020.

[94] Energy Community Secretariat, Policy guidelines on the concepts of energy communities, 2024.

[95] Energy Community Regulatory Board, Regulatory framework for active customers in the Energy Community Contracting Parties, 2025.

Conclusion: towards a holistic approach on energy efficiency in the Western Balkans

This discussion paper highlights the importance of approaching priority interventions in energy efficiency in buildings not merely as a technological upgrade but as part of a wider systems transformation that promotes social well-being, tackles inequality and ensures long-term resilience. Buildings in the Western Balkans are not only major consumers of energy but also central to the daily lives, health and financial security of households. Interventions therefore need to combine technical upgrades with regulatory and social measures that support residents rather than burden them. A holistic approach that considers technologies, practices and systems is essential for the region to meet its international climate obligations and reduce emissions, while tackling inequality and democratising the energy system.

A sufficiency-led perspective must underpin all efficiency efforts. Improving the performance of buildings without recognising the risk of rebound effects will limit the impact of even the most sophisticated energy efficiency measures. As efficiency lowers the cost of energy services, households may increase consumption in ways that erode anticipated savings and place greater pressure on energy systems. This is especially relevant in the Western Balkans, where low per-capita consumption and lower energy prices create conditions for demand to rise quickly once buildings are improved. Embedding sufficiency principles in policy design helps lock in lower absolute demand by setting clear expectations, limiting unnecessary growth in energy use and ensuring that efficiency gains translate into genuine reductions in consumption and emissions.

At the same time, what remains central is the imperative to address energy poverty in a way that combines immediate protection with long-term structural change. Efficiency measures must ensure that low-income households consume enough energy to meet basic needs while preventing wealthier households from increasing use in response to cheaper services. A balanced package of targeted financial support, deep renovation, clean heating, smart controls and rooftop solar can lift vulnerable households out of energy poverty while avoiding regressive effects. This is especially the case when supporting prosumers and energy communities. Such an approach supports social cohesion, protects public health and reinforces public trust in decarbonisation policies.

Overall, the Western Balkans stand at a strategic moment. With low per-capita emissions and a significant unrealised potential for savings, the region can pursue a development pathway that avoids the high-consumption model of many European economies. Delivering this vision requires long-term planning, strong governance, sustained investment and coordination across sectors. By tackling poverty, centring sufficiency, and advancing deep renovation, energy demand can be reduced in absolute terms, strengthening energy security while supporting stronger and healthier communities.

Recommendations

To the Western Balkan governments:

- Tackle energy poverty as an urgent priority. Robust definitions of energy poverty are needed for targeted support.
- Embed a sufficiency-oriented approach in national energy and climate plans. Without centring energy sufficiency in policy measures, energy efficiency improvements can result in absolute increase in energy usage through the rebound effect.
- Ensure that vulnerable households exit energy poverty without stimulating middle- and high-income households to over-consume. Progressive pricing or block tariffs need to be implemented.
- Promote the deep renovation of buildings through support for overcoming technical, legal, and social barriers, as well as targeted financial support. Implement programmes to reskill workers as part of advancing the just transition.
- Advance the implementation of comprehensive legal frameworks under the Energy Community Treaty, particularly in regard to energy communities, prosumers and energy efficient products.

To the European Commission, international financial institutions and other international partners:

- Send a clear signal to the Western Balkan governments that reducing overall energy consumption through energy efficiency and energy sufficiency measures is a question of advancing the energy security of the region.
- Further encourage the democratisation of energy production through prosumers and energy communities with regulatory and financial signals.
- Avoid using international finance for counterproductive energy efficiency measures that risk increasing overall resource consumption.