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Energy Efficiency in Green Recovery

best practices and opportunities for Ukraine



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1. Introduction

The issue of increasing energy efficiency in Ukraine is not new, as it has long been among countries with the highest energy intensity per GDP unit (e.g. twice as high as in Poland). In 2011, Ukraine joined the Energy Community to form a pan-European energy market with binding rules and principles, and in 2014 signed the [Association Agreement with the European Union](#), committing to implement a number of acquis, in particular [Directive 2012/27/EU On energy efficiency](#) and [Directive 2010/31/EU On the energy performance of buildings](#). In addition, in 2021, the country set a goal to halve energy consumption by 2030¹.

Ukraine has made significant progress in the fulfilment of obligations under the Association Agreement with the EU regarding the implementation of European legislation on energy efficiency. In recent years, a legislative framework aimed at reforming and supporting energy efficiency has been developed and adopted, in particular:

- [The Law "On Energy Efficiency"](#), which provides for the establishment of legal, economic and organizational foundations for activities in the field of energy efficiency, ensuring the implementation of energy-efficient measures that will be carried out during the production, transportation, transmission, distribution, supply and consumption of energy;
- [The Law "On Energy Efficiency of Buildings"](#). This Law defines the legal, socio-economic and organisational framework for energy efficiency of buildings and aims at reducing energy consumption in buildings.
- [The Law "On the Energy Efficiency Fund"](#). This Law defines the legal, economic and organizational principles for the establishment and operation of the Energy Efficiency Fund.
- [The Law "On the Introduction of New Investment Opportunities, Guarantees of the Rights and Legal Interests of Business Entities for Large-Scale Energy Modernisation"](#). This Law establishes the legal and economic basis for implementing energy services to improve the energy efficiency.

In 2022, the issue of energy efficiency gained new value and strategic importance not only for low-carbon development and reliable energy supply, but also directly for the sovereignty and independence of the state. Due to Russia's terrorist acts against energy facilities and blackmailing the civilised world with energy resources used as a weapon, the issue of reducing dependence on the imports of fossil fuels has become urgent, and energy efficiency has become a true integral component of energy security.

¹ According to the [National Energy Efficiency Action Plan by 2030](#) approved on December 29, 2021

Moreover, for Ukraine, the issue of energy efficiency is cross-cutting in the reconstruction to ensure that this process is sustainable. In the first months of the full-scale invasion, the civil society in Ukraine [developed](#) the principles of green recovery, one of which is the development of a low-carbon, energy-efficient economy.

Ukraine is already adopting the European practice of buildings that consume a minimum of energy. Thus, the Concept and National Plan for the gradual increase in the number of nearly zero-energy buildings (NZEB) were [adopted](#). According to the Plan, in the next five years, the creation of a regulatory and legal framework is expected, and after 2025 - the transition to new requirements for construction and commissioning of facilities. In addition, in 2022, the Verkhovna Rada of Ukraine [adopted](#) the Law to create conditions for complex thermal modernization of buildings, and in 2023, the Decarbonization and Energy Efficient Transformation Fund was [created](#) to finance energy efficiency programs and projects [starting](#) in 2024.

Combined with the need to rebuild the country after the Russian full-scale war, the necessity to secure the thermal modernization of buildings to address the climate crisis, and the future of Ukrainian accession to the EU, a lot of work shall be done in the Ukrainian buildings sector in the coming months and years.

Considering Ukraine's plans and needs for sustainable, green recovery according to energy efficiency standards, the DiXi Group team together with BPIE, taking into account EU experience and best practices for energy efficiency in buildings, developed an approach that can be applied to Ukraine during reconstruction and recovery.



2. Priority of Energy Efficiency

While there is no silver bullet to resolve the building renovation dilemma, the global climate crisis highlights the need to improve the quality of the building stock in Ukraine. Over the last several years Ukraine has shown considerable progress toward the establishment of the legal framework for energy efficient building renovation and improvement of building stock. On the other hand, the European Union's building [legislation](#) is undergoing a major transformation, substantially increasing its ambition. The majority of EU legal texts delivering the European Green Deal are being finalised in 2023, including those affecting energy efficient renovations.

2.1. Build back better principle

Ukraine has [suffered tremendously](#) over the course of Russian invasion: over 499,056 residential units are estimated to be completely destroyed, 787,799 units have suffered moderate damage and 285,257 have minor damage; 2,772 educational institutions were partially damaged and 454 were completely destroyed, both cases amounting to 10 percent of the total education institutions affected across all levels of education; 1,574 of public health facilities incurred damage or destruction amounting to 15.6 percent of total public health facilities (second Ukraine Rapid Damage and Needs Assessment, as of February 24, 2023).

To address this enormous damage in a prudent manner, the Ukrainian government, other international partners and NGOs actively discuss and develop how to ensure comprehensive reconstruction. One of the principles of reconstruction is to build back better in a green and sustainable manner.² However, there is still a substantial need to establish specific measures and actions to ensure that sustainability is taken into account, especially for the reconstruction of the building stock.

One effective way to do it can be the establishment of energy efficiency eligibility criteria for funding streams and other reconstruction initiatives. This can present a significant step forward in the progress of the thermal modernization of Ukrainian building stock and other broad long-term benefits, such as reduction of overall energy consumption and alignment with European standards.

² As of 2022, the '[Ukraine Recovery Plan](#)' was being developed by the National Council for the Recovery of Ukraine in order to create a comprehensive roadmap for the reconstruction among different sectors, which includes parts on building stock reconstruction and mentions green reconstruction priority.

2.2. Develop a Long-Term Renovation Strategy or a National Building Renovation Plan

Long-Term Renovation Strategies (LTRS) in the EU were first introduced in Article 4 of the [Energy Efficiency Directive](#) (EED) in 2012. Member States released their first LTRS under the EED framework in 2014 and revised them in 2017. In 2018, during EED and [Energy Performance of Buildings Directive](#) (EPBD) revisions, the legal framework for LTRS was moved to EPBD and considerably modified adding and advancing numerous criteria. The latest LTRS from the Member States were released in 2020 under the new rules. Now with the current revision of EPBD, this framework is being [changed](#) and made more stringent and renamed National Building Renovation Plan (NBRP).

A Long-Term Renovation Strategy is a reliable tool to structurally guide building renovation and direct the entire building renovation sector in a consistent manner by creating and enabling necessary transparency and monitoring mechanisms. This strategy should include information on the comprehensive set of criteria, such as an overview of the national building stock, identifying cost-effective approaches to renovation relevant to building types and climatic zones, policies and actions to stimulate cost-effective deep renovation, policies and measures to target worst performing buildings, address market failures, etc.

A Strategy can be used to unlock significant improvements for the building stock and the well-being of inhabitants. For instance, through an overview of the national building stock, highly inefficient buildings should be identified. Required targeting of these buildings with policies and measures creates [major advancements](#) in the energy efficiency of the stock, improvements of living conditions of the people, lower energy bills, and presently energy security. Moreover, the lowest-income families often reside in highly inefficient homes. Developing suitable instruments to tackle worst-performing buildings can [alleviate energy poverty](#).

Ukraine has put considerable effort into developing national plans to guide improvements of the building stock, such as previously mentioned the [Plan for Increasing the Number of NZEBs](#) of 2020, and the [National Energy Efficiency Action Plan by 2030](#) of 2021. In 2022, the government published [the draft LTRS and the corresponding Concept](#) of the National Economic Targeted Program to support LTRS implementation, having [reported](#) in 2023 on the LTRS development. However, in the face of increasing European ambition on energy and climate and considerable damage to Ukrainian building stock, Ukrainian plans could be revised and amended with more precision and higher ambitions.

To develop an effective LTRS with a strong reliable framework, Ukrainian counterparts can look at existing examples of extensive work done by EU Member States developing their LTRS. For instance, a '[Review of EU Member States 2020 Long-Term Renovation Strategies](#)' by BPIE, evaluates individual Member States' performance on different parts of their strategies.

Here, one could see Member States with the highest evaluation and look at their LTRS as an example of the best implementation. Another good source is the European Commission's [analysis of the national long-term renovation strategies](#), which assesses the Member State's LTRS on multiple criteria with examples of good practices.

Build back better (1)

Ukraine currently undergoes the development of its own National Energy and Climate Plan (NECP), within frameworks of the EU Governance Regulation and the Energy Community agreements. The Energy Community secretariat is [committed](#) to help Ukraine in developing the NECP focusing on green rebuilding. NECP and LTRS/NBRP are becoming tightly interconnected in the EU.

The development of NECP, international support for Ukraine, funding opportunities and available technical assistance give Ukraine an opportunity to also push for developing the *first tailor-made national renovation strategy* in order to structurally and adequately address the building sector's post-war rebuilding with energy efficiency as one of the priorities.

2.3. Prioritize the energy efficiency first principle

In the EU, the energy efficiency first (EE1st) principle was first legally defined in the 2018 [Regulation](#) on Governance of the Energy Union and Climate Action (Governance Regulation). Through the package on delivering the European Green Deal, the EED recast of 2023 created the legal basis for applying the EE1st in [Article 3](#).

EE1st principle requires that EU Member States ensure energy efficiency solutions are adequately assessed in the planning, policy and major large investment decisions. Member States need to adhere to different criteria in the application of the principle, for reference: to promote and ensure cost-benefit methodologies and wider benefits of energy efficient solutions and to address their impact on energy poverty. The implementation of this principle also includes monitoring by relevant authorities and reporting to the European Commission as part of national energy and climate progress reports under the Governance Regulation.

Overall, the EE1st [aims to](#) put supply and demand-side options on an equal footing, requiring policymakers to consider whether it is more [beneficial](#) to reduce energy consumption instead of focusing on supply-side resources. The EE1st creates a good legal environment for a push towards energy efficient solutions across numerous sectors, including the building sector. Given that the Ukrainian sectors are [largely based](#) on supply-side energy solutions (the same problem as in many other countries) and that Ukraine is one of the least energy efficient countries, implementation of the EE1st principle may bring a lot of progress toward addressing the thermal modernization pace.

Looking at how to do that, in 2021 the European Commission released a [Recommendation](#) on the EE1st from principles to practice – Guidelines and examples for its implementation in decision-making in the energy sector and beyond. This document is a good basis to develop a further understanding of the EE1st and start its implementation, which also covers building sector-specific recommendations. Furthermore, to support the implementation of the principle many sources are being presently [released](#).

Build back better (2)

Taking into account damages from Russia's war and the major reconstruction of Ukraine across all sectors, implementing the EE1st would balance attention and investments across demand and supply-side energy solutions in the upcoming restructuring of the Ukrainian economy.

In practical terms, the application of this principle to the reconstruction of the building stock means fairly evaluating the best cost-effective and long-term solutions. For instance, to understand if investments in the building envelope should be prioritised before installing new capacity to meet demand; or if renewable energy installations and measures to decrease buildings' energy needs should be financed and in parallel.

2.4. Make use of the best European practices at national, regional and local levels

Over the past decade, the European building renovation sector has experienced big progress with some ambitious practices deriving from national, regional and local levels, developed by both public and private actors and cooperation thereof. Some successful initiatives, such as one-stop-shops, digital databases, and renovation passports have proven themselves to the extent that now some of their full-scale introduction in the EU is being [suggested and negotiated](#) under the EPBD recast.

The knowledge of best practices in the EU continues to grow over time. The previously mentioned Commission's analysis of the national long-term renovation strategies [includes examples](#) of different projects and initiatives. Furthermore, BPIE's '[Long-term renovation strategies as key instruments to guide local renovation](#)' provides many good project examples in different areas. Some online sources also include relevant databases, such as the [FEDARENE](#) (European network of regional and local organisations working on implementation and coordination of energy and environmental policies) webpage containing a section on best practices.

On the other hand, good solutions also were developed in Ukraine. An example is the establishment of the [Energy Efficiency Fund](#) in 2018. The Fund provides support through programmes 'EnergoDim' focusing on energy modernization and 'VidnovyDim' focusing on the reconstruction of the war-damaged building stock. In addition, the Fund [started](#) the development of the concept of the new "GreenDim" program. Such solutions should be continuously scaled-up and developed to ensure progress in thermal modernization.

Several examples from the EU Member States:

- [KfW Energy Efficient Construction and Renovation](#) programme, developed in Germany, provided grants and preferential loans for measures exceeding the minimum requirements on energy efficient construction and renovation, with more financing for more ambitious measures. The programme covered insulation works, HVAC (heating, ventilation, and air conditioning), connection to district heating, planning and consulting, construction supervision and related tests and examinations.
- [RenoWatt](#), a platform that functions as a one-stop-shop for public building renovation in Wallonia, Belgium. It carries out energy audits and technical studies to execute services and renovation contracts, with an aim to achieve sizeable CO₂ emission reduction, reduction of consumption and larger generation of renewable energy. The platform is a good example of the correct use of European funds, as it benefits from the European Local ENergy Assistance (ELENA) programme, a joint initiative of the European Investment Bank and the European Commission.
- [EOL](#), a public building renovation project conducted under a public-private partnership and energy performance contracting models in Ljubljana, Slovenia. It is also a beneficiary of the ELENA programme. Since the beginning of the project's operation, it has renovated around a hundred buildings, including schools, health facilities, and administration buildings. Together with the companies Petrol and Resalta, the project won the European Energy Service Award (EESA) in 2019.

Build back better (3)

Ukrainian national, regional and local counterparts should continue establishing connections with project leaders of European good practices. Considering European and international solidarity in providing help to deal with the destruction caused by Russia's war, now is the suitable time for making these connections and turning them into long-lasting partnerships. Presently, many events are being organized to facilitate interconnections and capacity-building for sectors connected to the reconstruction of Ukraine.

3. Energy Efficiency in Reconstruction and Recovery

The sector of residential buildings, houses in Ukraine [use twice as much](#) energy per square meter, and sometimes even three times more, than residential buildings in the EU. Now there is a historical opportunity to change this, and it would be senseless to restore and rebuild the housing stock, as well as public buildings, according to the same standards as before the war.

Understanding and taking this into account, the first reconstruction projects have already started in Ukraine, taking into account the EE1st principle. As part of the Energy Efficiency Fund program "VidnovyDIM", grants are provided on a free and non-refundable basis for the restoration of buildings damaged as a result of the war in [compliance](#) with energy efficiency requirements. As of March 2023, in the city of Irpin (Kyiv region), the [first four houses](#), homeowner associations (HOAs) of which participated in the "VidnovyDIM" program, were restored. HOAs received a total of about 13 million UAH for repairs of facades, restoration of destroyed engineering systems, replacement of window and balcony door blocks, external and internal vestibule doors, i.e. they completely restored their energy efficiency.

There are already several initiatives for the reconstruction of the public sector. In October 2022, the European Investment Bank and the United Nations Development Programme (UNDP) [have signed](#) a 2 million EUR agreement funded by the Eastern Europe Energy Efficiency and Environment Partnership Fund (E5P) to support Ukrainian cities in financing thermal renovations of public buildings as well as war damage repairs and adaptations to buildings. At the end of March 2023, the [selection of projects](#) under the program "Energy efficiency of public buildings in Ukraine" started with a budget of 300 million EUR from the World Bank to finance the thermal modernization of public buildings, such as health care institutions, schools, kindergartens, sports and cultural centers, administrative buildings etc. The program also provides funding for the repair of war-damaged facilities, the construction of bomb shelters, and the adaptation of buildings to conditions that will better meet the needs of internally displaced persons (IDPs) and their host communities.

The World Bank will [provide](#) 232 million USD to Ukraine to compensate for minor repairs to private homes and apartments affected by the Russian invasion. The project is [financed](#) by a 70 million USD loan from the International Bank for Reconstruction and Development, secured by a guarantee from the Government of Japan, and a 162.5 million USD grant from the Multilateral Trust Fund. The project will be financed by a USD 162.5 million grant from the [multilateral Ukraine Relief, Recovery, Reconstruction and Reform Trust Fund \(URTF\)](#). The World Bank and partners are expected to provide up to 800 million USD in additional loan guarantees, grants and other contributions. As estimated, this funding will cover the cost of repairing partial damage and repairs to 98,000 individual houses and 8,000 households in 160 apartment buildings in five regions. The project aims to help repair approximately two-thirds of the damaged residential buildings in Ukraine that are considered suitable for repair.

The Ministry of Communities, Territories and Infrastructure Development of Ukraine is [preparing](#) a joint project with the Council of Europe Development Bank (CEB) for the overhaul of damaged apartment buildings. The target group for

major repairs is residential properties that suffered moderate to significant damage during the Russian armed aggression. An additional component of the joint project with the CEB may be compensation for destroyed real estate.

Such initiatives to restore the public sector are mostly funded by foreign donors, not the state budget. The public sector owns and operates many of the non-residential buildings (hospitals, schools, office towers, etc.) and a large share of the residential property as well, acquiring the necessary public funding for the renovation job is often a challenge.

Cities in need of renovation but lacking public funds [can learn a lot](#) from Croatia. By using [Energy Performance Contracting](#) (EPC), a mechanism for organising the financing linked to guaranteed energy savings in a project, together with an Energy Service Company (ESCO) to manage the project, Croatia has succeeded in attracting private investment into the pool of funding for large-scale renovations in many of its cities.

The success of the model can be seen all over the country. Between 2014 and 2016, a 220 million EUR energy renovations programme benefited more than 15,600 family homes, 2,300 multi-unit buildings, 80 commercial buildings and 262 public buildings. By 2020, the total investment in building renovations will reach 411 million EUR, much of it through ESCOs.

[Hospital renovation in Croatia](#)

The Karlovac Hospital, situated near Zagreb and established in the 1960s, serves as the primary healthcare facility for Karlovac county, housing approximately 130,000 residents. During its initial construction, energy performance standards were virtually non-existent, resulting in a structure comprised of a reinforced concrete frame with poorly fitted and energy-inefficient infill panels. The building lacked insulation, featured single glazing, and relied on a district heating network powered by heating oil.

In 2013, the Croatian government initiated an extensive and ambitious energy renovation program for public buildings, employing EPC as its primary delivery approach. Among the earliest beneficiaries of this successful program was the Karlovac Hospital, which underwent substantial improvements. Today, the people of Karlovac enjoy the benefits of a contemporary and highly energy-efficient hospital, significantly enhancing their access to quality healthcare services.

Karlovac Hospital underwent renovation in 2016 (60% private funds, 40% public), reducing energy use and CO₂ emissions by over 50%. The hospital now saves around 540,000 EUR per year, financing the investment in just 14 years.

As demonstrated by Croatia, the ESCO presents an appealing option for arranging the necessary funding to improve energy efficiency in various public buildings. This approach ensures that the public sector gains significant benefits from the contractual arrangements while accomplishing essential renovation projects.

4. Building Certification

The certification of buildings in Ukraine is mandatory for:

- 1) construction objects (new construction, reconstruction, capital repair), which according to the class of consequences (responsibility) belong to objects with medium (CC2) and significant (CC3) consequences, defined in accordance with the Law of Ukraine "[On Regulation of Urban Planning Activities](#)";
- 2) state-owned buildings with a heated area of over 250 m², which are often visited by citizens and in all of which public authorities are located;
- 3) buildings with a heated area of over 250 m², in all of which local self-government authorities are located (in the case of thermal modernization of such buildings by them);
- 4) buildings in which thermal modernization is carried out, for which public support is provided and which results in the achievement of the energy efficiency class not lower than the minimum requirements.

Commercial buildings and offices are generally certified due to corporate social responsibility under voluntary standards such as LEED, BREEAM etc. While there exists only about 6 registered projects under these systems, [green building](#) proliferation remains nascent and there is a great challenge to catch-up and pursue certification of green and healthy buildings.

Until 2021 about 6,000 buildings have been certified under the Law "On energy efficiency of buildings" since it came into force in 2017. Majority of them are [residential buildings](#) (see Figure 1) and about 46% were under energy class G. By 2023, the number of certificates [increased](#) to over 17 000.

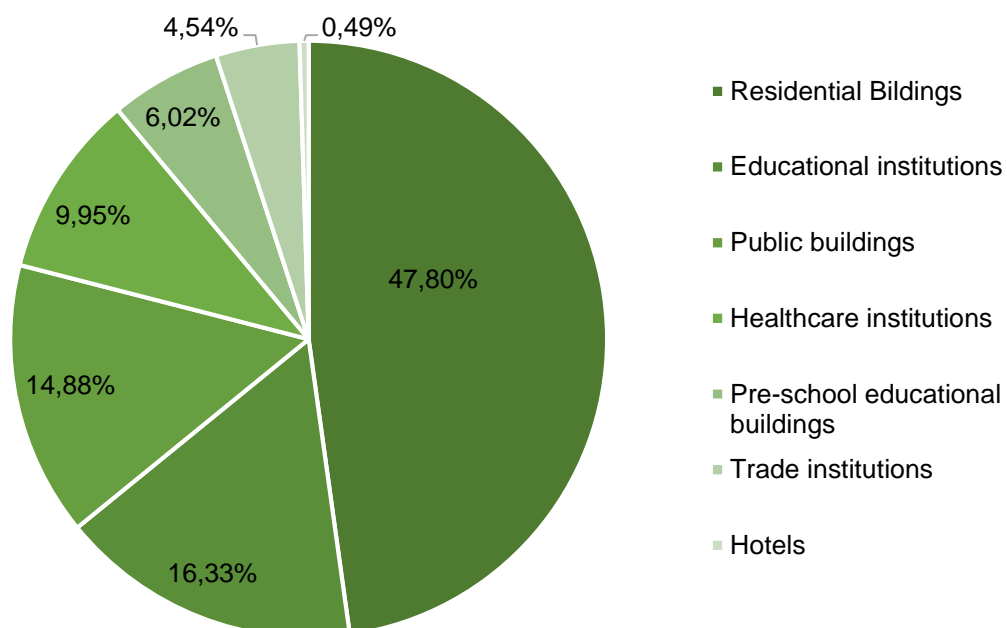


Figure 1: [Certificates issued until 2021](#)

The energy certificate is developed by a certified energy auditor and entered into an open database in the unified state system in the field of construction. The energy certificate contains the class of energy efficiency, determined by calculation according to the [methodology](#) of the national standard, developed taking into account European approaches to calculating energy consumption for various needs of buildings. From December 1, 2020, the [database](#) of certificates is placed in the Register of construction activities of the Uniform State Electronic System in the Construction Sector, the holder of which is the Ministry of Recovery.

Based on the above analysis of the existing legislation and its implementation, there is a promising direction to continue with the approach of issuing energy performance certificates (EPC) under the Law "On Energy Efficiency of Buildings". The existing system could be applied mandatorily on most building transactions (e.g. sell, buy, rent, lease) for residential and non-residential buildings. However, this system must be checked separately for historical buildings.

Furthermore, an alignment of internal EPC methodology with the existing EPC schemes in the EU Member States could benefit upgrading the existing system in Ukraine creating a common understanding and benchmarking of the existing and new building stock. This would enable close monitoring of the progress at national level and better integration with existing policies or development of financing schemes or national funds. Since these certificates need expert auditors to issue them, national programs for upskilling building sector professionals would be a prerequisite.

A better penetration and exposure in the building sector of international voluntary certification systems, used to identify buildings with high levels of performance (e.g., LEED, BREEAM, DGNB, EDGE etc.) would still be beneficial, however these certifications are quite costly and their activities might be limited to the commercial sector or public buildings, which are also covered by EPCs and other building regulations part of the EU *acquis communautaire*.



5. Financing Possibilities for Energy Efficiency

As stated in the November 2020 [report](#) submitted to the Energy Community Secretariat on EPBD implementation, Ukraine's Energy Efficiency Fund (EEF) has proven to be an effective instrument to support residential energy efficiency, due to its long-term focus and transparent corporate governance and monitoring and verification systems. Since its full-scale launch between September 2019 and July 2023, thermal renovations have been fully or almost fully [completed](#) in 280 multi-apartment buildings.

The EEF has been one of the few state institutions which continued providing support to beneficiaries in 2022 following the outbreak of the war. With the adoption of the law on energy efficiency of buildings in June 2017 and later amendments, Ukraine has increased the alignment of its framework legislation with the EU acquis in this policy area. There are some [compliance issues](#) related to the transposition of Directive 2010/31/EU and Directive (EU) 2018/844 that require further attention (e.g. on inspections of engineering systems, differentiation of buildings certification and energy audits for buildings, and the introduction of requirements for the certification of building units when these are sold or rented out).

There was a popular [state energy efficiency loan](#) financing program "Warm loans" providing support for the energy efficiency of buildings. Under the program, the government reimbursed individuals and multi-apartment building associations of certain amounts spent on energy-efficiency improvements. In 2015-2019, more than 700,000 Ukrainian families had [participated](#) in this program, investing 8.2 billion UAH, of which 2.7 billion UAH were reimbursed. Almost 5,000 HOAs also benefited, using more than 1.3 billion UAH of "warm loans" for energy-efficient measures in high-rise buildings. Since the beginning of the war, the program has been suspended.

In 2022, the Ukrainian government [decided](#) to allocate more public support for energy efficiency measures (1 percent of all annual budget expenditures - [app.](#) 15 billion UAH (375 million EUR)). This support has been suspended since the beginning of the war and should be reconducted once martial law is over. In this context, several questions arise. Is the funding sufficient to address energy-efficiency upgrading within the post-war reconstruction process? What experience do European states have in designing recovery programs to rebuild damaged buildings and addressing energy efficiency upgrading? Should there be a distinct budget allocated to energy efficiency³, or would it be relevant to design a reconstruction budget, where energy efficiency is integrated and recognized as a requirement? It seems relevant to have a closer look at recovery programs for reconstruction that were put in place in countries⁴ hit by natural disasters such as earthquakes or landslides.

³ The Law on Energy Efficiency provides for the government to include each year at least 1 percent of expenditures in the draft law on the State Budget of Ukraine for the programs to improve energy efficiency.

⁴ Italy, Croatia, Greece, Germany, Turkey, among others.

One of the most recent examples of major building destruction due to natural disasters is **Turkey**, which was hit by major earthquakes earlier this year. The damage costs are [estimated](#) between 34.2 and [over 100 billion USD](#). The costs are [expected](#) to be even higher when including energy efficiency measures. The World Bank announced a 1.78 billion USD assistance package for recovery. To date, the funding programs are still being designed, but the importance of addressing both aseismic and energy efficiency characteristics of buildings, and making funding conditional to sustainability efforts is [actively discussed](#) among public actors and academia.

The following examples focus on the Italian, Croatian and German experience of integrating the “build back better”-concept in the funding of reconstruction.

Italy (recovery programs for post-earthquake reconstruction). Italy has been hit by several earthquakes in the past 50 years that have caused 5,000 deaths and around 150 billion EUR damage. In the past decade, three major earthquakes have damaged larger building areas: L’Aquila in 2009, Emilia in 2012 and central Italy⁵ in 2016-2017. The support programs set up in response to these natural disasters focus jointly on repair measures, seismic strengthening and [energy efficiency upgrading](#).

- **2016-2017** – 220,000 damage inspections were [carried out](#) after the earthquake and direct economic losses of 21 billion EUR were assessed. Financing operations of 5 billion EUR⁶ were agreed by the European Investment Bank (EIB) and the Cassa Depositi e Prestiti (CDP) for reconstruction. As of today, a global support of 2.75 billion EUR has been [delivered](#) by the EIB in the form of low interest loans based on a tax credit mechanism. This mechanism shows two advantages: the financial resources are immediately available, and the mechanism allows savings for public finances (figure 2). The first loan of 1 billion EUR (June 2017) [focused on](#) residential homes, businesses, and production facilities. The [second loan](#) of the same amount followed (March 2018) to rebuild public infrastructures (schools, hospitals, courtrooms, and administrative offices). The third loan of 500 million EUR was deployed (September 2022) to rebuild residential and commercial buildings. Although no energy efficiency standards are required, the recovery programs highlight the ambition of making “significant improvements in energy efficiency and seismic safety” to [contribute to climate change mitigation](#).
- **2012** – Similar to the recovery program that targeted central Italy, the EIB has [delivered](#) a low-interest loan to the CDP to rebuild the area of Emilia-Romagna (12,000 buildings were severely damaged). A first tranche of 600 million EUR was allocated (November 2012) to support SMEs-buildings, followed by a second tranche (September 2015) of 1 billion EUR calibrated for residential buildings. The increase of energy efficiency and the use of renewable energy sources in addition to the “rehabilitation, renovation and

⁵ The earthquake hit the Abruzzo, Lazio, Marche and Umbria region.

⁶ 4 billion EUR for the private sector (families and businesses) and 1 billion EUR for the public sector.

reconstruction of residential and business buildings” are [mentioned as priority goals](#) in the program. In practice, the public grants have [widely covered](#) the reconstruction costs and partially the strengthening and energy efficiency measures. An extra 15% energy retrofit contribution was made available to firms, on condition that the buildings to be rebuilt perform better than the equivalent standard building, in compliance with energy efficiency laws (30% improvement in energy performance indicator).

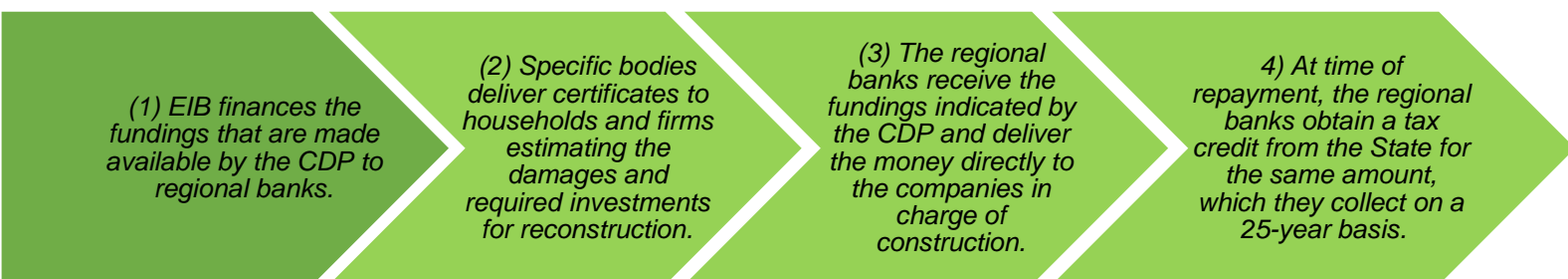


Figure 2: Funding based on a [tax credit mechanism](#)

- **2009** – The earthquake in L’Aquila [damaged and destroyed](#) nearly 15,000 buildings (70 percent of the local building stock). Before the reconstruction phase, an [assessment](#) to evaluate the usability of buildings in the historic centre (IHC) and outside the historic centre (OHC) was conducted⁷. For OHC-buildings, the repair costs to restore the buildings to their original condition were fully covered by public funding. In total, 2.6 billion EUR of public grants were [allocated](#) to OHC-buildings (2.1 billion EUR for E rating buildings and 0.5 billion EUR for B and C rating buildings). In addition, the public funding covered energy efficiency measures for E rating buildings (with medium and severe damages). The costs related to energy efficiency upgrade of these buildings were [established](#) between 38.89 EUR per m² (medium damaged buildings) and 68.83 EUR per m² (severely damaged buildings). Whereas the seismic strengthening measures [are based on](#) the New Building Standard, no energy efficiency standard is formulated.

Croatia (recovery programs for post-earthquake reconstruction). Croatia has endured two important earthquakes in 2020 that have [caused](#) major damages of 86 billion HRK (11.4 billion EUR) for Zagreb and 41.6 billion HRK ([5.6 billion EUR](#)) for the [Banovina region](#) (almost the annual state budget). In 2021, the government set a National Recovery and Resilience Plan for the period of 2021-2026, approved by the European Commission in July 2021. The plan is supported with 6.3 billion EUR in subsidies from the European Recovery and Resilience Facility, of which 789 million EUR are allocated to [reconstruct damaged buildings](#). The funding [covers](#) the renovation of 225,000 m² of residential buildings, 593,000 m² of public buildings and 31,000 m² of “buildings of a cultural good”. The budget combines seismic strengthening and energy efficiency improvements according to the “build back better” principle. The latter

⁷ For OHC-buildings, the reconstruction process involved slightly damaged building (B or C rating buildings) and heavy damage reconstruction (E rating buildings).

must lead to a [reduction in energy consumption](#) by 30 percent as compared to the state before renovation⁸.

Energy efficiency measures are integrated in the global recovery program and are not promoted separately but they are funded by a separate funding stream: whereas the renovation of the damaged building to their original state is financed by the European Solidarity Fund, the seismic safety measures and energy efficiency improvements are financed by the National Recovery and Resilience Plan. For damaged buildings, the public [grant covers](#) 80 percent of the repair and upgrading costs⁹. The national recovery program also establishes four physical one-stop-shops to simplify the reconstruction process in earthquake-affected areas and supports renovation training programs.

Germany (recovery programs for post-flooding reconstruction). Damages of nearly 33 billion EUR were recorded after the flooding in Germany in 2021¹⁰. 3,000 of 4,200 buildings (houses, commercial and industrial structures) located in the Ahr Valley were severely [damaged](#). Under the reconstruction law set in 2021 (Aufbauhilfegesetz) 30 billion EUR have been made available for reconstruction and compensation measures by the federal state and the [Bundesländer](#) (2 billion EUR are planned to rebuild infrastructure). Public funding covers up to 80 percent of the eligible costs, and up to 100 percent for the restoration of historical buildings.

The eligible costs include repair measures, new construction/acquisition of a similar residential building, as well as energy efficiency upgrading under [specific conditions](#) ([Section 3.2. of the Aufbauhilfefeuerordnung 2021](#)). The funding can be supplemented with support schemes delivered by KfW¹¹ if a building is to be rebuilt to a better energy standard compared to the pre-disaster [standard](#). The application process for KfW-support schemes has been simplified for flood victims to cover additional costs related to energy upgrading¹². KfW delivered also grants to support the construction of new energy-efficient buildings¹³.

⁸ The annual energy consumption for heating must be reduced by 50 %.

⁹ For undamaged buildings, the plan provides public grants that cover either 60 % of the work costs or 80 % of the costs (in case of deep renovation or combined work including energy efficiency upgrade and seismic reinforcement).

¹⁰ Mostly in the areas of North Rhine-Westphalia and Rhineland-Palatinate.

¹¹ As a state-owned development bank, Kreditanstalt für Wiederaufbau (KfW) delivers support schemes for energy-efficient construction and refurbishment.

¹² The project can already be started before the application is submitted. There is a possibility for re-application for damaged facilities or structures that have already been supported once by federal funds.

¹³ Following energy performance standards are supported: Effizienzhaus 40, Effizienzhaus 40 Renewable Energies (EE), 40 Sustainability (NH), Efficiency House 40 Plus, Efficiency House 55, Efficiency House 55 (EE) and Efficiency House 55 (NH).

6. Concluding Remarks and Recommendations

Energy efficiency is becoming an extremely relevant topic for Ukraine as the main road to post-war recovery and strengthening of the national economy. The introduction of the latest technologies through the reconstruction will not only reduce the energy bills, but will also contribute to saving of expensive energy resources and reduce emissions.

In addition, Ukraine aims accelerated accession to the EU, and therefore the post-war reconstruction should be carried out according to European standards, the economy radically rebuilt, its energy intensity reduced and the level of energy efficiency in all sectors increased.

In order to improve and modernize the Ukrainian building stock, many current and future challenges should be acknowledged. They include: ensuring green reconstruction while securing fast provision of affordable housing for people in need, improving the legal framework for renovation, targeting worst-performing buildings and energy poverty, and a resilient energy system through both sustainable supply and demand solutions.

To overcome these challenges Ukraine should seek different solutions and opportunities. The energy performance of buildings' framework in Ukraine can be improved and expanded through national plans, the energy efficiency first principle, and the correct implementation of other EU policy instruments. Many reliable practices and case studies of European countries may be used to support this work.

Besides, funding opportunities and technical assistance are becoming increasingly available through multilateral funders with reconstruction and pre-accession assistance programmes. Securing the inclusion of energy efficiency and energy performance requirements among eligibility criteria to access these funds should be a priority for all parties involved. The proper utilization of mentioned instruments can provide valuable support for progress in achieving lasting results. Capacity building for construction professionals have to be embedded as well into reconstruction programs and funding initiatives.

Emphasizing the enhancement and fortification of the energy performance certificates system, which serves as the foundation for adopting and implementing *acquis communautaire*, is preferable over investing in international voluntary certifications. This approach allows for the identification of highly performing buildings while encompassing sustainability aspects that go beyond just energy considerations.

Recommendations

- Focus on international experience and EU cases in designing support schemes and attracting financing for energy-efficient projects;
- Set the energy efficiency eligibility criteria for funding streams and other reconstruction initiatives by stakeholders;
- Developing national programs for upskilling building sector professionals should be a mandatory element of support programs and a prerequisite for projects start-up.
- Given the increased European ambition on energy and climate and considerable damage to Ukrainian building stock, respective plans could be revised and amended with more precision and higher ambitions and merged into a single reliable renovation strategy/plan;
- Developing the NECP and Long-Term Renovation Strategy as guiding policy documents, ensuring the energy efficiency first principle to drive incentives toward renovation solutions, and learning to replicate proven best practices at regional and local levels – are parallel priority solutions, which have the potential to bring substantial progress toward thermal modernization of the Ukrainian building stock.
- The energy efficiency first (EE1st) principle should be legally defined in Ukraine's legislation, based on the EU experience;
- Take into consideration the best practices of EU member states (e.g. KfW Energy Efficient Construction and Renovation, RenoWatt, EOL project) to improve the Energy Efficiency Fund of Ukraine performance and expand energy efficiency programs at national, regional and local levels;
- Acknowledge the importance of better penetration and exposure of buildings certification, as well as international voluntary certification systems, used to identify buildings with high levels of performance (e.g., LEED, BREEAM, DGNB, EDGE etc.).



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