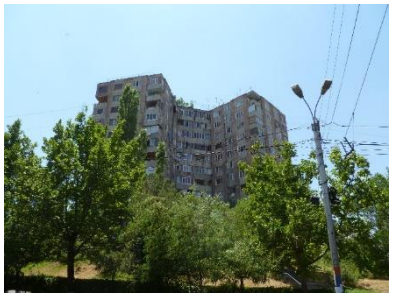
HOW ENERGY EFFICIENCY RETROFITS CONTRIBUTE TO ENERGY POVERTY ALLEVIATION. THEORY, BEST PRACTICE IN THE EUROPEAN UNION AND CASE STUDIES FROM THE REELIH PROJECT IN ARMENIA, BOSNIA AND HERZEGOVINA AND NORTH MACEDONIA

SHORT SUMMARY



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SHORT SUMMARY

Author:
Anna Zsofia Bajomi, PhD Candidate at Politecnico di Milano

Contributors:
Eva Gerohazi, Senior Researcher, Metropolitan Research Institute
Hanna Szemzo, Managing Director, Metropolitan Research Institute
Mariangiola Fabbri, Head of Research, Buildings Performance Institute Europe

Further Contributors:
Eleftherios Bourdakis, Buildings Performance Institute Europe
Frances Bean, Buildings Performance Institute Europe
Liljana Alceva, Deputy Director-Program, Habitat for Humanity Macedonia
Maarten De Groote, Buildings Performance Institute Europe
Marin Petrovic, Consultant, ENOVA Consultants and Engineers
Varsenik Khloyan, Residential Buildings Project Manager, Habitat for Humanity Armenia
Vivian Dorizas, Buildings Performance Institute Europe

Editorial Board:
Besim Nebiu, Director CEE/CIS, Habitat for Humanity International
Gyorgy Sumeghy, Associate Director, Policy and Advocacy, Habitat for Humanity International
Ludmila Perunska, REELIH Advocacy Assistant, Habitat for Humanity International
Zita Kakalejcikova, Senior Specialist/ Residential Energy Project Lead (CEE/CIS), Habitat for Humanity International

In 2018, Habitat for Humanity Europe, Middle East and Africa contracted Metropolitan Research Institute (MRI) and Buildings Performance Institute Europe (BPIE) to deliver an elaborated study evaluating the REELIH project in the three implementing countries – Armenia, Bosnia and Herzegovina, North Macedonia. The aim of the full report "*How energy efficiency retrofits contribute to energy poverty alleviation. Theory, best practices in the EU and case studies from the REELIH project in Armenia, Bosnia and Hercegovina and North Macedonia*" was to find out how these three countries contributed to the fight against energy poverty by encouraging energy efficient renovation of co-owned multi-family residential buildings. The full report has been completed and delivered in December 2019.

In spring 2020, Anna Bajomi, PhD Candidate at Politecnico di Milano, prepared a short summary of this full report. This summary aims to highlight the interrelation between the energy efficient retrofits and energy poverty alleviation, by offering an overview of the main findings of the research. This summary is updated with further references and additional literature that is included only in this short summary. Most of references to other publications and data sources can be found in the original full report.

May, 2020

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Introduction

Energy poverty is a situation in which a household is unable to secure their basic energy needs, necessary for heating, cooling, cooking and for appliances, due to the combination of insufficient financial and technical conditions. Low income, high energy prices and inefficient, technically low-quality homes and appliances are the main causes of energy poverty. Energy efficient retrofits can be potentially effective to fight energy poverty, as they increase the energy performance of the housing stock, thus can potentially lift out households from energy poverty by decreasing the energy need of their apartment. However, energy efficient retrofits have special financial (e.g. high up-front costs, relatively long turn-back periods) and technical (e.g. complex interventions, involvement of various stakeholders) characteristics. Because of these characteristics, they should be carefully designed to exploit their potential of energy poverty reduction.

RESIDENTIAL ENERGY EFFICIENCY FOR LOW-INCOME HOUSEHOLDS (REELIH) PROJECT

THE REELIH project aims to improve living standards in multi-unit apartment buildings in Eurasian countries. It focuses on developing a regional effort, resources and networks to address the impact of rising energy prices in collective housing. It involves all stakeholders who promote, create, finance and directly implement energy efficiency projects.

The REELIH project with the financial help of United States Agency for International Development (USAID) seeks to demonstrate that integrated efforts in this sector, at regional as well as national level, addressing market, capacity and knowledge gaps, bring significant improvements to the living conditions of low-income families in the broad Eastern Europe region, reduce energy costs, reduce carbon emissions, and thus overall, contribute with tangible changes to the ongoing dialogue and reform process.

https://getwarmhomes.org

To explore the energy poverty alleviation potential of the energy efficiency retrofits of multi-apartment building, Habitat for Humanity commissioned Metropolitan Research Institute (MRI) and Buildings Performance Institute Europe (BPIE) to carry out a research on energy poverty, energy efficient retrofits and related practices. The energy efficient refurbishments in three REELIH demonstration countries, Armenia, Bosnia and Herzegovina and North Macedonia were used as case studies for the research. The aim of the assignment was to implement an evaluation of the REELIH projects in the three countries to find out how they were able to contribute to the fight against energy poverty by encouraging energy efficient renovation of multi-family residential buildings.

This summary aims to highlight interrelation between the energy efficient retrofits and energy poverty alleviation, by offering an overview of the main findings of the full research. [1]

[1] Please note that most of references to other publications and data sources can be found in the original full research

Energy poverty

What is energy poverty?

Energy poverty refers to a condition in which individuals or households are unable to meet materially and socially necessary energy services at an affordable cost in their homes. Necessary energy services can be *heating, cooling, cooking, lighting* and usage of other appliances that are necessary for a socially acceptable living standard (e.g. telecommunications, laundry, etc). Materially necessary services provide healthy living conditions, most importantly adequate indoor temperatures. Under- or overheated and unhealthy indoor environment could contribute to the deterioration of the "respiratory, circulatory and cardiovascular system, mental health and well-being"[2]. Socially necessary services enable the household or the individual to fully participate in society (e.g. to wear clean clothes, invite guests in their home, use modern communication services, or children can prepare their homework at proper indoor light). Energy poverty is rooted in a combination of low incomes, high energy prices (compared to income) and inefficient buildings[3].

Based on the definitions of energy poverty, therefore it can be highlighted that households should have access to **quality energy services** that provide proper level of heating, cooling, and electricity use. At the same time, the proper energy services should be provided at **an affordable price**.

The combination of these two aspects is essential from a policy perspective: energy poverty is eased not only in case the costs are subsidized but as the service level remains the same (e.g. in case the price of fuel is subsidized but it allows to provide moderate heating for a family), or in case energy efficient interventions are implemented and the heat comfort is improved but the renovation costs increase the operational costs of households.

How to measure energy poverty?

In order to assess at what level society is affected by energy poverty and what are the main characteristics of affected groups, energy poverty should be measured. Indicators and indexes of energy poverty must capture in a way both **quality and affordability aspects of energy services**. There are two standard ways of pinning down energy poverty-based indicators: either based on monetary calculations (expenditure approach) or on self-assessment of the households (called consensual approach in the literature[3]).

Expenditure approach

The most common indicators that approach energy poverty from an expenditure approach rely on two components: **cost of energy and household income.** Level of energy poverty is therefore based on a ratio between those two.

[2] S. Bouzarovski, H. Thomson (2018): Addressing Energy Poverty in the European Union: State of Play and Action. p.6

[33] S. Bouzarovski, H. Thomson (2018): Addressing Energy Poverty in the European Union: State of Play and Action.

The **cost of energy** is generally calculated in two different ways:

(1) The real cost of energy paid by a given household is taken in account, based on the bills of the household.
(2) Or a modelled cost of energy is used, based on the price of energy that would be needed to heat up the apartment to an adequate level. (The WHO's recommendations on adequate heat are 21°C in the living room; 18°C in other rooms; to be increased by 2 degrees in households with children or persons suffering from illness or disabilities).

The combination of the two aspects of energy costs and household income - measures the ratio of energy expenditure to household income, in comparison to certain absolute or relative thresholds. For example, according to the **Low Income - High Cost** approach, that is used in England to measure energy poverty "a household is considered to be fuel[4] poor when:

- its required fuel costs are above the national median level (modelled to the building type, size of the flat and the household composition)
- was it to spend that required amount, it would be left with a residual income below the official poverty line" [60% of the median income]

The consensual approach

Subjective definitions are based on what the households self-report; they are assessments of their comfort level and the affordability of their housing costs. This data is gathered by annual surveys in the European Union extended to some non-member states like Macedonia (Survey on Income and Living Conditions - SILC).

The SILC indicators measuring different dimensions of energy poverty are:

1. living in homes free of damp and mould
2. paying energy bills on time
3. ability to cool home properly
4. ability to keep home adequately warm

Depending of which approach is followed (expenditure based versus consensual) and at what level thresholds are set, the identified groups affected by energy poverty will change significantly.

One may question the usefulness of energy poverty indicators in case they appoint to different layers of the society, into different characteristics of energy poverty, and all together may result in a high share of the society. But according to the experience of the experts[5] there are multiple benefits of using and calculating energy poverty indicators, as:

[4] UK terminology for energy poverty
[5] Based on the presentation of Sergio Tirado Herrero on the 25 of November 2019 at the international conference on energy poverty (ENERGY POVERTY: From Household Problems to Climate Crisis INTERNATIONAL CONFERENCE AND WORKSHOP 25-26. November 2019, Budapest): https://www.elosztoprojekt.hu/wp-content/uploads/2019/12/EP-in-Spain-2009-2019_ENGAGER-Budapest-2019-11-25.pptx.pdf

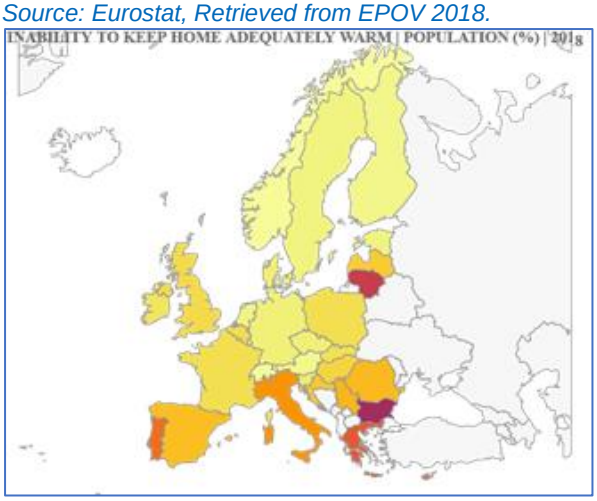
- It makes the problem of energy poverty visible for the decision makers;
- It helps creating energy poverty strategies by defining the different aspects of energy poverty (e.g. after 10 years of elaborating specific studies on energy poverty and working out energy poverty reports in every 2 years, Spain has created its National Energy Poverty Strategy in 2019);
- It points to the need for combining energy and social policies.

Prevalence of energy poverty in Europe

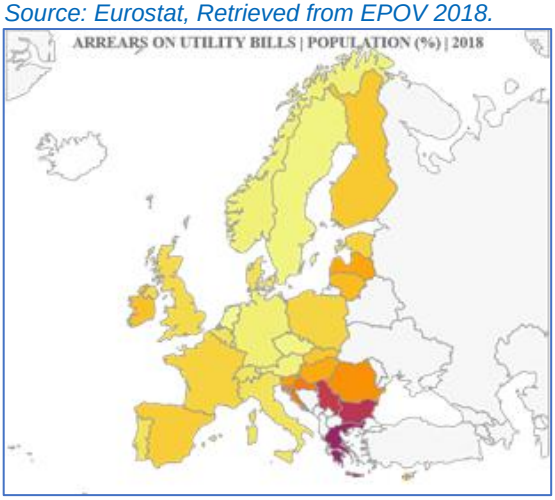
In Europe there is no official definition and indicator to measure energy poverty. In order to have a picture of the prevalence of energy poverty, it is possible to compare the indicators collected by EUROSTAT, such as inability to keep home adequately warm, arrears of utility bills. Also, researchers in 2019 created a complex and comparative energy poverty index.

Eurostat indicators

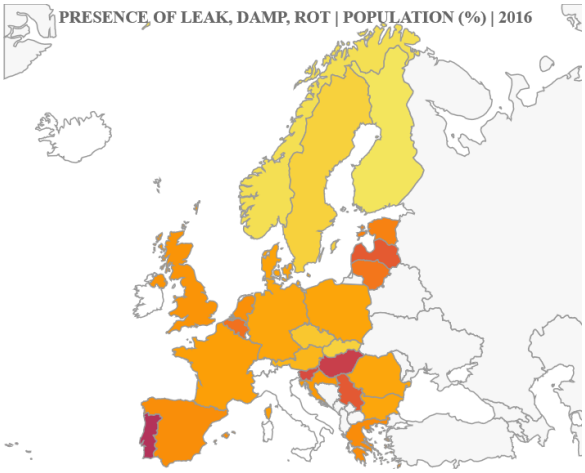
Picture 1. Inability to keep home adequately warm (2018) Source: Eurostat, Retrieved from EPOV 2018.



Picture 2. Arrears on utility bills (population %), 2018 Source: Eurostat, Retrieved from EPOV 2018.



Picture 3: Presence of leak, damp, rot (population %), 2016. Source: Eurostat, Retrieved from EPOV, 2018

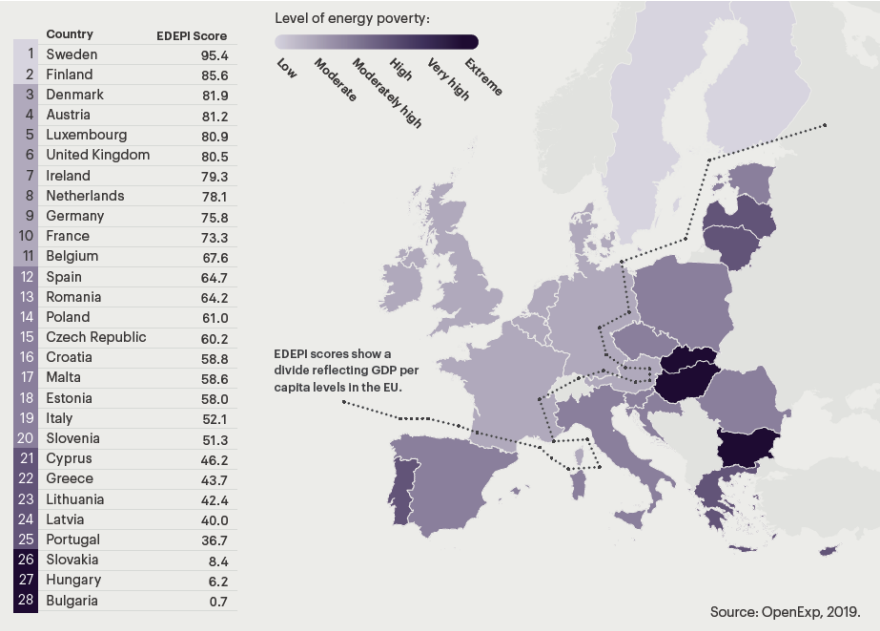


The maps above show at what extent some of the main symptoms of energy poverty are prevalent in European countries: households that are not able to keep their home adequately warm (Picture 1), the percentage of the population that has arrears on utility bills (Picture 2), and finally the share of population that lives in a dwelling with damp, rot and leaking walls or roof (Picture 3). Closer inspection of the maps shows that individual indicators points out different countries as vulnerable. A comprehensive analyses of Eurostat data[6], carried out by scholars working on energy poverty, “showed that there are substantial regional disparities in the exposure of various countries to the drivers of energy poverty” and “that there is a relatively well-off ‘core’ group of countries in Northern and Western Europe, and a heterogeneous ‘energy poverty periphery’ in the South and Eastern Europe”7. While in the core countries energy poverty is limited to certain demographic and housing groups, in the periphery there is more pervasive presence of energy poverty across a large share of the society. Also, several worst-case member states are found in the CEE region.

The existence of a territorial “energy poverty divide” emerges the most strikingly if we observe the European Domestic Energy Poverty index (

Picture 4: European Domestic Energy Poverty Index, 2019. Source: Data visualization created by Right to Energy Network (Right to Energy Coalition, 2019), data source: (OPENEXP, 2019) created from four energy poverty indicators[8].

Picture 4: European Domestic Energy Poverty Index, 2019. Source: Data visualization created by Right to Energy Network (Right to Energy Coalition, 2019), data source: (OPENEXP, 2019)



	Country	EDEPI Score
1	Sweden	95.4
2	Finland	85.6
3	Denmark	81.9
4	Austria	81.2
5	Luxembourg	80.9
6	United Kingdom	80.5
7	Ireland	79.3
8	Netherlands	78.1
9	Germany	75.8
10	France	73.3
11	Belgium	67.6
12	Spain	64.7
13	Romania	64.2
14	Poland	61.0
15	Czech Republic	60.2
16	Croatia	58.8
17	Malta	58.6
18	Estonia	58.0
19	Italy	52.1
20	Slovenia	51.3
21	Cyprus	46.2
22	Greece	43.7
23	Lithuania	42.4
24	Latvia	40.0
25	Portugal	36.7
26	Slovakia	8.4
27	Hungary	6.2
28	Bulgaria	0.7

[6] Inability to keep home adequately warm, arrears and housing faults in European countries across time, energy prices and poverty rates

[7] (Bouzarovski & Tirado Herrero, 2017, pp. 81–82)

[8] The indicators are:

Share of energy expenditures out of total expenditures

Share of 1st quintile population unable to keep their homes warm in winter

Share of 1st quintile population living in homes not comfortably cool in summer

Share of 1st income quintile population living in leaking homes

Programs tackling energy poverty

Energy poverty can be tackled in different ways. Among many possible policy interventions, the most common are energy price subsidies and regulations, protection of vulnerable consumers from disconnections, energy advice combined with small scale interventions in the apartment, and energy efficient building retrofits. Energy price subsidies could bring short term relief in case of energy price increase, also during investments in building efficiency are returning, as building retrofits potentially decrease or stabilize energy needs and costs in the longer term. To brake the vicious circle of energy poverty (when households cannot afford efficient homes and appliance, and thus their energy needs are higher), **the long-term policy priority should be the development and implementation of domestic energy efficiency measures,** such as promotion of efficient consumption choices, and increase of the quality and energy efficiency of housing (both retrofits and new constructions). Financial subsidies (for retrofits) and regulator measures (e.g. efficiency standards) are key policy elements of energy efficiency.[9] EU member states with higher prevalence energy poverty tend to use a policy mix, offering energy price subsidise and at the same time support energy efficient retrofits.[10]

Table 1 provides an overview of the different tools used to combat energy poverty.

Table 1. Typology of interventions tackling energy poverty

Generic income related tools	Combined income & energy related tools	Generic energy related tools
Allowances to housing costs Programmes to handle arrears (e.g. co-financing of debts, counselling)	Subsidized energy price for certain target groups (e.g. for households using low amount of energy, or for vulnerable customers) Allowances to energy consumption (e.g. subsidies to purchase solid fuel) Protection of vulnerable customers: prohibition/retention of disconnections, pre-payment meters or payment debts in installments.	Subsidies to implement energy efficient renovation of the housing stock Subsidies to change to more efficient heating sources Subsidies to install RES in areas where grids are not available Trainings to use energy more efficiently

The following section summarizes the most important lessons learned from previous European interventions that directly or indirectly tackled energy poverty. The focus of this chapter is on building retrofits, as they are considered the most sustainable and effective way to tackle energy poverty. Although, a number of challenges should be tackled in order to establish and carry out effective renovations programs that reach vulnerable households and can tackle energy poverty.

1) When designing the target-group of funding schemes, there are seemingly competing environmental and social goals:
    a. It has to be decided whether a given budget should be spent on:
        - the support of large number of middle- or higher-income households with a low-level contribution (keeping in mind climate goals) or

[9] (Council of Europe Development Bank, 2019)
[10] (Council of Europe Development Bank, 2019)

- the support of a smaller number of less affluent households with higher-level subsidy (and thus keeping in mind social goals as well).

b. By reducing the energy need of dwellings occupied by energy poor households their energy use might increase, as they are finally able to heat-up their apartment to an adequate level. Consequently, direct goals, such as emission reduction and cost reduction might not be reached.

2) Social targeting might have high transactional costs, thus makes difficult the realization of a social renovation program.
3) Institutional and financial environment might not be “ready” to support energy efficient investment.
4) It might be difficult to reach an agreement for owners in multi-apartment building regarding intent of starting the renovation.
5) High initial up-front costs and long-term payback periods of investments are both hindering the participation of low-income households.
6) To be able to implement energy efficiency retrofits, fundamental problems in the building might have to be resolved first. These problems are usually rooted in the long-term lack of maintenance (outdated systems: heating, water, gas, leaking roofs, lack of individual measurement, ineffective and undermaintained district-heating systems, etc.).

The following section reflects on some of these challenges, partly based on lessons learned from different retrofit programs.

Building retrofits - Practices from the European Union

JESSICA Fund for "Multi-Apartment Buildings Modernization" – Lithuania

Lithuania

Lithuania is a Baltic country, with 3 million inhabitants. Two-thirds of the Lithuanian population lives in the 38 000 multi-apartment buildings, mostly built before 1993, during the soviet- era. 65 % of multi-apartment buildings are heated by district-heating.

"JESSICA - Joint European Support for Sustainable Investment in City Areas, is an initiative of the European Commission developed in co-operation with the European Investment Bank (EIB) and the Council of Europe Development Bank (CEB). It supports sustainable urban development and regeneration through financial engineering mechanisms. EU countries can choose to invest **some of their EU structural fund allocations in revolving funds** to help recycle financial resources to accelerate investment in Europe's urban areas". E**nergy efficiency improvements** are one of the 6 main areas that are supported through the fund.

JESSICA fund is an instrument of revolving nature. "Returns from investments are reinvested in new urban development projects, thereby recycling public funds and promoting the sustainability and impact of EU and national public money." Eib.org

"Multi-Apartment Buildings Modernization" Program, financed by the JESSICA FUND

The "Multi-Apartment Buildings Modernization" is a major program in Lithuania for the implementation of energy efficiency renovations. The program started by the establishment of the JESSICA Holding Fund Lithuania (JESSICA I), a revolving financial instrument, which used EU and national funds to bridge the financing gap for energy efficiency projects in Lithuania. JESSICA I was followed in 2015 by JESSICA II. Both funds offered long-term loans for energy efficiency modernisation with low interest rates, complemented by a 30 to 40% subsidy for homeowners if a given level of energy savings was reached after the renovation. Furthermore, instalments for low-income households (recipients of heating compensation) were completely covered by local municipalities.

	Jessica I 2009- 2014	Jessica II 2015-2020
Fund	€265million EU structural funds, Lithuanian national funds, private contributions, revolved reflow	€150million European Investment and Structural Funds + €180million from financial intermediaries, including commercial banks and a public agency.
Loan	3% fixed rate loan for up to 20 years	Loan up to 20 years with a fixed 3% rate for 5 years.
Generic subsidy	40% if D level energy performance reached after renovation	30% if 40% of energy saving gained
Subsidy for low-income households	100% of costs are covered, for households that are eligible for heating compensation.	

Results

By March 2018 approximately 2,500 buildings were renovated (out of the total stock of 38,000) including about 75,000 households. Since then 500 buildings have started the implementation, and by February 2019 further 720 applications were already submitted. In the case of some smaller towns all the multi-unit buildings were already renovated in the recent years.

The average energy saving was 50% at a building level, many times reaching 75-80%. This is higher, than the minimum required savings of 40% (to obtain the subsidy).

Impact

The renovations increased the value of the apartments by 20-25% and contributed to nicer urban environment.

The program had increased employment, after the financial crises when unemployment rates were high. This was a key element that convinced the government to continue the program.

Learnings

- **The uptake of the loans increased, when local municipalities got involved in the program.**
- In order to carry out successfully the renovation of multi-apartment buildings, it is important to involve every owner. This was done through:
    - The aggregation of credit risks at the level of housing associations/administrators rather than to individual apartment owners
    - Costs of vulnerable households (recipients of heating allowance) was fully covered by municipal support, therefore the renovation did not put a financial burden on them. It was an obligation to participate and agree with the renovation in order to receive the subsidy.
- **Tackling the problems of the poorest can be an efficient tool to accelerate the renovation market in general.**
- Transaction costs of social targeting were kept low, the target group was identified as the recipient of an already existing, relevant subsidy (heating allowance).[11]

"Saving money at home" (Eksikonomisi kat'oikon) - Renovation program in Greece

The program was the first large-scale renovation program in Greece and aimed to motivate homeowners to improve the energy performance of their property. It also aimed to support the renovation of homes of low-income households.

[11] (Energy Poverty Observatory, 2019)

(Build Up, 2018)

Main features

The program targeted owners with relatively low income, owning inefficient dwellings, in zones/regions with low property values, that were built in 1980s (the criteria of the age of the building was later removed. Beneficiaries could be single-family houses, multi-apartment buildings and single apartment owners.

Table 2. The Greek renovation program I & II

	2011-2016	2017-
Source of funding	ERDF & National Strategic Reference Framework 2007-2013.	ERDF & National Strategic Reference Framework 2014-2020
Budget	€396 million	€700 million

The scheme offered a non-repayable grant with an optional interest-free loan, provided through commercial banks. The share of the grant and the loan depended on the income situation of the household, see table Table 3 and Table 4.

Table 3. Income categories of the scheme and level of subsidy, phase 1., original categories

Beneficiaries category	**A**	**B**	**C**
Personal annual income (PAI)	PAI ≤22.000 €	22.000 € < PAI ≤ 40.000 €	40.000 € < PAI ≤ 60.000 €
Family annual income (FAI)	≤40.000 €	40.000 € < FAI ≤ 60.000 €	60.000 € < FAI ≤ 75.000 €
Subsidy benefit	30% grant 70% interest-free loan*	15% grant 85% interest-free loan*	100% interest-free loan*

*interest rate subsidized 100% until 31/21/2015

Table 4. Income categories of the scheme and level of subsidy, phase 1., modified categories

Beneficiaries category	**A**	**B**	**C**
Personal annual income (PAI)	PAI ≤ 12.000 €	12.000 € < PAI ≤ 40.000 €	40.000 € < PAI ≤ 60.000 €
Family annual income (FAI)	FAI ≤ 20.000 €	20.000 € < FAI ≤ 60.000 €	60.000 € < FAI ≤ 75.000 €
Subsidy benefit	70% grant 30% interest-free loan *	35% grant 65% interest-free loan*	15% grant 85% interest-free loan*

*interest rate subsidized 100% until 31/21/2015

Table 5. Income categories of the scheme and level of subsidy, Phase 2.

Category	**Personal annual income (PAI)**	**Family annual income (FAI)**	**Basic Subsidy**	**Additional subsidy per dependent child**	**Max. subsidy level**
1	PAI ≤ 10.000 €	FAI ≤ 20.000	60%	5%	70%
2	10.000 € < PAI ≤ 15.000 €	20.000 € < FAI ≤25.000 €	50%	5%	70%
3	15.000 € < PAI ≤ 20.000 €	25.000 € < FAI ≤30.000 €	40%	5%	70%

4	20.000 € < PAI ≤ 25.000 €	30.000 € < FAI ≤35.000 €	35%	5%	70%
5	25.000 € < PAI ≤30.000 €	35.000 € < FAI ≤ 40.000 €	30%	5%	50%
6	30.000 € < PAI ≤35.000 €	40.000 € < FAI ≤45.000 €	25%	5%	50%
7	35.000 € < PAI ≤40.000 €	45.000 € < FAI ≤ 50.000 €	0%	0%	0%

Supported interventions

Building insulation, including the entrance and the roof

- Replacement of windows, installation of external shadings
- Upgrade of space heating and domestic hot water system

In order to be eligible for the financial support, the interventions had to increase the energy performance of the dwelling by 30% or at least to class C of the Energy Performance Certificate.

Eligibility criteria were changed during the program to accelerate the up-take levels:

- The requirement of the age of the building was deleted, as it turned out that majority of owners of older buildings in low property value zones are elderly people, who would not get a loan contract from the bank.
- Maximum property value level was increased once, then in the second phase of the program it was totally removed.
- The maximum renovation budget was also increased once.
- Income criteria were refined during the two phases of the program:
  - Lowest eligible income was lowered two times.
  - Highest eligible income was decreased once.
  - The three income categories of the first phase were split into 7 smaller categories in the second phase.

Results

In the first phase 60,000 dwellings were renovated: the share of dwellings with C or better energy certificate increased from 0% (pre-renovation) to 33% (post-renovation). Share of F category was reduced from 58% to 9%. In the second phase further 42,228 households were supported.

Impact

The program reached its goal to support low-income households in renovating their homes, as majority of the applicants belonged to the lower income categories.

Learnings

- Elements of the eligibility criteria had to be adjusted during the program in order to accelerate up-take levels.
- **Sophisticated income-based criteria might work in the case of individual contracts, such as in the case of the renovation of detached houses but**

can cause difficulties when an entire multi-apartment building applies for the grant.

- The fact that commercial banks were responsible for underwriting the loans limited the social impact of the program, as they were reluctant to sign contracts with elderly or less affluent households.

Learnings from the EU projects

The seemingly competing environmental and social goals might be united through well-designed financial schemes that combines socially targeted subsidies with loans. This way the funding of energy efficiency from a given budget can be financially sustainable (as larger part of the fund is revolving through the loans) but still guarantee the inclusion of lower income household into the program by the subsidy. Also, the socially targeted subsidies might accelerate renovations, as it is an effective tool to involve households that otherwise might oppose the renovation due to the lack of financial resources**Social targeting of financial schemes for energy efficiency retrofits can accelerate the renovation rate** if

- Loans are combined with non-refundable support, especially if targeted to the most vulnerable households of the building, to facilitate their participation.
- Subsides and loans fully cover up-front costs of low-income households.
- Loans are long-term enough that instalments are not higher than the realistically. reachable energy savings.
- Budget for renovation is balanced so that the it permits to reach the highest number of households possible, but still is generous enough to enable low-income households to participate.

Good examples of overcoming the problem that energy efficiency investments pause high initial up-front costs and long-term payback periods on homeowners are the revolving funds that involve EU, national and private funding. These funds can provide long-term finance for the investments, with relatively low interest rate. This way if complex interventions are done, costs saved on energy after the renovation might cover or be even higher than installments, and it is still feasible to include socially targeted subsidies for low-income households.

1) **To overcome high transaction costs of social targeting it is important to use already existing datasets on social allowance recipients, indebtedness towards utility companies, performance of buildings, etc.**
2) **Institutional and financial environment might need developments.**
   a. **Clarity of the schemes** and financial transparency are key to involve all stakeholders.
   b. **Municipalities can play a key role in the success of renovation projects**. By providing knowledge and assistance to building managers on the technical, financial and social aspects of energy efficient retrofits, the renovation rate can accelerate. Also, municipalities can take further responsibilities in the financial aspects of the renovations.
   c. **Good community-management skills and clear communication of building managers** is crucial in order to properly inform and involve the owners.
   d. **Homeowner association might be ideal customers of energy efficiency loans**, as banks can provide the loan through one stakeholder. This way the risks of elderly or low-income persons not being eligible for credits can be overcome. In this case the homeowner association

- must provide guarantees (this can be supported through the funding program)
- must be trusted by owners and have high collection rate.

e. Differentiation of subsidy levels or loan rates based on income categories might be difficult in the case of multi-apartment buildings, especially when the homeowner association takes up the loan (and not the individual households) .

4.) Fundamental problems in the building might have to be resolved, before being able to start energy efficient retrofits. Energy efficient retrofits might bring the possibility to resolve other basic structural problems of the buildings. Other factors than energy savings might contribute to a larger scale to the decision of homeowners to invest in the. Besides the resolution of basic problems, better comfort at home, increased independence (e.g. by decreasing energy need or heating devices become regulable), nicer building or neighborhood, increased market-value of the apartment can all be factors that motivate homeowners to renovate.

Energy efficient retrofits and energy poverty reduction in REELIH implementation countries

In three implementation countries of the REELIH project, energy efficient retrofits of multi-apartment buildings were carried out. This is an overview of the carried-out projects.

Armenia

Armenia is a landlocked country in the South Caucasus region of Eurasia. Its population is about 3 million, which makes it the most densely populated of the former Soviet states. Roughly one third of the population (1.08 million people) live in the capital Yerevan. Almost two thirds of the residents live in urban areas and one third in rural environments.

In Armenia there are approximately 19,150 multi-apartment buildings, quarter of them (4,860) are located in the capital Yerevan. 4,420 apartment buildings (approx. 23% of all multi-unit buildings) are constructed of prefabricated concrete.

Multi-apartment t buildings are mostly managed by homeowners' associations (HOAs), who are therefore important stakeholders of renovations. HOAs have the flexibility to move and accumulate financial reserves of different buildings under their management. This on the one hand enables them to finance retrofits. On the other hand, it decreases the willingness of owners to pay common fees, as they do not have the control over where their money goes. Besides the problem of low collection rates, the banks are also skeptical when it comes to provide loans for HOAs as their accounting system is not professional and transparent. The law regulating HOAs has been in negotiation in the parliament for several years now to make the functioning of the HOA more transparent and operational.

Armenia has a markedly continental climate with hot summers and cold winters and relatively short snowy months. The country is mostly located on a mountainous and highland terrain. During the Soviet era, the housing sector was dominantly heated by the district heating system. Currently the residential sector is served by a diversity of heating systems. In urban areas gas and electricity, in rural areas wood are the most commonly used heating sources. According to a Habitat survey in Yerevan, 77% of the respondents pay more than 25% of their income on utilities.

The REELIH project in Armenia

Habitat for Humanity Armenia in the framework of the REELIH project assisted so far, the implementation of basic energy efficiency interventions in the common areas of 13 multi-family buildings in the cities of Yerevan and Vanadzor. The interventions commonly included the replacement of entrance doors and staircase windows with more efficient ones and the improvement of the lightning system, insulation of roof and basement. Façade insulations were only partly feasible or not feasible at all, due to specificities of the buildings.

The renovations were financed from two major sources:

- A subsidy scheme operated by the municipalities (40% grant) and
- Joint commercial bank loans to the communities, with personal guarantees behind. The loans were managed by the Homeowner's Associations. Among the several loans available to HOAs through commercial banks, the most popular ones (with the best conditions)were funded by Habitat Armenia.

Habitat for Humanity Armenia in the frame of REELIH project:

- Provided (and at the same time tested) a financial scheme for homeowner's association, through a commercial bank, Inecobank. HOAs could take-up an AMD-based commercial loan – financed from Habitat financial sources - with 12% interest rate, up to the duration of 3 years. This scheme was complementary to the financial support of the local municipality.
- Provided financial and accounting training for managers of HOA
- Participated in the legislative work to modernise the legal background that shapes the HOAs functioning

Outcomes

The interventions resulted in only 2 to 6 % of energy savings, due to the limited space for interventions in the common spaces. Even though, the renovation did not have a substantial impact on the financial situation of the residents, their comfort level increased because of the better thermal conditions in the building.
The most relevant outcomes of REELIH project though, were rather at an institutional level. Namely, the project boosted crucial changes in the framework conditions of energy efficiency renovations. More concretely, through the project Habitat for Humanity Armenia

(1) Tested a financing model of building renovation, that can finance a renovation in a commercial basis on the long run
(2) Actively contributed to the modernization of HOAs legislative regulation, which is key to form an institutional framework that provides solid basis for the energy efficiency renovations
(3) Created new networks of municipalities in the field of renovations.

Bosnia and Herzegovina

Bosnia and Herzegovina is a former Yugoslav republic in South East Europe, with a total population of around 3.5 million according to the last Census from 2013. Sarajevo is the country's capital and largest city with a population of almost 440,000 people, followed by five other cities with a population between 100,000 and 200,000.

The current territorial and political setup of the state is defined by the Dayton Peace Accords signed in December 1995, ending the 3.5-year long Bosnian war. The country is divided in two entities (Federation of Bosnia and Herzegovina, Republica Srpska) and a district (Brcko). The administration and legislative power are also divided, which creates serious problems in

harmonizing policy solutions. For example, legislation about homeowners' association management, operation and financing is completely different in the different parts of the country and at the administrative levels.

In Bosnia and Herzegovina, multi-apartment dwellings represent only 16.4% of the housing stock. Regarding heating methods, two-third of the residential building stock is heated with wood. According to a survey of Enova, in Sarajevo canton 42% of the total floor area of multi-family buildings is heated by district heating, 33% by electricity and 20% by natural gas.

The REELIH Project in Bosnia and Herzegovina

The project was initially let by a consultant of Habitat for Humanity in cooperation with the local office of Caritas Switzerland and is currently implemented by ENOVA, a local consulting and engineering company. Pilot buildings were renovated in four cities. The renovations were co-financed by municipal subsidies (generally by 50%). The remaining costs were covered by the contributions of owners, in the form of savings, loans taken by the management company, or individual loans obtained through commercial banks and microfinance institutions. In the case of one building, the municipality financed 100% of the costs of three owners, who otherwise would not participate and therefore would block the project.

Two main obstacles in the way of the renovations were related to the regulation of multi-apartment building. The first is a legal obligation that owners who voted for the renovation have the obligation to finance it. Many like to interpret this condition as if a 100% approval were needed for any large-scale interventions. In reality a simple majority decision is enough, but the majority cannot enforce the payment obligation to the minority. In case there is a willingness to finance the share of some owners who are not willing/able to pay, the renovation can be implemented. However, if there is a bigger opposition, the renovation process is terminated. This legal obligation is a major impediment, which paralyzes the renovation. On the other hand, similarly to the Armenian case, the accounting mechanism of management companies is not very transparent, as several buildings' money is under one account. As legal processes against arrears are slow, the collection rate of common fees in a building highly depends on the trust towards the HOAs. In the case of smaller localities, only one management is present, therefore the lack of competition further decreases the quality of management.

Outcomes

According to the municipalities, the owners joined the program to fix crucial structural problems of the building (falling facades, leaking roofs), and their comfort level increased after the renovation. Energy costs might decrease at a longer term, after the repayment of the loans. The loans complementary to the public subsidies had rather short term repayment periods, thus in the first years, costs of the households were higher than the energy savings, especially in the case when they made extra investment to upgrade from wood-burning stoves to electrical heaters. In the case of buildings with district-heating, due to the lack of individual metering, the heating costs remain the same.

For local decision makers the main goal and intended outcome was the reduction of air pollution. This is a very crucial issue in the country, as individual heaters fueled by wood that produce most of the pollution, are the main source of heat in the dwellings.

During the implementation of the project, Habitat for Humanity switched the focus of the project from renovations of buildings itself to changing the legal and financial

framework of energy efficiency retrofits in the country, as some major obstacles were realized. The project partner of Habitat for Humanity, ENOVA elaborated cantonal renovation strategies in Central-Bosnia, Tuzla, Goražde and Sarajevo, including technical evaluation of the multi-family building stock and establishment of reliable financial sources for renovation. This included the technical evaluation and energy efficiency renovation potential of the multi-family building stock and the establishment of reliable financial sources for renovation itself. As aa result, a growing number of municipalities and cantons have started to introduce grants to support the energy efficient renovations of detached houses and multi-apartment buildings.

North-Macedonia

North-Macedonia is a former member of Yugoslavia, becoming independent in 1991. It is located in South-East Europe and has 2 million inhabitants. It's capital and largest city, Skopje has 500,000 inhabitants.

In North-Macedonia, homes are predominantly heated by individual heaters (stoves), mostly fueled by wood. In urban areas more than two-third of household's heat with solid fuel stoves and electricity is the second most common heating source (18.7%)[12]. District heating is present only in the capital city of Skopje.

Even in the capital, state of multi-family buildings is inadequate. According to a survey of Habitat for Humanity, in Skopje there is a large difference between the state of multiapartment buildings at a district level, in terms of heating methods and quality (see Table 6). An average 50 % of multiapartment buildings needs urgent repair due to leaking roofs or damaged facades and that there is a general lack of insulation.

Table 6 State of the multi-family buildings in selected districts of Skopje, and towns of North Macedonia (in share of buildings) Source: HFH Macedonia

	Karposh (Skopje)	**Aerodrom (Skopje)**	**Chair (Skopje)**	**Gazi Baba (Skopje)**	**Prilep**	**Veles**	**Negotino**
Most common heating form (and its share)	District heating (61%)	District Heating (64%)	Electricity (82.2%)	Electricity (37.6%)	Wood and electricity (48.1%)	Wood and electricity (28.6%)	Wood and electricity (83.7%)
Damaged façade without insulation	51.8%	46%	65.6%	77.3%	27.4%	28.7%	81%
Leaking roof without insulation	35.1%	54.5%	32.3%	69.3%	57.1%	29.3%	79.5%

[12] Ilievski, 2014

A local survey proved, that partially heated or underheated apartments are very much present even in urban areas. According to EU-SILC data[13] 24 % of the population reported that they are not able to keep their homes adequately warm.

As in the two other REELIH demonstration countries, the situation of homeowner's associations in Macedonia is also quite uncertain. According to the legislation, homeowners should choose to be self-managed or managed by a company. 40% of buildings have none of these options, thus are not considered as legal entities. This is due to the lack of trust towards management companies and that owners themselves are not willing to take responsibility of managing the building officially. Consequently Thus, they do not have bank accounts and are not able to enter into contracts, and consequently not able to benefit from the REELIH project.

The REELIH project

In the frame of the REELIH project, Habitat for Humanity Macedonia (HFH Macedonia) provided complementary financial assistance to the already existing renovation schemes of the local municipalities, through a **Residential Energy Efficiency Revolving Fund**. Municipalities in Skopje provided financial support (30-100%) for the insulation of the facades, basement and roof. Generally, 30-50% of costs are covered by the district municipalities, and in some cases recipients of social allowances are entitled to a scheme that covers 100% of the insulation costs. If a building receives the funding for the insulation, it is required to additionally replace 70 % of windows.
As the REELIH municipal subsidy in most of the cases covers only a part of the insulation costs, HFH Macedonia in the frame of the REELIH project has provided two types of loans to cover the remaining costs (the own share for the insulation, and the costs of the windows) not covered by the municipal scheme:

- A maximum 7 years loan to individual households with an income between minimum 8,000 MKD (130 EUR) and maximum 25,000 MKD (400 EUR, 75% of the national average). With an income higher than 75% households can easily access commercial bank loans to cover the remaining costs after the municipal subsidy.
- A short term, maximum 2 years loan for management companies, who then contract with all homeowners on the payment.

As a response to the deficiencies of buildings management, Habitat for Humanity Macedonia established its own building management company, Habidom to provide transparent and efficient management for homeowners in multi-apartment buildings.

Outcomes

Between 2010 and 2019, 72 buildings were renovated. Half of them are located in two districts of Skopje, with highest incomes. As the interventions were complex (insulation and replacement of the windows), the building manager applied for cost reduction to the district heating company, or the apartments were heated individually, energy savings reached approximately 30 to 50 %. In the case of the 7-years, longer-term loan provided by Habitat for Humanity Macedonia to the owners individually, the amount of the monthly instalments and the reduced energy costs were balanced. In the case of individual heaters, energy costs might not decrease significantly, as due to the better energy performance of the apartment, the owners could allow themselves to heat up properly their homes, at the same costs as before. Even if the savings are not significant in this case, the comfort level of the apartment definitely increased. Also, negative consequences of underheated apartment

[13] The European Survey of Income and Living Conditions is a survey of the Eurostat, and it covers EU members states and some other states. From the three REELIH demonstration countries the data related to the ability of keeping the apartment warm is only available for North-Macedonia.

could be avoided. The owners in one renovated building reported that the real gain of the renovations for them was that the value of their apartment increased (by 100 EUR/m^2).

From the three REELIH project implementations, the Macedonian one is most probably the one that is the best in tackling energy poverty, as the Habitat for Humanity loan is provided to low-income households so that they can take part in the renovation process.

The housing management company Habidom, established by Habitat for Humanity Macedonia, already manages 100 buildings and 14 staircases (that can be managed individually). The company provides transparent management for the buildings, including one sub-account and one reserve for each building. They have a high, 95% payment rate and are efficient in collecting arrears.

Energy poverty reduction through building retrofits in REELIH countries

In each REELIH renovation program, comfort level of inhabitants increased. Symptoms of energy poverty, such as cold and humid apartments due to the lack of proper heating and other technical problems, or too hot apartments during summer were somewhat reduced (depending on the complexity of interventions).

In the case of complex interventions, energy needs of the apartments were significantly decreased. This either decreased energy costs in a longer term or permitted to heat-up at an adequate level the apartment without financial sacrifice. As underheating is common issue in all REELIH countries, this is an important gain. Instalment payments might shade the savings on bills for few years. However, at a long term, the reduced energy demand of the buildings not only decreased the energy costs but also the dependency from changes in energy prices.

Some of the interventions allowed households to switch to more modern heating devices, which also contributed to a better comfort level.
In terms of the capacity to reduce energy poverty reduction, beside the various gains in the field of providing higher comfort levels for the households, there were some limitations. This was on the one hand due to underdeveloped institutional and financial environment of multi-apartment buildings renovation, as already discussed. Weak or non-transparent management of buildings combined with low payment levels significantly reduce the chance of the buildings to successfully apply to loans for renovations. n many cases, weakly managed buildings are also in a more vulnerable situation in general (e.g. higher share of owners have low-income), compared to the buildings with better management. This means, that the buildings with more vulnerable households have lower chances to access for funding that would enable the energy efficient renovations. Even if loans provided in the frame of REELIH project reached mostly buildings with good management, other outcomes of the project such as the establishment of a better financial and institutional environment for renovations secure that in a longer-term a larger share of vulnerable buildings will be renovated, as access to funding will be secured at a larger extent Thus, multiapartment buildings inhabited by lower income households will also benefit from the renovations.

In order to provide the possibility of energy efficient renovations to the buildings in a more difficult or vulnerable situation, it is important to first create a stabile building management.
To summarize the key achievement per country:

- In Armenia, Habitat participated in the process of renewing the HOAs' legislation and provided trainings for HOA managers

- In Bosnia and Herzegovina ENOVA contributed to several renovations' strategies. Also, at a municipal and cantonal level new schemes were launched to support building retrofits.
- In North-Macedonia a building management company funded by Habitat for Humanity Macedonia is now managing over 100 buildings in a professional and transparent way, and also carries out renovations.

Learnings from the REELIH project

Financial and institutional environment is crucial

In each REELIH implementation country while planning and carrying-out the renovation, the local implementer realized **that there are structural factors that hinders the implementation of energy efficient retrofits of multi-apartment buildings**. Low level of trust towards HOAs or management companies due to not fully transparent way of management and accounting could block either the approbation of the renovations from the part of the homeowners, and the willingness of banks to provide loans. Also, there was a lack of proper financial products for the HOAs and the building retrofits. Therefore, beside the focus on the renovations itself, there was a need to intervene at a level of the functioning of HOAs and to establish sustainable financial and institutional frameworks first.

To deliver large scale energy efficiency renovations, there is a need of the reinforcement of the institutional and financial environment that enables the renovation of multi-apartment buildings. In the REELIH project, this was done through:

a. The professionalization of HOAs by increasing the transparency of accounting and ameliorating the management skills. This leads to higher trust from both homeowners and banks, which is a step zero of energy efficient renovations.
b. The establishment of financial schemes that
    - can cover the lacking up-front cost investments
    - can complement locally available public funds
    - are long-term enough to secure that installments do not pause a financial burden on the households.

Improving building quality is crucial

- As in the REELIH countries the general state of the building stock seeks interventions, energy efficient interventions programs not only provided increased efficiency of the buildings, but boosted in general the necessary maintenance of buildings (e.g. repairing roof, facades).
- According to feedback from homeowners, the real benefits of the renovations are:
    - general increase in comfort
    - increased value of their property
    - fixed maintenance issues

Heating systems

Besides the general state of the building, heating methods also play and important role in the comfort levels of households. In the REELIH countries wood heating in induvial stoves is very prevalent, and where district heating is available, it is mostly outdated and not measurable. **One important learning from the REELIH project, is that is important to ameliorate not only the buildings itself but the heating system as well.** In the case of

wood fueled stove, switching to a more modern method can be a solution. While when district heating is present, involvement of the provider in the renovation process is important to reduce price after renovation (as consumption is reduced at a building level) and to introduce individual heat measurements.

Despite these challenges, important changes are taking place in the region in the field of building retrofits. The REELIH project contributed positively to these changes by fostering energy efficient retrofits through improvement of building management legislation and practice, facilitation of stakeholders, development and testing of financial schemes the are socially targeted and complementary to locally available subsidies, and finally through energy efficient retrofits.

Even though in neither or the REELIH countries exist a definition of energy poverty and due to lack of data it is impossible to precisely identify energy poor households. Given the general condition of dwellings and heating patterns, REELIH definitely eased the situation of many households: apartments are better heated and comfort levels increased. Furthermore, important maintenance issues, such as leaking roofs were fixed. In particular, achievements in the field of institutional and financial frames of energy efficient retrofits are highly needed steps towards the upscale of retrofits, that include buildings in the most difficult situation as well.

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REELIH
RESIDENTIAL ENERGY EFFICIENCY FOR
LOW-INCOME HOUSEHOLDS

This study is made possible by the support of the American people through the United States Agency for International Development (USAID). The contents are the sole responsibility of the Habitat for Humanity Europe, Middle East and Africa and do not necessarily reflect the views of USAID or the United States Government.

Residential Energy Efficiency for Low-income Households project is one of the many assistance projects supported by the American people through the United States Agency for International Development (USAID). Since 1992, the American people through USAID have provided a broad range of development programs in Armenia and Bosnia and Herzegovina and North Macedonia, shifting from an initial humanitarian emphasis to assistance for economic, political and social transition.

HABITAT FOR HUMANITY EUROPE, MIDDLE EAST AND AFRICA
ZOCHOVA 6-8, 81103 BRATISLAVA, SLOVAKIA
TEL. +421 2 3366 9000 EMAIL: EMEA@HABITAT.ORG WEB: HABITAT.ORG/EMEA

https://getwarmhomes.org/