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THE CONTRIBUTION OF ENERGY POVERTY ALLEVIATION TO A SUSTAINABLE FUTURE
Eastern European Urban Context

Georgi Georgiev

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ABSTRACT

Energy poverty as a phenomenon is linked to the combined effect of three main factors – low household incomes, high energy costs and low energy efficiency of housing. It is a proven fact that this phenomenon has a serious negative impact on the quality of life and citizen's health, but in the same time, energy poverty contributes to a huge waste of energy and thus affects sustainable development of the built environment. Altogether the energy poverty generates deficits and discrepancies for territorial economies and society. The paper investigates the issue of energy poverty and its appearance, also in the Eastern European context. The potential for alleviation and – in the long term – for the elimination of energy poverty by applying measures for energy-efficient retrofit of residential multistorey apartment housing is analysed. The emphasis is put on achieving the optimal ratio of saved energy versus used financial resource for renovated housing.

KEYWORDS

energy poverty, social exclusion, condominiums, affordable housing, energy efficiency

Georgi Georgiev, Architect and PhD, is a Full Professor at the Department of Architecture, New Bulgarian University (Bulgaria). Chartered member of UK Chartered Institute of Housing, Representative of the Union of Bulgarian Architects in Architects' Council of Europe (ACE) – Working Group on Housing and Living Environment, long term experience in sustainable development, housing, urban and environmental planning and management in transition economies. Mob. +359 888/45.26.88 | E-mail: gngeorgiev@nbu.bg

Energy poverty is a relatively new and insufficiently explored issue. Apart from its social implication, it is a significant constraint for sustainable development of the built environment. In most EU countries, buildings are the largest energy consumers; about 85% of the consumed energy is used for heating and hot water preparation. In view of the increased global economic insecurity, accelerated by the coronavirus pandemic, it is expected that the problem will become ever more prominent and, therefore, needs adequate attention and research. Such a conclusion is even more valid for Eastern European countries where energy poverty is a well-documented problem according to statistical data. One of them, Bulgaria, is leading (together with Latvia) in the negative ranking of share of households unable to provide normal heating for their homes. Households in Eastern Europe would consume twice more energy than the average in Europe to achieve the same welfare level. The vulnerability of citizens in Eastern Europe (Bulgaria, Croatia, Estonia, Greece, Hungary, Latvia, etc.) could be related to the legacy of the centrally planned economy, such as the poor thermal insulation of housing stock, the historically low energy prices and the predominance of unsustainable energy sources.

Existing approaches to defining energy poverty are still not well coordinated (Bouzarovski, 2018). Usually, energy poverty tends to be associated with specific demographic groups and/or types of housing. Therefore, energy poverty could be described as the inability to secure an acceptable level of heat comfort in energy-inefficient homes. Most common national social policies are indirectly related to addressing energy poverty, such as subsidizing a 'social electricity tariff' etc. However, few aspects of existing energy, social and climate policies have been identified as having a positive economic impact on energy-poor households. It can be concluded that common policies to tackle energy poverty at the European level are not yet established (Bouzarovski, 2018). In general, the possible policies to alleviate energy poverty could be seen in three directions: raising the level of household income; subsidizing of heating costs and subsidizing of housing retrofit. While the income level and energy costs policies are depending on much more variables and could be considered as long-term interventions, reducing fuel poverty by the implementation of energy efficiency measures in high rise apartment buildings can bring fast and efficient results if proper action will be put in place.

Energy (un)efficiency of existing mass housing in Eastern Europe | Energy inefficiency of the housing in Eastern Europe and related fuel poverty is a problem of momentous importance but it could also be viewed as an opportunity for reshaping of the housing sector through innovative housing initiatives in energy retrofit of condominium housing. Such an approach uses financial and management tools based on energy saving-oriented housing retrofit (Georgiev, 2017). The region comprises of 11 EU member states that joined the EU from 2004 to 2013. Due to process of forced urbanization during the rule of communist governments in Eastern Europe, about half of the

existing housing stock in these countries was constructed between 1960 and 1990 of the twentieth century (Economidou et alii, 2011). During this time, new housing construction was consisting predominantly of pre-fabricated large-scale multifamily housing apartment blocks built in cities with little or no consideration of energy efficiency. For example, this type of housing represents about 70% of the existing housing stock in Bucharest and 45% in Sofia (United Nations, 2013).

During the time of the centrally planned economy until 1989, the planning, development and construction of new housing were almost fully implemented by the state within the frame of the five year 'socio-economic development plans'. A limited and distorted private sector activity existed in the so-called 'individual' and 'cooperative' housing construction. That share of housing supply, in addition to being a minor, was the subject of inequality in terms of access to financing, subsidies and building materials supply, compared to the state housing development. According to the prevailing in this period doctrine of the centrally planned economy, all the parameters of the dwellings to be built – quantitative, qualitative, financial, etc. – were also determined in a centralized way through housing planning in the framework of five-year development plans (Georgiev, 2017).

A key characteristic of housing stock in Eastern Europe currently is the prevailing of private homeownership. After 1989 the transition to market economy in Eastern European countries forced privatization of existing apartment housing which was prior publicly owned to a great extent. The level of homeownership thus increased up to 90% that is far beyond the average figure of 65% for Western Europe (United Nations, 2013). In most cases, housing privatization was implemented in several years by simply selling the apartments in high rise multi-storey buildings to sitting tenants converting their status from renters to apartment owners in condominiums. The quick mass privatization of high-rise apartment buildings left many Eastern European countries without an adequate regulatory framework for management and maintenance of these newly formed condominiums, as pointed out by various researchers (Lujanen, 2010; Tsenkova, 2005; Georgiev, 2017). In addition, new homeowners had few resources to manage and maintain their newly acquired apartments as well as the adjacent common areas of the buildings. As a result, after the transfer of ownership, the housing stock in many countries from the region is ageing prematurely and deteriorating following the low quality of construction works and used materials, lack of funds and proper maintenance. Due to the above-mentioned reasons, combined with the inherited from the socialist past low construction quality and lack of management, high rise apartment buildings in Eastern Europe are in general extremely energy inefficient (United Nations, 2013).

Condominium model «[...] means that the owners own their dwelling, but, more accurately, they own the space which is defined by the internal walls of the dwelling, which might not be connected to the ground on which the building stands. Their ownership is listed as property in official records. The common parts and the land are,

however, owned jointly by all owners» (Lujanen, 2010, pp. 179, 180). Condominium model exists in all European countries. Different is how this property occurred in both parts of Europe. In Western Europe, but also in Eastern Europe (until World War II) condominiums emerged through the united efforts of private investors that jointly developed and inhabited an apartment building. In post-war Eastern Europe, most of the new apartment buildings were built and owned by the state and their dwellings were used as rental ones. They were hugely privatized in the period 1990-2000, along with imposing by the state of certain conditions for collective management and collection of running costs for these buildings. It was made by introducing requirements for the establishment of collective representative bodies at the building level – homeowners' associations (HOA). This is the case in Romania, Czech Republic, Hungary and others (Georgiev, 2017).

During the communist government after 1944 the state in Bulgaria, as well as in other centrally planned totalitarian countries in Eastern Europe, seized the role of the main developer and to meet the policy of forced urbanization has started a massive construction of multi-storey residential buildings in so-called 'housing complexes'. However, unlike other Eastern European countries and the former Soviet Union, the ownership of newly built apartments in Bulgaria was transferred immediately after their completion to their residents without providing the necessary legal provisions for adequate maintenance of the condominiums. Such 'primary' privatization of newly build apartment housing was quite peculiar for an Eastern European country at that time and implied further heavy problems with maintenance and management of Bulgarian condominiums later on. Within the time of large-scale industrialised housing construction in Eastern Europe (the sixties, seventies, eighties of last century), there were some changes in building regulations following the energy efficiency. The legislation dealing with the thermal resistance requirements of buildings changed over the years, taking into account the existing conditions for the supply of energy sources. For example, for large-panel construction systems, the stipulation has been adopted that the buildings will be operated in conditions of provided district heating (which is subsidized everywhere at that time in the frame of a central planned economy). Within the socialist economic system, for ideological reasons, the energy prices were kept by the government far below the market levels through heavy subsidies.

As a result, artificial energy prices, that were subsidized for the final consumer, combined with the relatively low energy prices on the international markets until the end of the seventies of the last century, had their impact on the low-level thermal insulation of residential buildings in most Eastern European countries. The global increase of energy prices, that occurred later, was reflected to some extent in regulations and housing design layouts. This led to some improvement in the thermal resistance of large-panel residential buildings. But in other housing systems, and especially in monolithic housing, nothing significant has been done in terms of energy savings (Georgiev, 2017).

Changes in large-panel housing construction in terms of improving energy efficiency were reflected in: a) changes to the facade panels, increasing the thickness of the thermal insulation layer in three-layer panels, reducing or eliminating thermal bridges, improving the composition of concrete for single-layer panels; b) obligatory laying of a thermal insulation layer in the floor slab above the basement; c) improving the thermal insulation above the ceiling level – the roofs so far were made according to the so-called 'cold' type – the transition from low to high under-roof space.

In all of the Eastern European countries, as a rule, high rise residential apartment buildings from that period have extremely low energy efficiency. For example, the building envelope of residential buildings had real heat transfer coefficients, more than 3 times higher than the norms for new building construction introduced after political changes. In most of the existing residential buildings, the basements and attic levels were without thermal insulation. Extremely poor thermal insulation of building envelope has become the main reason for increased heat losses (BPIE, 2016).

Housing retrofit: an overlooked tool for alleviating fuel poverty | The proposed approach that was analysed in the pilot cases reviewed, is focused on the improvement of housing physical structure potential to eradicate energy poverty, as opposed to the primary focus of existing research on tenants' behaviour aspects. Due to the prevailing share of homeowners, reducing fuel poverty by the implementation of energy efficiency measures in high rise apartment buildings in Eastern Europe is largely depending on their decisions regulated by the legal framework defining their rights and obligations within the condominium. These are framework legal regulations which need to be in place in order to ensure that energy-efficient retrofit can be successfully applied to residential buildings. Depending on the level of development in the condominium legal framework, different level of achievements is observed in renovation activities in Eastern European countries.

Although in complicated legal and economic environment innovative pilot projects have been implemented in Eastern European countries revealing the potential of improving the energy efficiency of housing as a tool to alleviate fuel poverty. International organizations have often played an important role in funding and realising projects to improve the energy performance of apartment buildings. In recent years housing refurbishment projects have increased in scale. The creation of a legal, financial and organizational framework to improve the energy performance of housing stock in these countries was speeded up by EU energy efficiency legislation. All countries in Eastern Europe have already transposed EU directive on energy efficiency (Energy Performance of Buildings Directive – 2010/31/EU) in their national legislation (Economidou et alii, 2011). The sharp increase in prices of fossil fuels, primarily imported from Russia, and the related increase of the importance of fuel poverty issue is another incentive for national governments to increase their involvement in legal and financial support for improving housing energy efficiency. However, some countries

are more advanced in support of residential energy efficiency therefore practically diminishing fuel poverty.

The main obstacles for large scale energy efficient retrofit activities for condominium housing can be outlined as follows (Lujanen, 2010; Economidou et alii, 2011; Georgiev, 2017): a) lack of legislation for adequate management of condominium housing; b) lack of energy-saving incentives and financial tools for the renovation of condominium housing; c) non-existent legal enforcement rule in condominium residential sector; d) undeveloped social rental housing sector able to accommodate insolvent apartment owners from condominium buildings. Regardless the overall problematic status of the condominium housing management and energy-efficient retrofit in Eastern Europe as a whole, there are, however, examples of innovative approaches that are creating a breakthrough and could be outlined as best practice cases. Most of the successful condominium housing renovation schemes in Eastern European countries are loosely or strictly based on the ESCO model.

Quasi ESCO approach combined with a (small) subsidy | Being not directly fully associated with EPC and ESCO this scheme actually contributes from savings from reduced heating bills thus allowing repayment of subsidized homeowners loans used for renovation.

Condominium Housing Renovation Scheme in Latvia – The project Energy Efficient Modernization of Condominium Buildings was started in Latvia in 2004. During this project municipalities and homeowners' associations had an opportunity to obtain soft loans under favourable conditions for energy-efficient retrofit of their buildings. The project has been implemented in cooperation with German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety, German Development Bank Kreditanstalt für Wiederaufbau (KfW), Ministry of Environment of the Republic of Latvia, Environmental Investment Fund and Mortgage Bank (Gerőházi and Szemzo, 2015). In total, 5 million euro has been targeted for the realization of the building renovation activities. In the beginning, 127 loan applications were received and Mortgage Bank specialists have selected 47 projects to participate in the 2nd stage of the competition. Some of the applicants left the project implementation during the preparation process.

Since this project was a first large scale attempt to tackle the energy efficiency problem in high rise apartment buildings in the post-Soviet era in Latvia numerous obstacles were identified during the implementation phase. It was difficult to obtain the necessary agreement of 75% of apartment owners to start the loan-based project. Due to the different socio-economic level of apartment owners, it was hard to organize common activities in loan obtaining. The project envisaged a comprehensive condominium building renovation, which was technically the best approach, but at the same time was expensive. Not all of the apartment owners were able to meet the loan requirements. As a result, until 2005 just five building renovation projects were com-

pleted. Evaluation of energy-saving results obtained during the heating season after the renovation was made. In 2005 renovation of two more condominium buildings has been finished.

Within the framework of the renovation project Latvian Environmental Investment fund provided following supportive activities: i) consultations to the representatives of municipalities about the possibilities of financing; ii) information for project popularization; iii) help for the municipalities during the project implementation, e.g. procurement process and renovation activities itself; iv) monitoring of the implemented project during the loan repayment period. Finally, out of allocated 5 million euro about 1.6 million euro were actually invested, with an average investment of approximately EUR 3,500 per renovated flat. The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supported the project with interest subsidies and non-reimbursable subsidies for construction costs totalling approximately EUR 580,000. The BMU commissioned the KfW banking group to make the reduced-interest loan available via the Mortgage Bank of Latvia (LHZB). During the first heating period following the modernisation savings of approximately 40% of carbon dioxide emissions were recorded, along with reduced heat consumption and heating costs (Beuermann and Bunse, 2008).

Zaharna Fabrika Pilot Condominium Renovation Project – By the beginning of the project start (2003), the condominium buildings in Bulgaria (60% of owner-occupied housing) suffered severely from low energy efficiency and the lack of adequate management and maintenance, leading to high energy bills, progressive deterioration of the stock and great reduction of its' market value (Fig. 1). Most of the apartment owners were not only unable to secure the necessary funds to cover the building management and repair costs of operating and repairing the building, but some of them could not pay their heating bills. Homeowners' associations did not exist in legal terms, making extremely difficult the attempts to maintain and refurbish existing condominium buildings, because all of the apartment owners have to agree and to be able to afford the renovation. By 2003 no single action was taken in Bulgaria tackling the issue of deteriorating condominium housing even at the level of a pilot activity (Georgiev, 2017; Eco Building Club, 2015).

Fig. 1 | Zaharna Fabrika pilot building before renovation (credit: G. Georgiev).

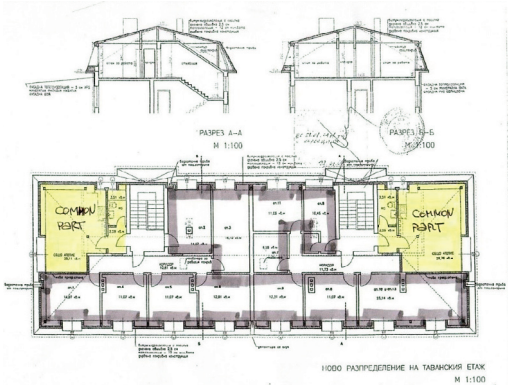

Fig. 2 | Roof reconstruction plan of the pilot building (credit: G. Georgiev).

The project initiator was the Bulgarian Housing Association (an NGO, developing housing-related projects in Bulgaria since 1995), supported by Dutch housing associations De Nieuwe Unie from Rotterdam and Woondrecht from Dordrecht. They found that the management and maintenance of residential condominium buildings in Bulgaria suffer from a chronic lack of adequate legal and organizational form. As well known, the problem of maintenance of common areas such as staircases, roofs, facades, engineering installations, is extremely acute and leads to the increasing degradation and decapitalization of buildings and surrounding areas. Defects in the amortised infrastructure also lead to compromising the construction of the buildings, the risk of fire, and so on. As a result of the preliminary study, the project partners concluded that the Dutch model of multi-storey apartment building management by owners' associations could be a good starting point for finding a solution in Bulgarian conditions (Vv.Aa., 2007). The project aimed to improve the living comfort, physical condition, energy efficiency, management and maintenance of existing condominium buildings in Bulgaria by testing a pilot activity, where an efficient organizational and financial model for reconstruction and subsequent management by newly established homeowners' union is applied. The renovation of the apartment building increases the standard of living, reduces energy costs and facilitates the future maintenance of the property. A logical outcome was also the increase in the market price of the renovated building (Georgiev, 2017).

The building's roof, basement, windows and external brick walls of block 10 were in poor condition. The construction, dating from 1947 had 13 flats, all of them privately owned. Based on the survey data and discussions with the owners of Block 10, the specific financing model was discussed. A project with financial and technical part for the implementation of the reconstruction was developed. It was assumed to perform complete thermal insulation of the external walls of the building and reconstruction of the attic space by an upgrade and thermal insulation of the roof structure. Two shared-owned ateliers were allocated in the upgraded under-roof area. They were targeted for

СЕРТИФИКАТ

за енергийните характеристики на сграда

Номер 063EEK001 | Категория A | Валиден до: 2016 г.

Сграда	Жилищен блок №10	
Адрес	София, ж.к. Захарна Фабрика	
Тип на конструкцията	Средна	
Година на построяване	1 946 г.	
Застроена площ	240,5	m^2
Отоплявема площ	1 214	m^2
Отоплявем обем	3 152	m^3

Годишен разход на енергия

ДЕЙСТВИТЕЛЕН	ЕТАЛОНЕН
138.9 kWh/m²	148.1 kWh/m²

Издаден на 06.06.2006 г.

Издаден от: ЕнЕфект –Консулт ЕООД

Рег.номер: 00063

Подпис/печат

Fig. 3 | The pilot building under renovation (credit: G. Georgiev).

Fig. 4 | View at the reconstructed pilot building (credit: G. Georgiev).

Fig. 5 | Energy efficiency certificate of the reconstructed building (credit: G. Georgiev).

rentals, in order to cover a part of the loan repayment (Georgiev, 2017; Fig. 2). Zaharna Fabrika Pilot project consisted of energy-efficient housing renovation by use of a soft loan, offered by Dutch International Guarantees for Housing (DIGH), followed by energy auditing and building certification. This pilot project was the first in Bulgaria example of a purposefully conducted operation to test all the interconnected stages that address the problem of reconstruction of the existing condominium building by establishing a homeowners' association to carry out the renovation and subsequent management of the building (Figg. 3, 4). A key moment for the successful implementation of

the renovation project of the pilot building (bl.10) was the establishment of effective interaction between project consultants and homeowners. The willingness to cooperate and the involvement of the apartment owners was the decisive precondition for achieving the end result, namely better housing, cheaper maintenance of the building without additional financial burden for the homeowners (Beuermann and Bunse, 2008).

Among the key benefits from the realisation of the project were more than 50% reduction of heating costs, allowing the money saved on energy bills to be used for renovation loan repayment. Following the retrofit, the building was audited for measuring the achieved savings and was given Certificate 'A' for energy efficiency (Fig. 5) In line with Bulgarian legislation the renovated building was granted a property tax vacation for ten years. Zaharna Fabrika pilot project proved that it is possible to renovate a condominium building with almost no subsidy, covering the entire retrofitting costs by a soft loan with a 'bottom-up' driven project, supported by an experienced expert team, working closely on site with the apartment owners. According to Beuermann and Bunse (2008, p. 17) «[...] there is huge potential for this project to be replicated».

Replicability of Quasi ESCO type projects – Considering that high share of residential buildings in Eastern Europe is privately owned, there is huge potential for replication of quasi ESCO type projects. There are a lot of multi-storey condominium buildings that need urgent renovation and could be improved to provide greater comfort for residents, lower energy consumption and higher market value of the property. While the Pilot Latvian Example is involving loan plus subsidy, the Pilot Bulgarian Example is based entirely on a soft loan but has shown the potential for the renovation even in this situation. In the case of Pilot Bulgarian Example, additional reserves for internal self-financing are utilized through upgrade of the renovated building. In both cases, careful project engineering is needed and involvement of specialized on-site consultant is crucial.

ESCO based projects, combined with EU subsidies | ESCO approach considers the participation of so-called Energy Service Companies in energy-efficient housing renovation activities. As mentioned in the FRESH EU Project: Energy Performance Contracting (EPC) refers to an energy service model type and includes the outsourcing of different forms of energy services from building owners to specialised EPC companies – usually Energy Service Companies (Milin et alii, 2012). One of the main purposes of EPC agreements is the implementation of housing refurbishment projects to enable quantifiable and long-term guaranteed savings. In terms of the EPC duration, the EPC contractor (i.e. usually an ESCO) and the building owner enter into a long-term contractual relationship allowing repayment of funds used for renovation from future energy cost savings. The contract duration depends on the types of investment/types of energy savings realised and the extent of homeowners' financial involvement or subsidy element. Contract duration for building technology measures (replacement of source of heating, ventilation etc.) is up to 10-15 years. Based on East-

Fig. 6 | Financial scheme of RenEsco (credit: credit: www.renesco.lv).

Fig. 7 | Renovated building in Valmiera (credit: www.renesco.lv).

ern European energy prices, building construction measures (building envelope interventions), however, cannot be repaid by energy cost savings over such a timeframe. They require a longer project contracting period of 20-25 years or/and additional co-financing – subsidy or own input on behalf of the house owner (Milin et alii, 2012).

RenEsco[1] projects in Latvia – Until 2010 the urban housing stock in Latvia was renovated only by the homeowners' associations (HOA) or Housing cooperatives (HC). Therefore, the number of renovated houses was rather small, since the occupants of multi-apartment houses were people of very different income and professions, and there were few among them which could assume the task of organizing and managing the renovation process on a professional basis. Therefore, at that time the renovation rate was reaching 1-2% of buildings in total. A small increase in the speed of multi-family building renovation was achieved after 2009 thanks to resources of EU Structural funds.

ESCO approach has been used throughout Europe for renovating of public buildings and also for industry and commercial sector buildings. Multiapartment residential buildings were actually not targeted by ESCOs. The same was the situation in Latvia until the first multi-family building EPC renovation project was commissioned in

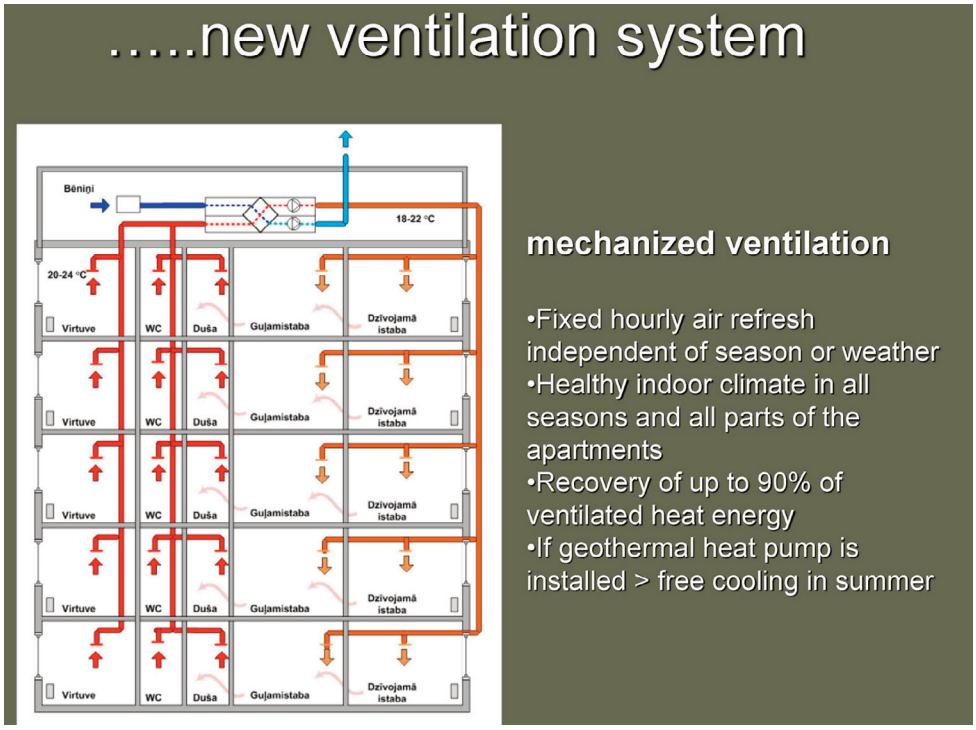

Fig. 8 | New ventilation system in renovated building (credit: www.renesco.lv).

2008 by the ESCO company named Sun Energy Baltic (Zvaigznitis et alii, 2015). It was a subsidiary company of the Netherlands company Zon Energie that was newly established with the support and participation of Dutch experts and capital to develop and implement energy efficiency projects for residential housing. For the new scheme, the available ERDF co-financing was also attracted. Subsequently, the new ESCO company changed its name to RenEsco Ltd. The RenEsco company business model was based on the combination of loan and a subsidy: a) energy performance contracts (EPC's) were signed with condominium buildings guaranteeing RenEsco to receive the energy savings during 20 years; the savings were typically 50% or more; b) a combination of 40% ERDF grants (National Renovation Program) and 60% loan was used to cover the renovation works; RenEsco Ltd collected on behalf of homeowners the renovation loan and the subsidy and paid for all renovation costs, increasing the comfort and value of the building and extending the building lifetime; c) after the renovation, apartment owners paid the same money for the heating costs as before the renovation and the funds from the saved energy are used for loan repayment; RenEsco gives a 20-year guarantee on everything it has improved and changed; d) RenEsco decides about the measures, technologies and quality of materials.

The energy-efficient renovation measures included: full building envelope, new hot water networks, new heating network, new ventilation recovery systems, repairs in common spaces of the building, switching (sometimes) to renewables (geothermal). Because of the business model used, RenEsco could invest much more than flat owners would do themselves (Figg. 6-8). Due to the innovative renovation scheme within 6 years (2008-2014), RenEsco Ltd financed and performed energy-efficient renovations of 15 typical Soviet-era apartment buildings in four Latvian towns using Energy Performance Contracts (EPC's). The total heating area of refurbished buildings is about 42,000 square metres with 660 apartments and totally invested EUR 5,360,000. The monitoring of the energy behaviour of the renovated buildings shows that on average space heating consumption is reduced down to 77 kWh/m^2 per annum and network circulation losses is down to 4.5 kWh/m^2 per annum, meaning a combined figure of 81.5 kWh/m^2 per annum. The energy savings of the renovated buildings are calculated at 55% (Zvaigznitis et alii, 2015).

The successful activities of RenEsco have been acknowledged in the EU, and it has won the European Energy Service Initiative at EUSEW 2012 in Brussels. Recently RenEsco Ltd was involved in EU funded Sunshine project that foresees a further step in the use of EPC for energy retrofit. Sunshine project supports public and private ESCO's and leads to an innovative investment scheme based on the long term guaranteed safety, health, comfort, and affordability for deep renovation of buildings. Sunshine project is about deep renovation – the idea of capturing the full economic energy efficiency potential of existing buildings with a focus on building envelopes that leads to remarkable energy savings. The RenEsco Ltd achievements have made a good start, but having in mind the enormous size of the issue of high energy consumption of privatised apartment housing in Eastern Europe needs urgent expansion in Latvia and in other countries with the same problems. As in the most European countries, the implementation of ESCO principles in Latvia is still being hindered because of regulatory, administrative and financial barriers. Therefore, only RenEsco is actively providing energy services for the Latvian housing sector. Actually, it is the first company in the world to offer ESCO based renovations for privatized former rental multiapartment buildings (Zvaigznitis et alii, 2015).

Several preconditions are crucial for the development of a larger-scale follow-up activities in ESCO based condominium housing retrofitting activities: 1) establishment of rule-of-law (contracts must be enforceable); 2) development of long-term governmental policies and programs in housing sector enabling organizing large-scale renovation activities; 3) establishment of transparent and market-based pricing of energy (at least €/MWh 50); 4) availability of affordable long-term financing vehicles.

Conclusion | Using capital subsidies for fighting energy poverty through the improvement of the built environment is the most efficient and socially acceptable approach. Such an approach is associated with a higher initial level of investments, as well as the

need for capacity to assess, design and implement energy-efficient housing reconstruction activities. However, in the long run, investing in energy-saving housing retrofit has no alternative in terms of the efficiency of the subsidies used (both socially and financially). Eliminating the problem of 'energy poverty' is impossible without the support of the affected households through subsidies. Subsidies invested in energy-efficient housing reconstruction result in efficient and immediate savings in housing heating costs, which in turn reduces or eliminates the 'energy poverty' phenomenon for residents of reconstructed housing. Energy-efficient housing reconstruction (retrofit) is the fastest and most efficient (in terms of public resources used) way to combat energy poverty. However, there is a limiting effect on the requirement for a larger one-off public financial resource. This resource could also be obtained or complemented through financial engineering schemes with third party involvement.

Assistance for preparing and implementing the renovation process is necessary for the successful renovation of the multistorey apartment buildings on a larger scale, as homeowners' associations and their umbrella bodies do not have the proper competence for undertaking efficient renovations (Georgiev, 2017). It is important to point out that technical assistance should enable market actors in the field of housing sector rather than strengthen the monopolies of publicly owned companies. It is worth to concentrate geographically the initial pilot condominium energy retrofit projects (i.e. concentrate loans and subsidies used) because this could provide substantial economy of scale which can serve as a layout for a larger neighbourhood.

The lack of well-functioning legislation is an obstacle for sustainable maintenance of existing condominium housing, that is well recognized among researchers. But we cannot undermine the probably bigger obstacle of fuel poverty that is universally valid for tackling large scale energy efficient renovation actions in big cities' housing estates in Eastern Europe. We cannot achieve a satisfactory rate of energy retrofit of condominium housing up to the desired standard in Eastern Europe, without substantial reduction of the fuel poverty among apartment owners. «[...] In situations where the owners are unable to pay for rising energy costs and the required major renovations, other parallel measures such as subsidies are needed» (Lujanen, 2010, p. 193). Although common in Eastern European condominiums, the fuel poverty problem is even more important because «[...] the challenges are geographically wider and affect the management of apartment blocks in most parts of the world, including large-scale developments in many fast-growing metropolitan regions» (Lujanen, 2010, p. 193).

Due to the universal nature of the problems of the renovation of owner-occupied apartment housing the above-mentioned pilot approaches (best practice cases) could be replicated in a wider European context. However, this can be made in limited scale developments with relatively identical income level tenants, avoiding 'fuel poverty enclaves'. Large scale energy retrofit projects for condominiums in Eastern Europe as well as in other countries can only happen after a partial restructuring of the tenure status of the residents – from poor owners to renters (Georgiev, 2017).

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Note

1) For more informations on Renesco Projects see the webpage: renesco.lv/projects/renovating/en [Accessed 18 October 2020].

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