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STACCATO

Sustainable Technologies And Combined Community Approaches Take Off

Integrated project

Concerto

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"STACCATO stands for Sustainable Technologies And Combined Community Approaches Take Off. With the STACCATO project three European capital districts: Amsterdam-Noord (Amsterdam), Óbuda (Budapest) and Oborishte (Sofia), demonstrate sustainable energy concepts in representative existing residential areas. The urban areas all face technical arrears and a lack of social cohesion.

These large-scale demonstration sites in combination with research and development aimed at innovative and reproducible renovation concepts and approaches, serve the purpose to accelerate the transition to a sustainable energy supply in existing housing areas in Western and Eastern Europe.

Redevelopment is a unique opportunity to implement energy efficiency measures and sustainable energy sources. The three city districts jointed in STACCATO will integrate large solar thermal systems in their energy supply. The heat distribution based energy infrastructure will be modernised and the building envelopes will be improved drastically resulting in healthy indoor climates and low energy bills.

The STACCATO project started on 8 November 2007 and is an example for other renovation projects in Europe. STACCATO is carried out under the European Concerto initiative"[1].

[1] http://www.concerto-staccato.eu/about-staccato.html

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1. Introduction

The European Union (EU) has embarked on two major reforms in energy and climate policy: first, the progressive liberalization of the internal electricity and gas markets; and second, the ambitious 2020 climate and energy targets. Since then, the Union's national support policies and subsidies for energy efficiency and renewable energy have been driving the targeted decarbonisation. The IEA World Energy Outlook 2014 estimated the total value of subsidies for renewable energy in the EU to be around 52 billion EUR in 2013, equivalent to 57% of the global subsidies for renewable energy. The support schemes have a strong impact on the wholesale electricity market, pushing down prices and reducing operating hours of conventional power plants. Thus, as a result of a number of policy decisions, the growing deployment of renewable energies and energy efficiency action and lower demand for energy during the economic crisis, greenhouse gas (GHG) emissions had decreased by 19.2% in 2012 compared to their 1990 level, and final energy consumption from renewables had increased from 8.7% in 2005 to 14.1% in 2012 (IEA 2014a).

In order to continue the positive trend, new financial instruments for energy RDD&D[2] are now envisaged under the EU 2014-2020 budget. The European Investment Bank (EIB) currently plays a substantial role in financing of energy projects and leverage of EU funds. However, the challenge of coordinating and raising significant EU funding for energy projects in member states remains. There is a need to leverage large-scale funding at the EU level, to increase risk guarantees and design appropriate policy instruments to remove technology barriers and financial risks (IEA 2014a). These steps are important to encourage private and public co-financing.

Improving energy efficiency in the residential buildings sector is an essential part of the requirement for the 20% total reduction of CO_2 emissions by 2020 set by the European Council. Most experts agree that the best solution is a complex approach combining fiscal and policy measures, along with economic incentives to create favourable financing conditions and induce significant behavioural changes of end-users.

In the STACCATO project there was an opportunity to test different solutions for the realization of sustainable energy systems, incorporating the opportunities offered by liberalized energy markets and financial/tax instruments to present a cost neutral offer to the tenants/residents in the project countries. Sustainable energy concepts that were represented within the framework of the STACCATO project have been planned as a demonstration to be replicated in other similar actions. The goal of this report is to explore and assess the financial mechanisms existing in the project countries that are available to support such a replication. The report will also attempt to assess the financial benefits to the residents in the project sites.

Energy efficiency projects can be funded from various sources with different financial instruments applied. For instance, renewable energy use in electricity supply is subject to preferential feed-in tariffs, while carbon credits generated within the project can be traded to bring additional benefits. These and other features of energy efficiency projects make them a potential business opportunity. For the purposes of the report the existing fiscal instruments are analysed from the point of view of their stimulative nature and accessibility for energy efficiency project development.

[2] Research, Development, Demonstration and Deployment

In many cases it is difficult to evaluate the general profitability of energy saving projects in the residential buildings sector due to the absence of unified financial schemes. In countries lacking project development experience every investment project aiming at energy efficiency improvements is unique. At the same time it has to be considered that all financial instruments are based on certain standards, and there are some quite general challenges which investments in this field have to face. If we compare energy efficiency investment with traditional investments and base the comparison on payback time, the results generally do not favour the former; while efforts to improve energy efficiency in residential buildings are often complicated by social factors and the position (attitude and capacity) of local government, factors which are liable to make investors concerned about related hidden costs of the projects. Even today, when energy efficiency has become a priority policy direction in Europe, there is a belief that energy efficiency investments are characterized by high risks and should be accompanied by significant discounting (Houlihan 2008).

On the other hand, energy efficiency projects provide a predictable and immediate positive cash flow which is achieved by energy cost reductions. This allows a choice from a wide range of financing mechanisms, including types familiar to house owners (e.g. subsidies, direct loans) and non-traditional ones (e.g. foreign investments). In order to ensure profitability of the project one should explore various funding options. The choice of the most effective project financing plan depends on several criteria including the legal status of stakeholders/project partners (private or public), the size and complexity of the project, requirements of the control body and risks.

Another impediment to be taken into account is the initial cost of energy efficient retrofit. Previous experience shows that due to lack of finance or lack of information on available financial mechanisms consumers typically make their choice in favour of less efficient options at a lower price (Boermans *et al.* 2011). Economic theory suggests that the market must meet the investment needs taking into account the associated risks including initial costs, but in practice the low income of potential loan recipients often becomes an insurmountable problem for the formation of initial capital for energy efficient retrofit. By providing financial bonuses, compensation or purpose-oriented credits, governments may create a basis for developing energy efficiency if the market alone is unable to do so.

On the basis of the conclusions drawn from the study of the STACCATO projects, it is possible to identify the most effective financial instruments existing in the STACCATO project countries, with the focus on tools that can lead to significant improvements of energy efficiency indicators in residential buildings and can be applied to similar projects. Taking into consideration the barriers mentioned above, it is necessary to study those measures in terms of their accessibility and transparency for all stakeholders. One of the main goals of this report is to study the availability of funding where EU funding (a substantial element within STACCATO) is absent. It should be ascertained what financial organizations are interested in realization of energy efficient projects and development of renewable energy sources in the project countries. For example, national and private banks that offer low/zero interest loans for energy efficient projects and are willing to participate as investors are also important potential funding sources. Conditions of financing will therefore be examined. With the integration of climate change policies in national systems, additional financial opportunities become accessible for project developers. Special attention must be paid to

recoverable and non-recoverable funds such as financial opportunities brought with Green Investment Schemes and state budget sources allocated for climate change mitigation and adaptation.

At the report planning stage it was decided to include in the scope of the study international financial sources, i.e. availability of project funding in the form of grant support provided by international financial organizations. However, the research showed that this type of funding has tended to be somewhat "episodic" and cannot be considered as a stable and reliable funding source for energy efficiency retrofit of panel blocks in the project countries. Thus, the report is mainly structured around basic financial options on the national level.

In order to formulate conclusions about the effectiveness of available financial instruments and stimulative measures in the project countries, legislation in the related field has been analysed. To identify the gaps and shortcomings of the national funding systems and external financial possibilities available for energy efficiency projects in the residential sector, the following documents and materials were reviewed:

1. National policies and programmes on administrative issues of project finance, offering direct financial support in the form of subsidies and grants, and providing for stimulative measures facilitating project implementation
2. Current reports of local and international organizations on the major issues related to development of financial mechanisms for energy efficiency projects in the residential sector
3. Actual EU studies and recommendations influencing the process of project finance
4. STACCATO documents, social surveys and monitoring data from the three STACCATO sites, official data on average energy costs for households in the project countries (used for calculation of economic benefits of the project).

In addition to the desk-top review the study was supplemented by empirical data on funding for energy efficiency in residential buildings gathered through personal communication with project partners and interviews with Hungarian bank officers (OTP and Unicredit).

In order to give a background for the economic and financial environment in which energy efficiency retrofit projects have been and can be implemented in STACCATO countries, Chapters 2 and 3 of the report provide an analysis of available national and local funding opportunities for such renovations in the Netherlands, Hungary and Bulgaria. Chapter 4 discusses the position of energy efficient real estate on the markets in these countries, as one of the important aspects which can provide additional stimulus for investment in energy efficiency measures (PIKE Research 2012; Popescu *et al.* 2012; evidence from STACCATO surveys[3]). Since STACCATO involved application of renewable energy sources in the retrofits[4], Chapter 5 provides a brief overview of related regulations (e.g., feed-in tariffs) adopted in the three countries and difficulties connected with implementation of renewable energy projects in the residential sector.

3 See Chapter 8 and STACCATO Social Report for more details

4 Solar thermal collectors were installed on the roofs of Het Breed (Amsterdam), Obuda (Budapest) and Oborishte (Sofia) renovated blocks

A number of recent studies (Bertoldi *et al.* 2014; BPIE 2010; BPIE 2013; ECEEE 2012), as well as STACCATO experience prove that participation of energy suppliers and energy service companies (ESCOs) may largely contribute to successful implementation of energy efficiency projects, particularly through financing of measures and provision of energy services in residential retrofit projects. Thus, Chapter 6 provides an analysis of the main energy suppliers in the three project countries and project cities in particular (Amsterdam, Budapest and Sofia), and discusses the role that local district heating companies played in STACCATO implementation. Chapter 7 then focuses on the state of ESCO markets in the project countries marking out the key drivers for their development.

The final chapters of the report provide an insight into the experience and results of STACCATO. Chapter 8 discusses financial aspects of the project and economic benefits which resulted from its implementation. Chapter 9 carries out a comparative analysis of STACCATO with an earlier deep retrofit project SOLANOVA, in order to evaluate the effectiveness of STACCATO in terms of the investment volume, applied financial scheme and gained energy savings. And finally, conclusions are drawn summarizing the main findings of the report.

2. National Funding Opportunities and Local Finance

It can be seen from the experience of some Eastern European countries that wrongly directed regular subsidy support of the energy sector for example in the form of partial coverage of residential energy bills rather impedes than enhances the development of the energy efficiency market. In Hungary and Bulgaria the high levels of energy consumption compared to Western European countries can be linked to long-term subsidizing of energy prices, and over time the situation has been aggravated by the obsolete condition of the residential building stock, which with cheap energy was under less pressure for renovation.

Still, this is rather a problem with the *object* of earlier subsidy programmes rather than with the very principle of subsidisation in the energy sector. Programmes of energy sector modernization funded by governments have clear advantages such as accessibility and low/zero cost of funds, transparency of the application scheme provided by legislation, and a single funding source. Another potential advantage of grants and subsidy programmes is that they provide a possibility for immediate "plugging" of financial gaps in particluar economic sectors. Moreover, as these programmes are state-run, they target market actors in a particular sector of the economy. It is true that grants and subsidies have their limitations. So far, the average reduction of energy consumption which could be achieved with state programme support in the study area has not exceeded 36% (Bencsik 2009). Moreover, although grants are able to meet specific market needs quickly, they tend not to have a lasting impact on micro-economic processes as the influence of subsidy programmes on the market is limited by the period of their validity. However, these deficiencies can to some extent be mitigated by intensive educational and awareness campaigns organized in parallel with the subsidy programmes and by strengthening and deepening state commitment to such programmes. At any rate they form a very important part of current financing possibilities in the sector, as the following detailed analysis of the study countries shows.

Figure 1. *Financial programmes and incentives in Europe (BPIE 2010)*

Currently the project countries have a number of strategies and programmes that provide funding for energy efficiency in buildings.

The Netherlands

In the Netherlands most subsidy programmes are based on the public-private partnership principle. During the decades of its existence in the country this approach has shown itself to be a successful

and efficient approach where all parties have a chance to satisfy their needs and gain benefits, while at the same time contributing to national strategic goals in the field of energy efficiency. The evidence of success is a considerable improvement of the energy efficiency indicators in the country since 1990 (Bertoldi *et al.* 2014; BPIE 2011). The Dutch residential sector can be characterized as one of the most successful sectors in terms of realization of energy efficiency measures comparing to other European countries. A comprehensive approach which includes a complex legislative system supported with regulatory and fiscal instruments has led to substantial decrease of energy consumption in new and existing dwellings, especially in the area of district heating, and some of the major specific programmes and measures are briefly outlined below.

"More with Less" is a programme which unites governmental bodies, social associations, construction companies and energy distributers for joint actions in the field of energy efficiency for buildings. It aims to make 2.4 million buildings 30% more energy efficient by the year 2020. One of the major efforts of the programme is to ensure participation and support of all stakeholders. The programme offers a scheme where energy efficiency measures and programme support are applied to the regular renovation cycle thereby enabling house owners to save energy with the least possible effort. Project implementation is coordinated through the contact person assigned by the house community.

The Virtual database ***Energiesubsidiewijzer (***Energy Subsidy) was created as a supportive tool in order to facilitate accumulation of funding for energy efficiency projects. The database is available for regular customers and professionals and offers a current overview of all existing subsidies and stimulative financial instruments. On the basis of certain criteria (legal status of building, location, type of building, etc.) the system suggests several funding scenarios for the renovation project including subsidies, loans and other financial instruments at national, regional and local level. This internet tool is beneficial not only for project developers. At the stage of project planning the database can be used by housing associations for communication with tenants. It allows the delivery of clear information to residents about the financial benefits associated with energy efficiency measures.

In order to achieve the goal of reduction of energy consumption in new and existing buildings, the Dutch government has also established ***the National Energy Saving Fund***. Since January 2014 homeowners are able to apply to the Fund for low-interest loans to make their homes more energy-efficient. The Fund is a product of the Energy Agreement for Sustainable Growth and the Housing Agreement. Under the former Agreement, the Dutch Government has also been working on developing plans for transforming bank financing of large-scale energy efficiency projects into capital-market financing by Dutch and foreign institutional investors.

Hungary

Hungary's National Development Ministry prepared a long-term national strategy for energy efficiency in buildings. The strategy was finalised recently and presented to an audience of professionals during a conference in November 2013. The plan aimed to present a conceptual framework for upgrading Hungarian buildings to be more energy efficient, as well as for constructing new buildings. Having an overall concept in place is expected to allow for more

effective incentive programmes in this area, including further subsidies. According to the Ministry of Rural Development, in Hungary energetic rehabilitation is advisable for approximately two million buildings. The strategy's publication, which was expected by the end of November 2013, has not been published so far.

At the same time, a large number of funding programmes and schemes launched in Hungary in the last decade. The main ones are briefly discussed below.

The ***National Energy Saving Programme*** (NESP) (2000 – 2008) was launched to provide a direct grant support for the improvement and modernisation of residential buildings. The Programme aimed to improve energy efficiency indicators and reduce greenhouse gas emissions in the household sector. The total budget of the programme made 1,063 million HUF (c. 3.7 mln EUR) where 880 million HUF (c. 3 mln EUR) were allocated in the Hungarian Central Budget for energy efficiency measures.Prime activities supported by the programme included: additional heat insulation, modernisation (additional insulation or replacement) of doors and windows, modernisation or replacement of heating and hot water supply equipment.

Grants provided within the framework of the ***Panel Programme*** (2002-2009) aimed to improve the energy performance of block panel buildings. Change of doors and windows, thermal insulation of walls and ceilings, and modernisation of heating, ventilation and air conditioning systems (HVAC) were eligible energy conservation actions. The programme functioned on the basis of post-finance and refunded a maximum of one third of the total investment. The maximum support was not more than HUF 500,000 (c. 2,000 EUR) per residence. The remaining two-thirds were co-funded by the local authorities and from the own contribution of residents.

Based on the Panel Programme, ***Panel Plus Credit Programme*** was developed providing financial state support from 2005. The programme budget made 40 billion HUF (c.136 mln EUR) and a maximum loan amount made 1 million HUF (3,400 EUR) per apartment. Panel Plus, just like its predecessor, also aimed to be used to support energy-saving modernization of residential housing built on 'industrialised technologies' (block panel buildings). The eligible borrowers included local municipalities, housing cooperatives and condominium owner associations. STACCATO in particular received state support through the Panel Plus Programme (see Section 8 of the report).

The ***National Energy Conservation Programme (NECP)*** was operating for 6 years (2008 – 2013), offering energy efficiency grants to households. With a total budget of HUF 1.6 billion (c. 5.5 mln EUR) the NECP subsidized the following types of energy efficiency improvement:

- Change or insulation of windows and doors (HUF 265,000 or c.910 EUR per dwelling)
- Improvement of heating and hot water supply (HUF 400,000 or c.1,400 EUR per dwelling)
- Thermal insulation of existing buildings (HUF 400,000 or c.1,400 EUR per dwelling)
- Complex energy efficiency refurbishment of the building (HUF 720,000 or c.2,470 EUR per dwelling)
- Use of renewable energy for generating heat and/or electricity (HUF1,000,000 or c.3,400 EUR per dwelling).

Source: IEA 2014b

In 2008-2009 Hungary as a party of the UN Framework Convention on Climate Change starting using its right to sell part of its greenhouse gases emissions quotas, and since then revenues from the sale are re-directed to implementation of the ***Green Investment Scheme*** (GIS). For the efficient distribution of the targeted funds of the GIS two sub-programmes were established in 2009: the Climate-friendly Home Panel Sub-programme and the Energy Efficiency Sub-programme (MND n.d.). Later these two programmes were merged and at the moment GIS funds are allocated within the National Energy Saving Programme (NEP). On August 15, 2011 the Ministry of National Development announced a fund with a total value of HUF 1.6 billion (5.5 million Euro) to provide subsidy funding for energy efficiency renovation and construction of energy-efficient buildings. The government set certain eligibility criteria. Applicants - individuals, homeowners, condominia and construction organizations – were required to present documentation proving that the main objective of the project is complex modernization of traditional apartment buildings. Approved activities included changing and installing doors and windows, heat insulation of facades and ceilings, and reconstruction and conversion of traditional water heating systems. For such purposes 3-5 million HUF could be obtained for each flat or house if the upgrade results in at least 50-60% energy saving. The subsidy for each house may cover 40-50% of total project costs. The subsidies were non-refundable and the projects post-financed.

A number of other sub-programmes also launched within GIS, including:

- GIS Energy Efficient Household Appliance Replacement and GIS Energy Efficient Light Bulb Replacement Sub-Programmes started in spring 2010 and provided people in need (the elderly, large families, the handicapped and registered unemployed) with a possibility to replace their energy inefficient appliances (e.g., refrigerators, washing machines, ligh bulbs) with energy efficient equipment
- GIS „Our Home" Renovation and „Building New Home" started in 2011 to promote complex energy-efficient and CO2 emission reducing renovation, modernisation of extant blocks of buildings, promotion of the usage of renewable energy and construction of new, energy-efficient building of blocks
- GIS Sub-Programme for Promotion of Renewable energy usage of 2011 implied installation of multifunctional solar collectors systems for the generation of residential hot water and heating purposes, supporting the procurement and installation of energy efficiency promoting and emision reducing solar collector systems of the extant building blocks
- In the end of September 2014 three new GIS tenders were opened in the frame of „Otthon Melege" programme: Household Appliances Replacement Sub-programme, refurbishment and modernisation of heating systems and windows replacement.

In Hungary emissions related to buildings account for 30% of total national carbon dioxide emissions (Czako 2012). Complex state programmes such as the National Energy Saving Programme directed at improving energy efficiency in the residential sector are considered crucial to encourage gradual reduction of energy consumption in the field (MND n.d.). Researchers who

have studied different scenarios of increasing energy efficiency indicators in housing have concluded that up to 85% of energy consumption and associated greenhouse gas emissions in Hungary may be reduced through implementing a comprehensive deep-cut renovation programmes, whereby public and residential buildings would be renovated with passive house technology (Ürge-Vorsatz *et al.* 2010).

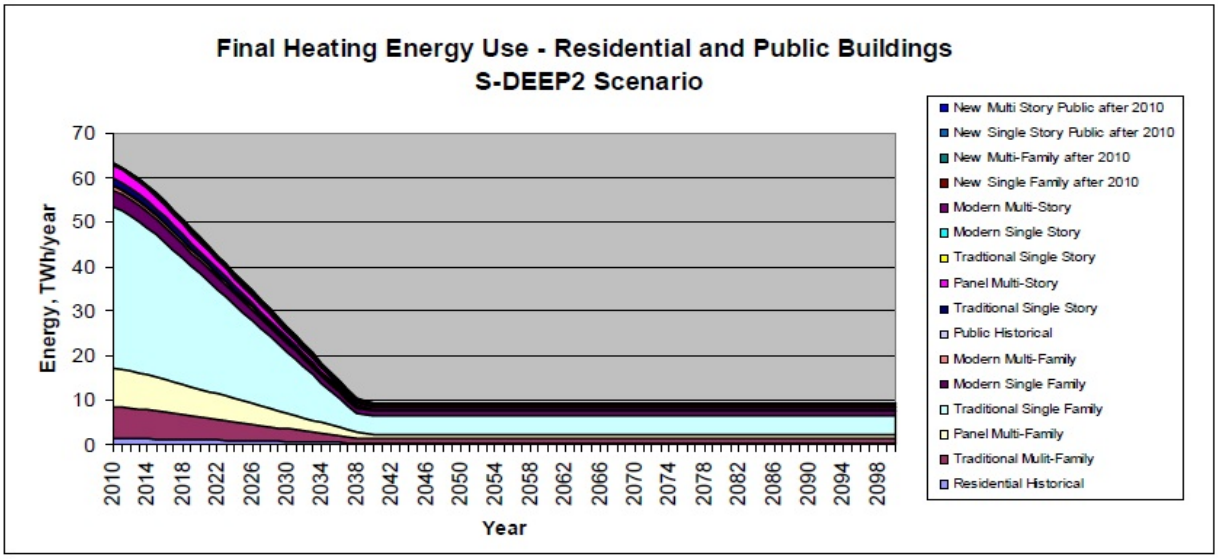


Figure 2. *Final heating energy use in residential and public buildings. S-DEEP2 scenario*

Source: Ürge-Vorsatz et al. 2010

Measures and activities on deep retrofit of houses planned within the existing GIS programme are less ambitious. It is expected that systematic investment of the programme's funds into energy efficient modernization of residential buildings will allow energy savings of up to 60% (compared with the c.85% of a deep-retrofit programme). This target was set taking into account existing financial instruments and available technologies. At the moment there is not enough empirical data for programme evaluation but at this stage of the programme's realization it is successfully attracting project developers and residents willing to use the funds for energy efficiency renovation.

On this basis we can assume that government is able to respond to the needs of the society and use funds from international carbon trading to reduce the country's energy needs. The programme is aimed to facilitate reduction of greenhouse gas emissions and to positively affect other related areas such as the employment rate, new business opportunities and development of energy markets, improved social welfare and living conditions, modernization of the real estate market (MND n.d.). However, advocates of deep-retrofit programmes note the risk of "lock-in", since major house refurbishments are generational events: there is a danger that sub-optimal retrofits will leave Hungary and other countries with fewer options to meet the cuts in greenhouse gas emissions that will probably be required in coming decades in order to avert the threat of destabilising climate change (Urge-Vorsatz *et al.* 2010).

In 2013 in the frame of the New Széchenyi Plan ***„Társasházak Energetikai Felújítása" programme***[5] was opened for traditional brick multihosehold buildings built before 1971. It allocated 830 million HUF subsidy for this call and was only open from august 2013 to september 2013. The maximum amount of subsidy made 750-900 thousand HUF per flat (IEA 2014b). And in the end of September 2014, in the frame of New Széchenyi Plan, three new grants were opened in the frame of ***„Otthon Melege" programme***: Household Appliances Replacement subprogramme, implying refurbishment and modernisation of heating systems and replacement of windows. Results of the programmes are not yet avilable.

In addition to domestically generated funds, the Hungarian Government has been utilizing and plans to use further partial allocation of the EU funds (European Regional Development Fund, European Cohesion Fund and European Social Fund) for energy conservation programmes (MND 2013). In accordance with the New Hungary Development Plan for the period until 2013, Hungary received approximately 3.3. billion EUR of such funds per year. About 1% of these funds (c. 30 million EUR) were planned to be used to implement energy efficiency projects in end-use sectors. However, a considerably larger scale of support would be needed in the future in order to fund a deep-cut (passive-house level) retrofit programmes, where the costs per m^2 are currently in the region of 250-350 EUR for a typical Hungarian apartment, compared with less than 1/3 that level for a mid-level retrofit along the lines of the STACCATO project (Herrero and Ürge-Vorsatz 2012; Urge-Vorsatz *et al.* 2010).

Thus, in recent years, Hungary has set up an substantial array of subsidy programmes aimed at improving the energy efficiency of buildings. The residential sector has significant energy savings potential (and therefore greenhouse gas emission avoidance), as simple upgrades of old soviet era housing complexes can decrease power and heat use significantly. As of 2014, financing for the building energy efficiency programmes comes mainly from the EU via various funds, including the Environmental and Energy Operative Framework, but also from revenues made by selling surplus Kyoto Protocol assigned amount units to countries like Austria and Spain.

However, these subsidy programmes are usually available at short notice and only for a short period. This also applied to the subsidy programmes launched during 2013. Among the relevant subsidy programmes on energy efficiency in buildings in 2013 was the subsidy programme for Multi-Storey Buildings' Energetic Refurbishment ('ZBR Panel II') which allocated HUF 4.56 billion (approx. € 15.25 million) to finance related projects (Smith *et al.* 2013). Another programme, launched in August 2013, offering grants to energy efficiency measures in multi-storey dwellings, had to be terminated after only one day due to the enormous demand for this subsidy (Smith *et al.* 2013).

Bulgaria

Bulgaria has been prioritizing the development of state financial support in the field of energy efficiency in recent years. Financial sources of ***the Bulgarian Operational Programme "Regional Development"*** for the period 2007-2013 and of the EU Regional fund can be additionally used to

[5] "Energy Renovation of Blocks"

facilitate energy saving measures in the building sector of Bulgaria. Among other purposes the programme provides funding for energy audits and implementation of energy saving measures in state and municipal property buildings. Since 2011 the programme has allocated €80 mln for energy efficiency in the residential sector, which is sufficient for partial reconstruction of 600 prefabricated buildings.

The National Strategy for financing building insulation for energy efficiency – 2006 to 2020 aims to improve thermal insulation in existing buildings, and the strategy foresees insulation of some 651,000 private flats in panel blocks during the announced period. The priority buildings have been selected on the basis of certain criteria, which were provided with initial energy audits and related reports on recommended measures, financial, environmental and energy parameters.

The National Programme for Renovation of multi-family buildings for the period 2006-2020 was developed in order to provide state financial support for the energy efficiency renovation of 684,683 dwellings, 362,792 of which are panel blocks. The estimated value of the Programme funds required for implementation is about EUR 1273 Mln. The support is provided in a form of direct subsidy and covers 20% of the total value of the retrofitting project. The state agency responsible for the programme's implementation and for the coordination of relevant activities is the Ministrty of Regional Development and Public Works. The Ministry allocates funds for state subsidies in the national budget on an annual basis.

The evaluation of the existing Bulgarian policy in the field of funding opportunities for housing renovation shows a few major gaps that may impede energy efficiency projects' implementation in the residential sector. The main improvement that could be made without great additional cost would be to encourage apartment owners to participate financially in retrofit of their buildings by ensuring the possibility for condominia to access national funds. The major impediments for successful implementation of the national programmes have to do with the social and economic status of residents. The majority of them do not have any experience in joint management of their real estate which makes it especially difficult to involve all apartment owners in common financial obligations. Due to the mostly poor financial condition of residents living in panel buildings apartment owners prefer to make property related arrangements independently. Another identified constraint is the lack of professionals in the area of property management, as full-scale retrofit demands comprehensive technical qualifications from the person who is able to take responsibility for renovation. Additionally, the involvement of municipalities, which can play a great role for the project's success (as seen in the Óbuda case), is not currently provided with regulatory support. As a result, despite the large amount of resources available to the programme, its implementation has been rather ineffective to date.

Energy Efficiency and Renewable Sources Fund is a public-private financial vehicle which is based on donations from variety of entities, both public and corporate. It was established with the Energy Efficiency law of 2004 and at present it is still operational. The fund is mainly focused on municipal and corporate projects for energy efficiency improvements. It supports medium-to-large scale renovations (from BGN 30,000 to BGN 3,000,000). However, residential projects are also possible. Applicants should provide between 10 and 25% of the project costs with the rest covered by the fund or by a loan from a commercial bank. Initially, it was planned that 5 years are need to

get returns on investment but as of February 2014 the fund extended this period to 7 years. This will allow for more expensive equipment such as biomass boilers, solar water heaters and photovoltaic installations to be also financed and ultimately paid back.

The Bulgarian Energy Efficiency Fund (BEEF) is a multifunctional instrument which provides for lending opportunities, credit guarantees and consulting in a related field. It was established in 2004 under the provisions of the Energy Efficiency Act with a total estimated budget of c.13 million Euro. The goal of the Fund is to support development and financing of energy efficiency projects and capacity building. The additional purpose of the BEEF was to establish a market for energy efficiency credits. It is expected that such a market will contribute to funds of municipalities, small and medium-sized enterprises and public organizations. In its first three years of operation, BEEF approved more than 70 energy efficiency projects valued at 21.9 million USD, with BEEF financing of 11.5 million USD and about 60% of the projects approved in the public sector (Sarkar and Singh 2010).

Initially supported by grants, currently the funding budget of the facility is formed by voluntary contributions of local and foreign banks, legal and private entities, and international financing organizations. The fundamental principle of the BEEF's activity is public-private partnership executed according to World Bank rules and procedures adopted by the Bulgarian government. In addition to regular loans the BEEF offers credit guarantees that allow project developers to share credit related risks with other financial institutions. This opportunity can be used by other investors willing to participate in energy efficiency projects in the residential sector.

Potentially the BEEF could be a good opportunity for financing energy efficiency retrofits in the residential sector. But, unfortunately, at the initial stage of projects the conditions of the loan are liable to be unacceptable to tenants. The fund provides loans at 8-10% interest rates and sets a payback period of 5 years. Taking into account that most panel blocks are occupied by low-income people such loan conditions would place a difficult financial burden on them. It has been estimated that in the best case scenario when a project is implemented on schedule with timely contribution of all partners there is at least an 8 to 10 years of payback period before the costs of energy saved yields a "profit" for the resident relative to the costs of the renovation. Moreover, according to BEEF's rules, it offers funding on the grounds of co-financing and requires at least 30% self-financing. The implication is that self-financing ought to be arranged by tenants united in the condominium/house union. However, until very recently the establishment of a condominium has been associated with serious administrative difficulties as it required 100% consent of apartment owners in a building. Given that and the generally weak financial conditions of tenants the BEEF has so far remained a theoretically useful but in practice unattainable financial opportunity. It has to be noted that from 2011 the required participation of home owners for establishing a condominium was reduced to 67%. Eventually along with the development of other financial mechanisms for implementing energy efficiency projects (e.g. soft loans, governmental subsidies) it can therefore be hoped that this measure will become more useful in the residential sector.

3. Investments and Loans

Depending on the scope of the planned renovation project two investment scenarios can be envisaged. In the first case the initiation of energy efficiency retrofit has been determined by the availability of funds. Such examples are the STACCATO projects carried out in Hungary and Bulgaria where the very idea of the project was dictated by the offered EU support. According to the developers of the project, the implementation of reconstruction would be difficult (Hungary) or even impossible (Bulgaria) in the absence of EU support. In the other case reconstruction or improvement of residential buildings is already planned and energy efficiency measures are added to it using the available financial opportunities. This is the scenario seen in the Netherlands where energy efficiency in the residential sector is supported by comprehensive legislation and accompanying financial instruments. According to Book 7 Section 4 of the Dutch Civil Code, regular renovation and improvement of the owned building is an obligation of the house owner, in this case the Housing Corporation. Moreover according to article 7:255 of the Civil Code raising the rent is only allowed if increased comfort can be shown to arise as a result of a renovation. The STACCATO funds provided by the EU were an additional incentive for the project which was used as a demonstration and could have been implemented (at least to a large degree) without European funding.

The most obvious and accessible way to finance energy efficiency projects from an administrative point of view is by allocating funds from the budget of the condominium/housing association. This funding has a distinctive advantage in comparison to other funding sources. All internal gains from energy saved can be used internally for current expenditures, put into a revolving fund or used for investments in other energy efficiency projects. An alternative to internal finance in case of lack of initial capital is a direct loan from private creditors. Similar to funding from the budget all gains from energy reduction minus loan payback are retained within the organization. Of course, this approach is administratively more complex and associated costs will vary depending on the conditions of the loan.

Funding of most such projects is usually divided between debt and equity financing. Debt obligation is expressed in the ordinary commercial bank loan on which a recipient pays interest. Loans are an available financial solution in all three project countries. The total amount of credit lines and interest rates are determined on the basis of supply and demand which is formed by macroeconomic conditions. There are special factors that are taken into account by credit facilities when offering loans. One of the key concerns for the lender, as well as for the investor, is generally the payback period. On average the payback period of energy efficient renovation is 7-8 years. Guarantee of repayment is provided by the loan conditions and identity of recipient. Lending money requires detailed information about the borrower, and his/her capacity to pay back the loan. If a loan is not secured by assets of the borrower, the bank bears a greater risk and has to charge higher interest rates. The availability of stimulating factors provided by the creditors (for example soft loans) significantly reduces the range of fundraising sources for the borrower.

The Netherlands

In the Netherlands preferential loan rates are available for energy efficiency project developers in the framework of the ***'Regeling Groen Projecten'*** programme or Green Funds Scheme (GFS). The programme offers organizations of different types the possibility to approach credit facilities with a lower interest rate. In order to get the favourable loan conditions the project developer has to request from the government a green label which certifies the "green" context of the project. This programme is run by most of the country's banks and has been successful enough so far. The core idea of the scheme is to enable individual investors to put their funds into projects that are beneficial for the environment and can be considered green. The programme can be used by any organization aiming to invest in sustainability, energy conservation in new and existing buildings or reconstruction of office buildings. Since the programme was started in 1995, up to 5 billion euro were invested for funding of 5000 projects. Available financing in green funds is regularly replenished through private investments, as there is a possibility provided to purchase shares of the green fund on the stock market or from the fund directly. As with standard shares, dividends are paid depending on results that the funded projects achieve. Later the investor can sell the shares and the selling price will be determined by supply and demand. Thus, the programme's policy enables an equity element to be added to the funding.

Since its start in 2011, the central government concluded some 150 Green Deals with companies, civil society organizations and local governments (provinces, municipalities). The Government also aims to enhance energy efficiency by lowering VAT on energy efficient measures (such as isolation and renovation) and the availability for cheap loans for house owners.

At the same time, the number of approved projects is much less than the offered funding. In order to understand how convenient this mechanism is for financing energy efficiency projects in the residential sector, it is necessary to define the eligibility criteria of projects and major actors. To become a part of the programme, a project must meet two basic criteria: match one of the project categories and get a green certificate. Projects must have good economic fundamentals and favourable future prospects. If a project meets the necessary criteria, a developer can expect a one percent discount from the normal interest rate. When a project application is approved, the developer will receive the green certificate and it is obligatory to start project activities within two years from the moment the green certificate has been issued.

There are a few steps to make in order to obtain the green certificate. A bank which offers green funding and declares his/her intention to initiate a green investment project requests the green certificate for the project from the national authorities. The documents should include a description of the project, its dexpected environmental benefits, necessary funding and estimated risk and return. Only a credit or investment institution recognized by the government as a green fund may apply for the green certificate

Depending on the scope of the project the validity of green certificate varies from 10 to 30 years and within that time any major change in the project which was not announced in the initial application has to be reported to the green fund. There are numerous banks in the Netherlands that offer their clients green funding, e.g. ASN, Rabo, ABN, Fortis, ING and Triodos. This contributes to healthy

competition among credit facilities and gives more freedom of choice for borrowers. Every bank with a green fund can receive and proceed with application for the green certificate.

To sum up, the described scheme is convenient and transparent. The Netherlands has a well operating practice of property management and the scheme itself, as well as the rights and responsibilities of all parties, are regulated legally and institutionally. All this makes it possible to apply the scheme for the successful implementation of energy efficient reconstructions in the residential sector in the future.

Hungary

The loan scheme that has been used in Hungary by the Faluház residents to cover their STACCATO input is a ***Lakáskassza*** (Apartment Bank) credit line. The Hungarian system of Lakáskassza is a system of residential saving accounts available for individuals and legal entities. The preliminary goal of the Lakáskassza was to offer society accessible governmental funding and motivate people to make savings for improving and investing in their property. The savings can be spent on certain improvements to houses or apartments.

The main rules and conditions of the scheme are set by three laws :

- Law on residential saving accounts
- Governmental decree on subsidiary support of residential savings
- Governmental decree on the main conditions of residential saving accounts

The Law on residential saving accounts regulates the relationship of individual residents, condominia, foundations, churches and municipalities in the area of savings and related governmental subsidies aiming to improve the quality of buildings. The objective of the law is to create legally regulated conditions for private savings where the main provisions of the contract between the credit facility and the borrower as well as a list of criteria for financial organizations – potential account managers - are defined by the state. Pursuant to the act an account can be established by a legal entity or individual for him/herself or a beneficiary. Since 2011 there is a possibility to use savings from different accounts for the needs of one property. For example, members of one family can establish several accounts and collect money separately. In case of contract termination before the end of the period set in the contract there is a possibility to collect only the money deposited by the account owner during the reporting period. The governmental grant and interest rates will not be added. At the end of the deposit period when savings have already been spent over a certain period of time, the account holder has to present to the bank evidence that the money was invested in property, e.g. bills for construction materials or energy efficient equipment.

A contract between an account manager and an account holder is supposed to be set for a certain period of time from 4 up to 10 years. After the contract is signed the account holder is obliged to pay a fixed amount in regular monthly installments. According to practice, the amount of the installment is usually in a range from 5,000 HUF to 20,000 HUF (circa 17 to 70 Euro). Every month the deposit is supplemented by a 30% state subsidy and interest defined by the credit facility.

Figure 3. *Lakáskassza loan scheme, Hungary*

In the case of condominia the savings can be applied to common areas only, e.g. stairways, walls, roofs etc. The amount of maximal monthly deposit and state subsidy is raised depending on the number of dwellings in the building (see Table 1).

Table 1. *Cumulation of funds in OTP-Lakaskassa*

Number of apartments in condominium	Maximal monthly payment (thousands HUF)	Annual state subsidy (thousands HUF)
2-4	30	108
5-30	40	144
31-60	50	180
61-120	60	216
121-180	70	252
181-240	80	288
241 <	90	324

Source: OTP Bank 2012

At the end of the deposit period the bank offers the account holder the possibility to take out a preferential loan. The amount of the loan depends on the deposit size, but cannot be more than 8 mln HUF (c. 28,000 Euro). Conditions of the credit are set by the bank but, as a rule, interest rates for such a loan are much lower than average. The average standard interest rate for loans for reconstruction offered by the OTP Bank is currently 11.83% while the interest rate within the OTP-Lakaskassa scheme can be reduced to as little as 3.9% (OTP Bank 2012). At the moment there are two major leaders in the country working within the framework of the Lakáskassza law: OTP-Lakáskassza and Fundamenta. From 2012 on ERSTE Bank joined the programme with similar conditions.

OTP-Lakáskassza is a recognized leader in the market of credits for condominia/house associations. As the largest commercial bank in Hungary, OTP provides loans to private clients, corporations and municipalities. OTP's share of loans in the market of similar services is 13.4%. When carrying out the corporate policy of the bank, the bank's directorate considers it necessary to take into account environmental risks and aims to promote an environmentally friendly corporate image. In 1999 the Bank signed an agreement with the IFC-GEF Programme, under which the bank contracted liabilities to provide financial guarantees of the risks associated with implementing energy efficiency projects (OTP Bank 2012).

Historically with its status as one of the most stable banks in Hungary OTP holds responsibility for operating accounts of most Hungarian condominia in multi-apartment blocks. The long-term experience of banking in the residential sector made OTP the primary credit facility offering loans for improvements of housing. Having access to these accounts, in case of issuing a loan within the Lakáskassza scheme the bank can generally use the condominium for a loan guarantee. In case of non-payment the bank imposes a fee on the condominium's account.

According to data provided in personal communication with Imre Dögei (10.09.2011), manager in the Budapest regional OTP Bank, applications from individuals and condominia for opening Lakáskassza accounts and issuing credits are submitted constantly. To open an account the applicant provides the bank with a draft project for future changes with the calculations of the estimated cost attached. On the basis of this the bank makes a decision about issuing a loan. Credit contracts are signed by the condominium with each apartment owner separately. The bank makes a loan agreement with the condominium as an official representative of the residents. The maximal amount of the loan depends on the contract value but various scenarios for loan agreements are outlined in the Table 2 below.

Table 2. *Loan agreement scenarios within the Lakáskassza programme in the OTP Bank, Hungary*

Value of the contract	Minimum saving period (months)	**49**	**61**	**96**
	Maximum loan payback period (months)	**84**	**116**	**191**
HUF 400,000	Monthly deposit	3,000	2,360	1,570
	Expected minimum saving	203,546	202,718	221,150
	Maximum loan amount	196,454	197,282	178,850
	Monthly loan payback	2,995	2,360	1,565
	Account opening fee	4,000	4,000	4,000
HUF 500,000	Monthly deposit	3,750	2,950	1,960
	Expected minimum saving	254,433	253,397	276,438
	Maximum loan amount	245,567	246,603	223,562
	Monthly loan payback	3,744	2,950	1,956
	Account opening fee	5,000	5,000	5,000
HUF 600,000	Monthly deposit	4,500	3,540	2,350
	Expected minimum saving	305,319	304,076	331,726
	Maximum loan amount	294,681	295,924	268,274
	Monthly loan payback	4,492	3,540	2,347
	Account opening fee	6,000	6,000	6,000

Source: OTP Bank, 2012

According to the statistics, deposits are usually opened for implementing minor renovations or replacing windows and internal systems (gas, heat, electricity); a big energy-efficient renovation of apartment blocks is a rare case. At the time of the conversation with the OTP Bank representative there were just two panel blocks on the list of submitted applications. According to the bank's expert, who is responsible for the selection process, so far the main reason for the relatively low number of deep renovations was the lack of state funding available. In the case of the Faluház project the positive decision on issuing credit was made on the grounds of the project developers'

confirmation that the project received state subsidy and EU funding. Thus, according to an unwritten rule, to arrange a loan in the OTP-Lakáskassza the applicant is expected to affirm state subsidy support. According to Mr. Dögei this measure is unavoidable since apartment owners of multi-storey apartment blocks are generally not able to collect sufficient funds for deep retrofit of their building by themselves. For the bank, state subsidy in this situation is not only a source of co-financing but a credit guarantee as well.

The other financial institution which works within the Lakáskassza programme is Fundamenta. Fundamenta is represented by 3,500 agents and offers financial services aimed at facilitating the construction or purchase of new property, as well as modernization or renovation of an existing one. Fundamenta is a complex banking product available for customers in such Hungarian banks as UniCredit Bank Hungary, Erste Bank Hungary and FHB Bank and operates in accordance with the same rules as the OTP-Lakáskassza. The main difference between the Fundamenta and OTP-Lakáskassza is that Fundamenta is an independent financial organization or a banking product which is represented and sold by a network of agents. The terms and conditions of Fundamenta loans depend on the participating bank. Figure 4 shows a possible scenario of savings and loan available.

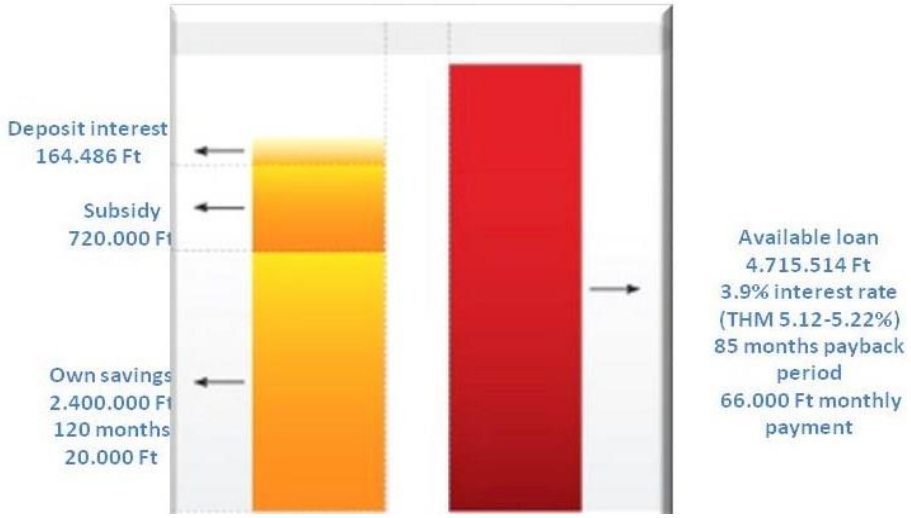


Figure 4. *Cumulation of funds in Fundamenta*

Source: Fundamenta 2011

Besides these options, Hungarian banks started to show an active interest in development of energy efficiency related instruments. There is a tendency to open new targeted credit lines targetted at reconstruction and modernization projects in the residential buildings sector. For example, the ÖkoHitel programme (EcoLoan) established by the UniCredit Bank (Hungary) a few years ago offered soft loans for retrofit of residential buildings. The requirements for a decreased interest rates (0.2% discount) were the evidence of energy saving and an environmental protection component of the project. The maximum loan amount was 40 million HUF (c. 115,000 EUR) (Unicredit Bank 2011).

From 2014 the Ministry of National Economy also provides subsidized loans under building refurbishment scheme. Currently, there are two type of subsidy that are available. The first one is ‘Otthonteremtési kamattámogatás’ which is aimed to provide subsidy in the form of decreased

interest rate with the following conditions: it can be requested for not more than 5 years (the loan can be for a longer period but the subsidy will be over after 5 years), and the total cost of refurbishment should be less than 15 million HUF. The second is the "Nagykorú személyek kamattámogatott korszerűsítési lakáskölcsöne" which is also a subsidized loan with the condition that it can be obtained for a refurbishment of maximum 5 million HUF. Both are available for home owners (with at least 50% of ownership) for flat renovation measures, such as improvement of insulation, heating system change and any new installations applying renewable energy sources. In order to receive the subsidy, invoices should be shown at least for 70% of the total cost of refurbishment (MEH 2014).

The greatest disadvantage of these types of loan is that the only possible loan guarantee that can be accepted by the bank is a property mortgage. Most of the residents of panel blocks have no savings or free financial means to start deep energy efficiency renovation independently - home owners and condominia are not able to allocate internal funds for co-financing. In this regard they have to appeal to existing credit lines. However the traditional credit products are generally inadequate for financing energy efficiency projects and require a bank guarantee. Most of these loans set the mortgage as a loan guarantee, which makes it impossible to use the loan for refurbishment of a multi-apartment block, since in case of involvement in a significant house retrofit residents will not be willing to risk their own dwellings for the needs of the condominium. Probably if energy certification of individual apartments would become a common practice residents would find this funding option applicable for co-financing or as a singular funding source. Sometimes it is difficult to convince residents to contribute to the funding of the whole block if they are satisfied with their quality of life, the temperature in the apartment and the heating bills, or simply refuse to put up any capital. As a last resort projects thus sometimes proceed with exculsisions of certain apartments (though this leads to a greater number of smaller projects and reduces overall efficiency).

As can be seen from the Hungarian example, soft loans are an efficient financial mechanism if strictly regulated by national legislation. Thus, providing a loan with advantageous interest rates is usually based on a clearly defined scheme. In most cases soft loans are part of a public-private partnership where the government provides tax benefits to the bank and the bank offers preferential interest rates on special credits for their clients.

Bulgaria

In Bulgaria, as practice has shown, one of the most serious barriers for implementation of energy efficiency projects is a lack of commercially viable funding. This is due not so much to a lack of funds as to the difficulty in accessing these funds from local financial institutions on commercial terms attractive for energy users. This forces would-be investors to look for alternative ways to meet the financial demands of energy efficiency projects. According to the experience gained through STACCATO implementation, it appears that financial schemes available on the national level for funding of energy efficiency projects are too complex and frequently changed due to policy modernization processes. This situation is rather discouraging and does not provide the sort of conditions for long-term planning that is required for involving private investors, i.e. ESCOs.

Even so, there is a significant volume of private capital available for infusion into the Bulgarian energy sector, made possible due to changes in national legislation on taxation and investment. The Investment Promotion Law (1997) regulates the activities of state authorities and their interrelations with investors in the field of investment. On the regional and local level governors of regions and mayors of municipalities must provide stimulating measures for investment on their territory. The law provides certain selection criteria for investment projects, notably that the project implementation period should not exceed three years from the beginning of the project, at least 40% of the total investment should be covered by the own means of investor or funds from external financial sources excluding public subsidies.

From 2007 the Law provides equal opportunities for foreign and local investors in the country. However, investors note that despite a number of achievements made by the Bulgarian government in laws and legal documents corruption and bureaucracy are still among the most serious problems in the investment climate in Bulgaria. Also among the problematic issues impeding investments in the country they list a lack of transparency of administrative procedures, weak infrastructure, frequent changes in legislation and lack of qualified personnel (Energy Charter Secretariat 2011).

The current tax system of Bulgaria offers the most favourable conditions for investment in the EU. There is an exemption from VAT on imports for investment projects for the first 2 years if the project costs more than € 5 million and the project will create at least 50 jobs. In addition, it is possible to write off the cost of R & D.

Unfortunately, most financial institutions in Bulgaria have limited experience in financing energy efficiency and prefer to engage external experts to assess the technical and financial risks of projects. Financiers with lack of knowledge and qualifications question the effectiveness and payback capacity of projects. Partly this problem is solved by involvement of international financial institutions willing not only to provide loans through local commercial banks, but also to raise awareness of bank officers in the field of energy conservation projects.

The EBRD's ***Sustainable Energy Financing Facilities (SEFF) programme*** is a group of credit lines provided with technical assistance available for local banks to finance small and medium projects in the field of sustainable energy in a particular region.

The programme is one of the components of the Bank's Sustainable Energy Initiative and currently involves 46 banks in 15 countries. All credit proposals are designed for financing energy efficiency investments, and they are operated by local banks on the grounds of commercial loan conditions. Each credit line is accompanied by a package of technical assistance, as experts of the programme provide initial evaluation of investment initiatives and participate in preparation of the loan application. Furthermore, the programme aims to raise awareness of bank officers in the field of sustainable energy credit practices: assistance is free of charge and is provided by a group of local and international experts. With technical support from the EBRD participating banks have the potential to evaluate and finance energy efficiency projects.

Table 3. *Bulgarian banks participating in the EBRD funding schemes*

Commercial bank name	Partner in REFCL	Partner in BEERECL	Partner in REECL
UniCredit Bulbank	yes	yes	no
DSK Bank	yes	no	yes
United Bulgarian Bank	yes	yes	no
Raiffeisenbank Bulgaria	yes	yes	yes
Eurobank EFG (Postbank)	yes	yes	no
Piraeus Bulgaria Bank	no	yes	yes
MKB Unionbank	yes	no	no
Aliianzbank Bulgaria	no	yes	no
Procredit bank	yes	no	yes
CiBank	no	no	yes

In addition to technical assistance there is a possibility for grant support in case of successful realization of the project. The grant component is expressed in percentage from total amount of credit: 15% for general energy efficiency projects and 20% for households.

In Bulgaria the programme is represented by the Bulgarian Energy Efficiency and Renewable Energy Credit Line which has been operating since 2005 and involves 8 local banks. The facility possesses €155 million for investment in medium and small-scale energy efficiency projects.

Another loan mechanism run by EBRD in 2005-2014 was the ***Residential Energy Efficiency Credit Line*** **(REECL)**. The mechanism made use of EUR 40 million from EBRD (loan funding) and EUR 14.6 million from the Kozloduy Decommissioning fund (grants made as a compensation for the shut-down of four units at Kozloduy NPP, Bulgaria's only nuclear power plant).

The most widely-advertised programme in recent years is the ***Energy Renovation of Bulgarian Homes project*** financed by the EU Regional Development Operational Program (2007 – 2013). As of October 2013, up to 75% of the total renovation costs could be covered with a subsidy under this project. However, there were multiple delays in the implementation of the programme and as of September 2014 only two buildings had been renovated (with another nearly 400 approved proposals pending). In June 2014 the bank, which had been selected to manage the funds in this project, was temporarily closed due to severe liquidity problems. In this way, about 13 million leva provided from the EU funds remain blocked in the Corporate Commercial Bank (commonly known in Bulgaria as KTB). Nevertheless, the Ministry of Regional Development tries to push forward the Energy Renovation of Bulgarian Homes project and negotiates for assistance with other financial institutions. The latest media reports that Bulgaria's Ministry of Regional Development reached an

agreement with most of the 11 banks participating in the negotiations and most of these banks would join the renovation project (Bogdanova 2014). When the Ministry and the respective bank sign a loan contract, the Ministry pledges to provide the bank with all the relevant information for the applicants and it will also provide the needed expert assistance for the project. According to the Ministry, if more banks get on board with this project, Bulgaria can claim more renovation money from the EU in the next multiannual program period.

4. Position of energy efficient real estate on the market

In comparison to non-retrofitted panel blocks with similar technical and physical characteristics (number of storeys, type of construction, location), buildings where energy efficiency retrofit has been implemented have several advantages that make them more attractive on the real estate market. In theory consumers should be aware of benefits associated with buying an apartment in an energy efficient house. The price of the dwelling, which is higher compared to the same apartment in a house without reconstruction, is compensated by lower energy consumption, better air quality, and reduced maintenance costs.

Unfortunately, there is as yet a dearth of evidence assessing the correlation between real estate prices and improvement of energy efficiency indicators. According to surveys conducted in Faluház, the residents themselves position their apartments in a higher rated real estate category than before the renovation, i.e. they expect to realize more for their property if they sell it. However, statistical information about the real position of the building on the real estate market could not be found.

In 2010 a study conducted in the Netherlands showed an increase of prices for retrofitted housing of 2.7%. In other project countries at the moment there are no examples of similar studies. As in the case with an impact on energy efficiency market the real estate market is very dependent on public awareness. One of the reasons limiting the effect may be a lack of knowledge among consumers about the benefits associated with energy saving tools in residential buildings.

In the future one of the factors creating greater market demand for energy efficient housing may be energy certificates. At present the system of energy efficient certification is rather new and its influence on the external sectors is limited. As soon as the practice becomes widespread in the EU housing prices may be adjusted in accordance with energy efficiency indicators of the building. An example is the evaluation system of housing that exists in the Netherlands (AEDES 2011).

Correlation of rental prices in the Netherlands is carried out by housing corporations according to national legislation. Changes in rental prices are based on the points that are given to a dwelling within the valuation system for residential houses (Woningwaarderingsstelsel - WWS) on the assumption of major characteristics like size and type of dwelling as well as number and level of facilities available. The total number of points defines maximum rental prices. The system is well developed and functions in the Netherlands as a tool enabling the quality of social housing to be defined. The main goal of the system is to set a maximum level of rent which can be charged by house owners. The WWS is an essential policy tool in maintaining the affordability of social housing for low income target groups.

According to the Dutch legislation, housing corporations/landlords have the right to raise the rent once a year on the 1st of July. In March 2011 the Dutch Parliament approved a bill making energy labels a part of WWS, meaning energy consumed by the dwelling now has to be counted in the house valuation.

Table 4. *Rating of energy labels from July 2010*

Energy label	Detached house (points)	Multi-apartment house (points)
Label A++	44	40
Label A+	40	36
Label A	36	32
Label B	32	28
Label C	22	15
Label D	14	11
Label E	8	5
Label F	4	1
Label G	0	0

Source: AEDES 2011

The amendment was supposed to come into force in July 2011. By this time housing corporations were expected to obtain energy certificates for their buildings and review the rental charges, taking into account the new legal provisions. However, most housing corporations had not received energy certificates by late 2011, meaning that the rents were frozen till recalculation could be carried out.

It is expected that inclusion of energy labels in WWS will create additional competition within the social housing market. This legislative innovation is highly consistent with STACCATO's goal of broader take-up of energy-efficient renovation, since the obligation to obtain an energy label is an additional incentive for implementation of energy efficient retrofit of residential buildings. However, it has to be mentioned that a situation in which investments in energy efficiency of a building are compensated by higher rental prices is not necessarily favourable to all parties. From the point of view of the housing corporation the attractiveness of the investment is defined by the expected long-term benefits from the energy saving. Both sides (owner and tenant) can be satisfied if the greater energy efficiency of the dwellings is valued with more points within WWS. In that way landlords can gain payback by raising rental prices. On condition of development of long-term strategy on improvement of energy efficiency, indicators in dwellings will allow housing corporations to raise rental rates without infringing the rights of low income households. The increased rent will be compensated by reduced energy bills.

5. Renewable energy component

One of the specific features of the STACCATO project is the combination of renewable energy sources (RES) and energy efficiency measures in one retrofit. In general this can potentially complicate the project implementation with additional regulatory requirements, coherence of technical standards and complexity of administrative procedures. On the other hand, in terms of finance, inclusion of RES in the project idea makes it eligible for additional funding sources.

In recent years a large number of various financial mechanisms to support renewable energy development were introduced in the EU countries, such as. feed-in tariffs, premium, fiscal incentives, R & D grants, guarantees etc. (Ecofys *et al.* 2011). Access to the power grid is considered to be one of the main risks for renewable energy projects (Ecofys *et al.* 2011), a risk which is determined by the condition of the infrastructure and national regulations for the connection to grid in the country concerned. Underdevelopment of the grid for the transmission of the energy produced from renewable sources is a major barrier for reaching renewable energy targets at lower costs. The feed-in tariffs and premiums are designed to encourage project developers financially to develop the RES market and improve the grid. In the EU the most common financial instrument to support renewable energy sources is a feed-in tariff which experts characterize as the easiest to implement (Ecofys *et al.* 2011). This system is used in Bulgaria and Hungary. Another system of subsidizing renewable energy is a feed-in premiums system. Among the STACCATO project countries this system has become widespread in the Netherlands.

In **Hungary**, a feed-in tariffs system has been in force since 2003 and is regulated by the Electricity Act. Pursuant to the related Regulation Nr. 105/2003, it is obligatory for electricity suppliers to purchase electricity from renewable energy sources. The obligation is restricted with production capacity which should be more than 100 kilowatts. The feed-in tariff is set the same for all RES and administrated by the state authority which is responsible for annual adjustment of the tariff for inflation. The feed-in tariff was initially set as a financial flow not related to the state budget. The national KAP fund, the Central Price Support Mechanism, cover the costs of both the feed-in tariff for renewable energy and CHP through the transmission charge of the electricity system.

Subsidy support for renewable energy in the residential sector has been available through a number of programmes. One of them was the Environment Protection and Infrastructure Operative Programme (EPIO) structured around three main types of projects that it supported including modernization of residential buildings with RES installments (IEA 2011). Moreover, under the Environment and Energy Operative Programme and the New Széchenyi Plan, EU and Hungarian government funds have been utilized since 2006 to provide subsidies for renewable energy, in order to support its integration into the electricity and other energy networks of the country (IEA 2014b).

In **Bulgaria** a feed-in tariff was adopted in 2007. It was planned that the system would be supplied with additional regulatory measures ensuring effective implementation provided with simplified administrative procedures including licensing and equal access to the grid, though at the moment the existing legislation related to position of independent renewable energy producers on the energy market and their access to the grid is not sufficiently transparent to attract investments. Renewable energy producers were reporting difficulties in grid connection that do not allow effective operation

of the market. Specifically for the development of RES in the residential sector there are no subsidies available as yet in the country.

The Netherlands have a long-term experience of supporting renewable energy, and the current system of feed-in premium Incentive for Renewable Energy Production ('Stimuleringsregeling duurzame energieproductie') has been in force since 2007. According to this the difference between production costs (annually calculated per technology) and income (i.e. energy price, which is determined annually) are covered by the fund for a number of years (maximum 10). In order to meet the EU target of 14 percent renewable energy use in 2020 in a more cost-effective way the system was improved in 2011. The basic cost price (basisprijs) is estimated for each technology, and the difference between this cost price and the actual market price is subsidized for a period of 15 years. In this way the grants are more likely to be provided to the cheapest technology.

Direct support for renewable energy in the residential sector is provided within the Green Fund Scheme and Energy Premium (EPR) subsidy scheme. Projects targeting sustainable construction are eligible for green funding on the basis of green certificates issued by the government for a maximum of 10 years (details are described in the Investments and Loans section below). The goal of the EPR is to support investments in renewable energy from households and social housing corporations and the subsidy available for RES is up to 50% of the total project costs.

Regarding private investments, it has to be admitted that for many investors renewable energy technologies still remain largely unknown and, therefore, they are often considered a risky investment. Technology-related investor risks are usually associated with the lack of qualified specialists, non-standard business models and the underdeveloped renewable energy market. When it comes to project development certain administrative barriers may occur such as licensing of technology operations. Success in overcoming these barriers directly depends on the experience and skill of project developers, as well as their ability to negotiate with government officials and partners. In addition, investors should be confident in the stability of governmental support, namely the availability of state financial incentives during the whole duration of the project. The existence of state guarantees is one of the most important factors in attracting private investment in renewable energy projects.

6. Energy suppliers of STACCATO project cities and their involvement in the retrofit

In case of realization of an energy efficient project the main stakeholders on the local level are community groups, municipalities and energy suppliers. In the countries with a socialist history, like Hungary and Bulgaria, energy suppliers, in addition to state energy companies, are usually large factories or plants that have obligations to provide with energy certain districts of a city with a number of apartment blocks assigned. For the system to work effectively, the factory/plant should be provided with a full utilities payment collected by the municipal authorities and paid back to the company. However, due to the rapid increase of energy costs, low income families, often living in high density panel houses with low energy efficiency characteristics, struggle to cover central heating costs. In such cases the heating suppliers may also face significant problems. At the same time, large-scale energy producers are active contributors to the national CO_2 emissions volume. Therefore, the retrofitting of apartment houses in an energy efficient way is not only profitable from the point of view of fuel reduction costs but also from the perspective of reduction of CO_2 emissions.

As STACCATO experience has shown, it is important to ensure collaboration with energy/district heating (DH) companies, or at least their neutrality towards the project. This is mainly due to the fact that improved energy efficiency in residential blocks, which are supplied with energy (heat, hot water and/or electricity, depending on the type of RES applied) by the companies, can potentially be a threat for the latter in face of losing a certain amount of clients and thus the associated profit.

The Netherlands

The consumer energy sector in the Netherlands is mostly liberalized and the consumers are free to choose one energy company that will supply their dwelling with electricity and gas. Amsterdam is a part of the national grid and there are three power plants located near/in the capital (three operating on gas, one on coal and one on waste fuel) which supply the city with electricity. The liberalization and enlargement of energy companies reduced the influence of local authorities. This leads to lobbying on a national level and vertical cooperation with energy providers and network companies in the city, while generally the national ambitions are low (CASCADE 2012).

The main energy company in Amsterdam, Nuon, has recently built two new power plants, Hemweg 9 and Diemen 34, that deliver electricity to the Dutch power grid since mid-2012. The two gas-fired plants were constructed by Siemens Energy and have a very high energy efficiency of about 60%. The 440MW Hemweg and the 435MW Diemen plants have a capacity to generate enough electricity for about 1.5 million households in the region, reducing CO_2 and nitrogen oxide emissions by using natural gas as a primary energy source (PT 2013).

The Dutch heat market is not fully liberalized, so the consumers cannot choose their heat provider and the heating bill comes separately. There are only two heat providers of heating in Amsterdam: Nuon (Vattenfall) and Westport Warmte. The current district heating network in Amsterdam provides heat to approximately 45,000 houses and is planned to be expanded further in the future. The Waste and Energy Company and the Nuon power station in Diemen are primary sources for the

collective heating network in the Dutch capital. The Diemen 34 plant is designed to generate thermal energy of about 260MW of heat for Amsterdam districts.

The current power grid is has been expanded by increasing the share of renewable energy sources powering the city (installation of windmills, solar PV panels). Individual initiatives provide a contribution to this, such as the 2007-2011 "Sun on your roof campaign"[6]. It is planned that 70% by 2015 and 100% by 2025 of potential sites for construction of wind turbines will have been utilized. Solar panels are projected to become cost effective for houses around 2020 and for companies around 2025. Heat and cold storage heating are planned to be used to make the existing buildings more energy efficient (ACO 2011).

Companies in the Dutch energy market include Nuon, Delta, DONG Energy, E.ON, ENECO, Energie Direct, Essent, Green Choice and Oxxio. Most of the energy companies offer a number of fixed and variable tariff options, although prices are generally similar across the board. There is also a possibility to purchase energy from renewable sources (*groene stroom*) such as from wind or biomass. The Netherlands has some of the highest retail electricity prices in the world at around €0.20 per kWh. There are dual tariffs available with slightly cheaper rates during weekday nights[7] and at weekends. Depending on energy use, a combined monthly bill makes around €120 for a standard apartment, and up to €200 for a larger dwelling. And although fuel poverty is not yet prominent[8], it may become so as energy prices grow (CASCADE 2012). Electricity meter readings are done on an annual basis and when a tenant first moves in, the energy company conducts an estimate of a monthly payment to be charged by direct debit. As it takes a certain period of time (sometimes one year) to adjust the payments with the usage pattern, the tenant is usually overpaying for his energy use to the company at the start.

ENECO is one of three largest energy companies in the Netherlands specialized in production, trading, transmission and supply of gas, electricity, heat and related services. ENECO took an active part in implementation of the STACCATO retrofit at Het Breed. The company was responsible for replacing the existing domestic heating and hot water system with a new sustainable energy system, which includes 1,000 solar collectors on the roofs of the buildings (for heating of hot water) and new pipelines of a total length of 155 kilometers (Eneco 2013). Eigen Haard and Ymere also replaced 5,000 radiators. ENECO in Amsterdam showed a forward-thinking model where an energy company seeks new business opportunities in energy efficient retrofits in combination with application of renewable energy.

[6] subsidy provided for homeowners of Amsterdam districts and the province of North-Holland, which resulted in installation of solar panels with a capacity of more than 2 MWp

[7] between 11pm and 7am

[8] the lowest income groups often live in the cheapest houses with the worst energy performance and therefore with relatively high energy costs, spending increasingly on energy, bills namely about 7.5% of their total income (Agentschap NL, 2010)

Hungary

Nearly two-thirds of district heat energy consumed in Budapest comes from five power plants run by Budapest Power Plants Rt (BERT), from Csepel Power Electric Generation Co. Ltd. (CSA Kft), from the Municipal Common Land Management Rt and the United Chemical Works Rt. The remaining one-third is generated at 6 boiler plants by Főtáv, the city's largest district heating company. The EDF Group is currently the main actor of the Hungarian energy market. BERT is a member of EDF Group operating among others three combined-cycle gas power plants, all of them located in the centre of the Hungarian capital. The three plants produce more than a half of the district heating energy in the city, which is then sold to Főtáv. BERT also generates 10% of Budapest's electricity (EDF 2014).

In Hungary, municipalities establish district heat supply tariffs for the residential sector, while the prices of gas and electricity are set and regulated by the state. Because of the exiting fuel poverty problem, the recent 'utilities reduction' policy introduced in 2012 by the government resulted in reduction of more than 20% of heating, electricity and gas costs for the Hungarian citizens[9].

In Budapest the institutions of individual boroughs are currently being supplied by Főtáv, which is owned by the Budapest Municipality. At the same time, the boroughs sometimes disconnect and separate their buildings from these central services choosing individual heating based on natural gas, in order to achieve operational cost savings. To prevent the disconnections and ensure that the buildings remain within the district heating system for the long term, Főtáv has been making efforts to sign agreements with the boroughs. Under such agreements the company accepts an obligation to carry out energy saving analyses for the buildings supplied with district heating and provide solutions for reducing operational costs of investments financed by the boroughs.

Főtáv was supporting and cooperating in the implementation of the STACCATO project at Obuda site. In particular, the company participated in upgrading of a local heating centre. Főtáv had a number of incentives to stimulate the energy efficiency retrofit, as it would bring a number of advantages to the company. Most of the Obuda residents were low-income families or individuals spending a large share of their monthly wages on energy and utility bills. Therefore, the reduced energy bills (specifically the heating bills) lead to decrease of non-payment of Faluhaz residents.In addition, improvement of insulation and other energy efficiency measures adopted at the end-user side help the company to have less heat losses and thus use energy more efficiently. Of course, Főtáv also had to suffer certain losses, as application of the solar heating system in the project meant decrease of district heat consumption by Faluhaz, and consequently less revenue from this site. It can be thus concluded that the company was motivated by both fear to lose its customers and a good chance to upgrade the system and try to decrease the loss by improving the system's efficiency.

[9] More about the policy in STACCATO Policy Report

Bulgaria

There are over 30 regional and district heat suppliers operating in Bulgaria: some of them produce heat only for the residential sector needs, while others work primarily for industrial consumers, also generating electricity through combined heat and power facilities. Bulgarian district heating companies are commonly known as 'toplofikaciya' *('топлофикация')*. Most of the heat suppliers use natural gas as their primary fuel with only a few using coal, such as Toplofikaciya Ruse and Toplofikaciya Pernik (SCEWR 2014).

Among the suppliers, **Toplofikaciya Sofia**, which serves Bulgaria's capital, is the oldest and the largest in the country and according to its own estimates it is the largest on the Balkan Peninsula[10]. It supplies 400,000 residential and commercial clients with heat and hot water. In the early 2000s, the ownership of the company was divided between Sofia Municipality as a main stockholder and the state (the Ministry of Economy) but now the company is entirely in hand of the Municipality. Among other activities, Toplofikaciya Sofia is currently working on a EUR 130 million project of construction of a waste-to-energy plant in Sofia, which is expected to lead to an annual drop of 11% in the use of natural gas at conventional power generation facilities.

As far as electricity supply is concerned, in Sofia and the entire Western Bulgaria, the regional supplier **CEZ Bulgaria**, a subsidiary of the Czech group CEZ, is responsible for retail market sales to end-consumers. As a result of privatization efforts of the Bulgarian government, CEZ obtained control over the regional distribution grid in 2005 and has ever since made progress in improving the quality of service. The supplier provides electric energy to households and small businesses according to regulated prices set on an annual basis by the State Energy and Water Regulatory Commission (SEWRC). Electricity distributors like CEZ publicly support energy efficiency efforts and have produced corresponding materials to raise public awareness on the issue. Moreover, some of energy suppliers, such as Bulgaria's gas distributing company Overgas Inc., offer its clients assistance in getting loans for energy efficiency retrofits.

In reality, the company turned out to be a de facto a heat supplier: in those places where connection to the central heating grid of Toplofikaciya Sofia is absent, the households rely on air conditioning or other electric heating systems to keep their homes warm in wintertime. Moreover, some tenants prefer using electricity for heating because the monthly bills seem clearer and arrive on time, as well as the electricity is cheaper in Bulgaria relative to gas[11]. In contrast, the billing system of Toplofikaciya is somewhat complicated. It allows for hefty payments throughout the heating season and at the end of it, when the reconciliation bill is issued, it often turns out that the customer should be partly refunded. And contrariwise, extra payments may occur at the end of the winter if the customer appeared to have underpaid. In this way, it takes months to realize the actual consumption/ due payments and in many cases this lack of clarity complicates the relationship of the energy company with its customers.

[10] http://toplo.bg/
[11] See STACCATO Policy Report

Toplofikaciya Sofia was not directly involved in implementation of the STACCATO renovations at Oborishte. However, an issue between the residents of one of the retrofitted blocks and the company has occurred recently. The Bulgarian partners reported that the level of bills in one of the blocks started rising again significantly in 2013/14 after initially falling post-renovation. The estimate was a pre-retrofit level of 15 EUR per month, which went down to approximately 4 EUR per month immediately after the retrofit, but then returning to the level of around 10 EUR per month. According to information provided by the residents of the block, this is due to a large increase in the "common charge element" of their energy bills, while the variable, an "individually metered element", has remained low post-retrofit. It is possible that the district heating company was suffering from over-capacity of the combined heat and power plant, especially during the summer months, and attempting to compensate in this way from the risks of having unusable excess heat if retrofitting is scaled up. The issue as yet remains unresolved. At the same time, it serves as a good example showing the problems faced by district heating companies in Bulgaria, which are losing their market as individuals and companies are increasingly shifting to alternative energy sources.

It is also worth noting that large amounts of heat energy are lost in the distribution grid and in the buildings, and the loss is usually calculated in the customer's energy bills. Thus, Toplofikaciya has a very little incentive to dramatically cut the energy loss, as long as it is reflected in the bills and paid for by end-users. If the pricing methodology does not change and the company is not stimulated by the state to foster greater energy savings, central heating prices may increase significantly. This would cause the consumers either to start reducing their energy consumption (while also sacrificing their comfort) or to look for alternative ways of dealing with the problem (e.g., implementation of energy efficiency measures or switching to alternative energy sources as in the previous example).

7. ESCO Practices

The Netherlands

The Netherlands is one of the most successful countries in the EU in terms of energy efficiency and is a good example of how the ESCO concept can establish well in favourable market conditions with a good regulatory framework. At the same time, due to the still limited size of the market there are only a few ESCOs that are active in the country, and both the level of activity and the number of energy service companies have remained practically the same over the last 15 years (Bertoldi *et al.* 2014; EC JRC 2012). According to the last estimates, the current number of functioning and active energy efficiency providers, which can be considered as ESCOs, is around 50 (Bertoldi *et al.* 2014).

With the development of technologies for reducing greenhouse gas emissions the content of projects has been slightly revised. The Netherlands has over 20 years of practice of various incentives, financial instruments and governmental programmes to improve energy efficiency, which has somewhat reduced the need for an ESCO market. For example, in the industrial sector there is a well-functioning practice of voluntary agreements - industrial enterprises are quite independent and have all the financial and technical means for introducing and implementing energy saving measures. In the residential sector meanwhile there are such instruments available as subsidy support and preferential loans. Residential buildings owned by housing corporations usually belong to social housing stock occupied by low-income tenants, which provides an opportunity for ESCOs to be involved as a source of third party finance. The stability and legally secured status of housing corporations makes them a safe investment partner in energy efficiency retrofit, and the support of local authorities may be provided as a further guarantee.

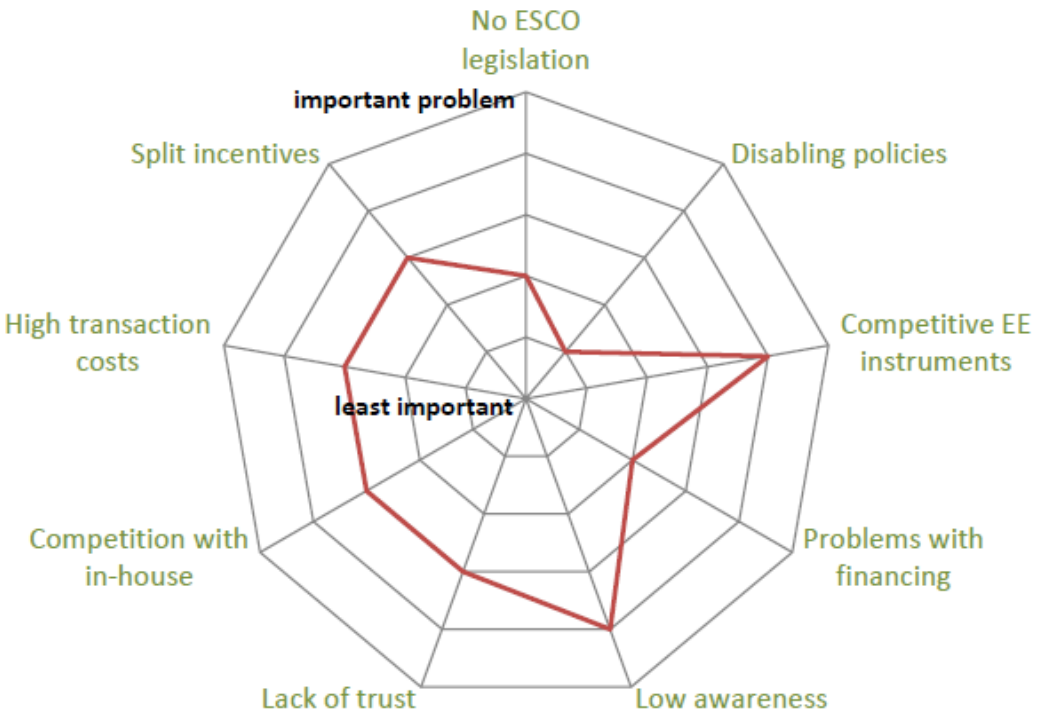


Figure 5. *Barriers to ESCO projects in the Netherlands*

(Source: Bertoldi et al. 2014)

At the same time, a number of barriers to ESCO involvement in energy retrofit projects exist (see Figure 5).

There is a lack of awareness, including reliable information and examples, which is one of the key barriers of the ESCO market. Subsequently, there is unfamiliarity with the concept and a deficit of trust. And while some ESCO projects prove successful, others have worse results than expected because of the lack of proper knowledge and experience of contractors. In addition, while technical aspects are provided and trusted, the ESCOs experiences with complete ESCO packages is limited and the financial schemes (e.g., a guarantee fund) require further development to earn clients' trust.

Split incentives hinder ESCO investments as the owners are not allowed to share or pass on investment costs and integrate them into the rents directly. As a result of an ESCO project, property value increases influencing the renting price. This fact, however, is not widely acknowledged and appears to be not enough to drive the ESCO market.

In general, the policy framework on energy efficiency in the country is such that the development of ESCO practices is unlikely to significantly impact the state of the housing sector, as ESCOs are representing here only one more option among many other successful schemes. Moreover, the Dutch ESCO projects are usually complex if compared to alternatives (such as own investment via a grant support), and therefore are considered expensive. There has also been a problem with establishment of baseline data by ESCOs (e.g., due to the absence of individual energy meters), which leads to the company undertaking monitoring of the projects and consequently growing transaction costs. As a result, lack of standardized measurement and additionally of verification procedures deepens the issue of trust.

According to Bertoldi *et al.* (2014), key drivers for further development of ESCO market in the Netherlands are the following:

- 100% sustainable procurement
- Lack of most legal barriers
- VAT reduction for labour-related to energy-related refurbishment
- Changing procurement practices towards life-cycle cost consideration and requirement for long-term maintenance
- Growing environmental awareness.

Hungary

Hungary has a long-term experience in involving ESCOs in municipal projects. The ESCO industry in Hungary dates back to the early 90s. Initially the projects were mainly focused on cogeneration, modernization of street lighting and district heating. Support provided within the state subsidy Panel Plus programme facilitated the extension of project areas and encouraged implementation of projects in the municipal sector directed towards improving the efficiency of hot water systems, air conditioning and renewable energy. (Bertoldi *et al.* 2007). As of 2010, however, it was clear that the Hungarian ESCO market had major problems. The market was fluctuating and many companies were either considering to reorientate or went out of business, while others were engulfed by more successful competitors. The financial crisis also had a negative impact on the market due to the increased pressure to save on costs, the sharp decline of the construction rate and the fear of bank

loans combined with municipal budgetary limits and liquidity problems.

The first NEEAP[12] (2008-2010) of Hungary placed ESCO amongst the priority axis for increasing energy efficiency of the Environmental and Energy Operative Programme, as part of the New Hungary Development Plan (2007-2015). Close to 50% of the tertiary sector savings targeted for 2016 was planned to be achieved through ESCO and/or third -party financing projects (MND 2011). However, achieving the goal is currently becoming less realistical as many issues appeared impeding ESCO practice in Hungary.

For an ESCO, as a private investment company, one of the major problems of participation in the modernization of residential buildings is duration of the payback period. The length of the contracts and payback times has increased in the last years (from an average of 5-7 years to around 10 years in 2013) (Bertoldi *et al.* 2014; Marino *et al.* 2010). If there is a central heating system in the building or if tenants do not report their monthly energy use, bills are drawn on the basis of an average annual usage. In this situation the ESCO cannot prove the energy savings achieved through the retrofit. Usually it takes a company about 1-2 years before the project starts to collect basic information (Bertoldi *et al.* 2007), which extends the project payback period further and complicates administrative procedures. Companies that sponsor such projects therefore need strong financial stability. In addition, there is a lack of a centralized database for levels of energy consumption in the residential sector. As a result, monitoring activities are usually done by an ESCO on a professional level, using international standards. This contributes to additional increase in transaction costs.

Renovation programmes in Hungarian residential sector were largely based on the strong incentives from Structural Funds (e.g., the Panel Programmes). However, these incentives have ceased or drastically decreased. While expecting these grants to reappear, property owners in large residential districts have been postponing their investment decisions. Because of the absence of regular ESCO practice in the residential sector in the country, successful project implementation depends very much on details of the project scenario. The realization of project activities greatly depends on interrelation of project partners, specific project goals, the level of involvement of the state and especially the local authorities. Therefore, personal connections with decision makers and available the funding opportunities may play as important a role in determining project success.

Besides, there is still a problem of low awareness about ESCO practice among the public and municipalities. Local authorities do not realize the scale of ESCOs' capacities while residents do not trust in "dubious" financial schemes. In addition, municipalities have problems with sharing project benefits with private companies (Bertoldi *et al.* 2007). As a result, projects may be delayed or the contract conditions are not entirely fulfilled. These problems may be partly solved by the newly adopted national development strategies. For example, a standardized monitoring and information system, as well as the introduction of awareness raising campaigns are to be elaborated within the government's Széchenyi plan.

Another serious barrier for ESCO practice is the complications of establishing long-term financial

[12] National Energy Efficiency Action Plan

agreements in multi-apartment blocks. Even taking into account that a condominium has the right to represent residents, the law requires that the contract is signed by all apartment owners. If this is not achieved, some minor renovation may be undertaken in those parts of the house where consent was obtained but most of the work, which allows achieving the greatest reduction of energy consumption, can only be performed in the block as a whole (changing water pipes, modernization of the heating system, thermal isolation). Overcoming this barrier is closely related to the problem of awareness, and trust is still considered one of the major impediments. There is a possibility that project developers may reach consensus with tenants regarding their financial participation in the project but related administrative procedures may still delay project implementation. In that case temporary financial support of projects can be performed by a bank as a third party.

The regulatory framework of energy efficiency and especially of the ESCO market remains weak. Policy-making in Hungary has not been supportive of the ESCO market in the last years. Policies are made without proper public or expert consultation and in a short time. Several new policies have been counterproductive, and delineating the energy sector layers', the banks' and even the clients' attention from energy efficiency. Special taxes have been put on banks and energy firms, which in turn have reformulated their Hungarian presence and portfolios. Some banks and some energy supply companies have been deprivatized. In addition, since 2012 the utility prices have been controlled (i.e. 'utilities reduction policy') by the state by 25% for the residential sector (Bertoldi *et al.* 2014), which has questioned the profitability of some of exemplary residential ESCO projects.

All existing barriers to ESCO projects are summarized in Figure 6.

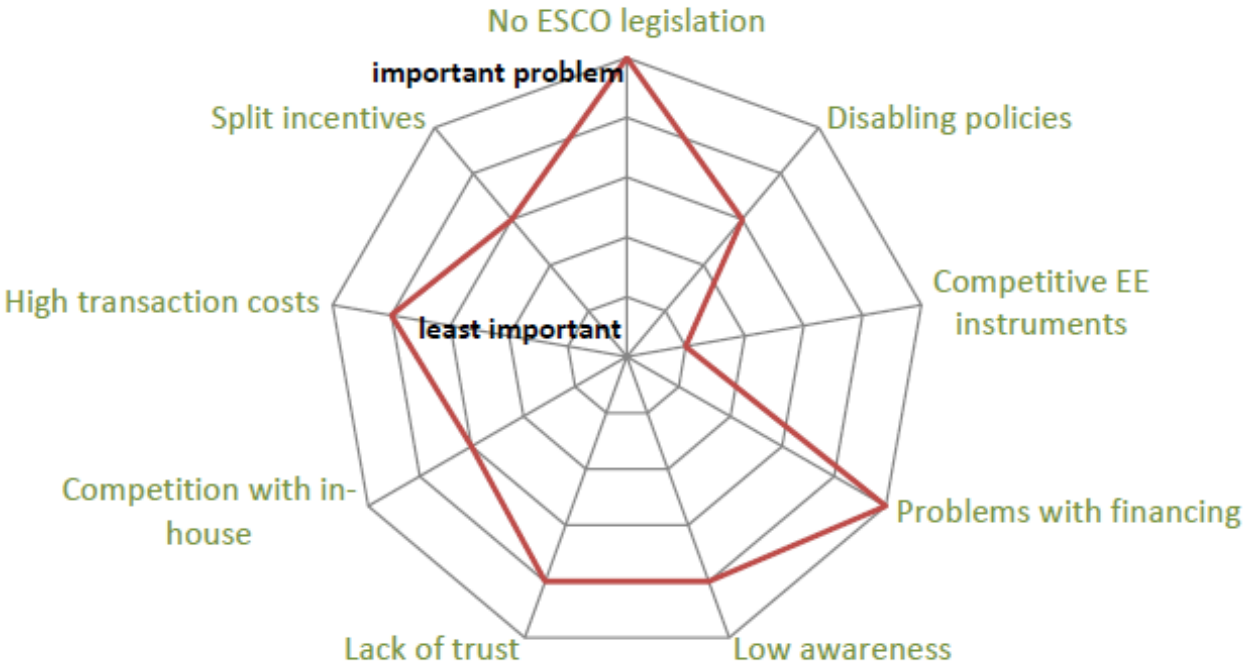


Figure 6. *Barriers to ESCO projects in Hungary*

(Source: Bertoldi et al. 2014)

In conclusion, the Hungarian ESCO market has a remarkable history. While it was quoted as the

exemplary model of ESCO market development in Central Eastern Europe, it was fluctuating and experienced a lack of stability between 2006-2010, while since 2010 it has seen in a continuous decrease. It is hoped that the regulations to be introduced as a result of the transposition of the EPBD and EED, and the relief of the municipal liquidity due to the take-over of loans by the state will be able to push the market in a positive growth direction.

According to Bertoldi et al. (2014), key drivers that are expected to turn the changes around are the following:

- The Hungarian National Energy Efficiency Action Plans indicate political commitment to the inspiration of the ESCO market
- Introduction of an Energy Efficiency Obligations scheme and the transposition of the EPBD
- State ESCO and the 3% mandatory renovation rate of governmental buildings
- Revival of state grants for residential renovation
- Continued presence of international funds (e.g. EIB and EBRD)
- Market-based development.

Bulgaria

The energy services market in Bulgaria is still in its infancy, although it has been alive since 2000. ESCO practice is unstable and underdeveloped, so that at the moment ESCOs cannot be considered as equal project partners. According to the Naional Energy Efficiency Act, companies and other investors can make investment in energy efficiency improvements in buildings which they do not own. The owner of the building ('the principal') can award an Energy Performance Contract (EPC) to a company which assumes the responsibility to renovate the building (acting as an 'agent'). The investment paid by the company is then expected to be refunded by the savings of energy after the renovation. In other words, the principal is obliged to pay his/her energy bills in a business-as-usual manner after the renovation up to the point when the agent gets his/hers returns on investment. As of 2012, there were about 50 companies in Bulgaria offering energy efficiency services, but experts estimated only between 7 and 12 EPC companies (EC JRC 2012). Most of the active companies are national firms (Khamrakulova 2013), offering energy efficiency services in addition to their main businesses.

The Bulgarian Energy Efficiency Fund established in 2006 offers ESCOs financial support. Companies may apply for technical assistance, partial loan guarantee or co-financing in case of a bank loan. Nonetheless, given the enormous potential of energy saving that exists in the residential housing sector in Bulgaria, involvement of ESCOs in energy efficiency renovation remains difficult. The legal and institutional framework in this field is rather underdeveloped and there is still a legal ambiguity about the ownership transfer of equipment installed through ESCOs. There is no clear regulation which would define property rights of project partners in case of ESCO involvement. The situation is complicated by the lack of reliable initial data which, as in the case of Hungary and the Netherlands, increases the transaction costs and payback period of the project.

Currently, the number of projects implemented in the country with ESCO involvement is not sufficient for dissemination of good practices. During the last decade some 15-20 energy performance contracts were concluded by the four most active ESCOs, resulting in refurbishment of

over 300 public buildings (EC JRC 2012). Other ESCOs in Bulgaria have been mostly involved in projects for improving heating systems in public buildings. There are a few examples of ESCO participation in municipal projects, in which local authorities attract energy service companies to project finance as a third party. At the same time, as the experience of STACCATO implementation has shown, the Bulgarian ESCOs do not yet see large-scale energy retrofit projects as attractive or efficient. However, according to the second National Energy Efficiency Action Plan, the government does expect implementation of energy saving projects with involvement of ESCOs also in the residential and industrial sectors (RB 2011).

Many barriers are overpowering and hindering establishment of a commercially viable ESCO market in Bulgaria (see Figure 7). The currently limited experience creates one of the key barriers: an insufficient level of trust to ESCO practices. In order to overcome it, it is essential to implement complex actions towards behavioral change in the society disseminating information about benefits of energy efficiency improvement and ESCOs' capacities, and spreading knowledge and experience about ESCOs and EPC in the country.

The financial barrier is also a crucial one: ESCO projects do not prove to be profitable without external grants, while commercial banks are not open for alternative financing mechanisms (EC JRC 2012). Thus, dedicated programmes for the involvement of the state of buildings are imperative, as well as ESCO projects may incorporate normal renovation elements, which is also important for normalization of living conditions in (Bertoldi *et al.* 2014). In addition, a number of competitive energy efficiency instruments exist in Bulgaria. The available financial instruments and funds, although are helpful by softening credits and increasing project profitability, are often given away too generously, without strict monitoring and/or requirements (EC JRC 2012). As a result, the grants and credits may be used by non-effective projects and as a result compete with EPC suppliers. The situation is aggravated when such projects fail to deliver expected energy saving results, dissatisfying clients and reducing trust in the market.

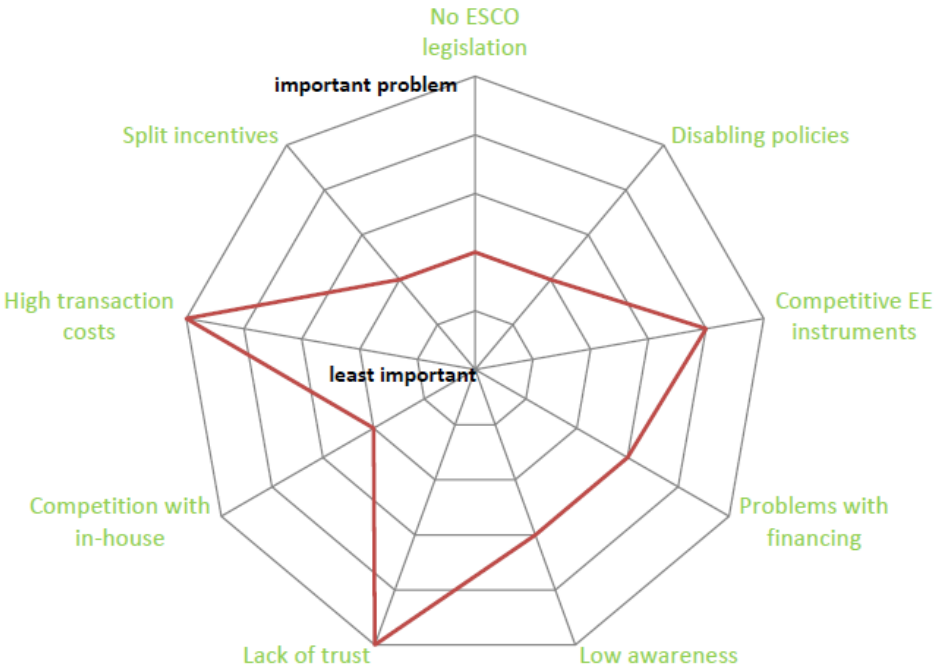


Figure 7. *Barriers to ESCO projects in Bulgaria*

(Source: Bertoldi et al. 2014)

The necessary changes to start-up the ESCO market in Bulgaria as suggested by Bertoldi *et al.* (2014) include:

- Normalisation of the state of buildings, living conditions, illumination level to a level mandated by regulation
- Establishment of statistics, data collection and information about buildings
- Development of building level metering
- Awareness raising activities
- White Certificates.

8. STACCATO experience

The Netherlands

Initially, the large-scale retrofit in Amsterdam-Nord could be implemented without the European funding, which was involved to test the project scheme. The EU grant provided for the retrofit measures covered only a fraction of the actual renovation costs: the entire project cost 15 times more than the sum allocated by the EU. The project was facilitated by governmental programmes, active participation of the two housing corporations, the support of local authorities and a variety of economic incentives,.

However, during the project's implementation many additional costs arose and a number of partners are negative on the financial outcome of the Het Breed retrofit. As the renovation project experienced a number of financial setbacks (such as removal of asbestos), part of the property of the corporations had to be put on sale to cover the costs. As a result of the freeze of some of the building activities after the 2008 stand-still, builders issued claims for compensation, the level of which is currently being negotiated (as of autumn 2014). The total renovation price is therefore expected to rise significantly because of the building freeze and the cost indexation caused by the prolongued building period[13].

Moreover, because of the substantial delay in renovation, housing associations may lose up to half of the European subsidy. This became a big disappointment for the partners who find it inconsistant that the project is judged through the prism of time duration instead of its end results. At the same time, for other partners who were reimbursed only according to the hours they worked, the financial side of the project was less problematic, while for the municipality the idea of the project was more important than the grant (IVAM 2014).

Because of the large scale of the project and the goal to combine energy efficiency retrofit with application of renewable energy technologies, housing corporations found it difficult to create support for the plans in a big area of over 1,100 residents. The project was also complex because it had to deal with many stakeholders and individuals with various cultural backgrounds. As it was suggested by some of the partners, the experience has shown that it would be more convenient and efficient to break the retrofit into parts and carry out the renovation works and related activities based on smaller scale projects.

Hungary

At the Obuda site more than 50% of STACCATO financing came from the European Commission and the Hungarian Government. The government provided financial support through its Panel Plus Programme aimed towards redevelopment of outdated buildings constructed by industrialised technology (panel blocks), coupled with increase in application of renewable energy sources. In 2005 the municipality of Obuda joined the STACCATO project. The total project implementation costs made approximately 4.18 million EUR (1.2 billion HUF) with 1 million EUR coming as a

[13] During the standstill there was a need to rent emergency heaters, provide storage of materials and pay the builders for the waiting period

contribution from the EU. As a result, the so-called "Village Block" (Faluhaz) - one of the largest panel blocks in Eastern Europe with its 15 staircases, 884 flats and 3,000 inhabitants - was selected as a project retrofit site. Preparation of the renovations took place between 2006 and 2009, during which financial plans were developed.

The results of the tender have shown that Faluház is a positive and definitely motivating example. Many applications for state funding were submitted by condominia located in the 3rd district of Budapest (Óbuda) where the Faluház renovation took place, and one fifth of all funding allocated for energy efficiency refurbishment was assigned to Óbuda sites (Óbuda Újság, 15.06.11). Taking into account that state funding was offered as co-financing, it required additional investment from tenants. To cover this part, residents had to take loans. In order to support this initiative the municipality of Óbuda volunteered to take responsibility for covering 5% of the total interest rate of such loans. The money was provided in the form of grants, requests for which needed to have been submitted by the end of 2011. To cover this support the Óbuda municipality reserved 100 mln HUF (c. 343,000 EUR) per year until 2016.

In addition to the requirements related to the state funding, there were two special conditions regarding the renovation process and the outcome set by the municipality for grant recipients. First of all. condominia were supposed to sign an agreement which transfers all procurement rights for the refurbishment to a private company, Celler Kft. The company was to be responsible for the selection process of contractors and suppliers, as well as accounting. At the end of the renovation Celler Kft was to carry out quality assessment and financial monitoring. The second condition for receiving a grant was that the future facade of the retrofitted building had to be approved by the main architect of the 3rd district. The requirements were met and the project took 6 months to be completed by the end of 2009.

STACCATO is a unique retrofit project for Hungary on a national level, as it received matching funds from the EU, the Hungarian Government and the Obuda municipality in the following shares:

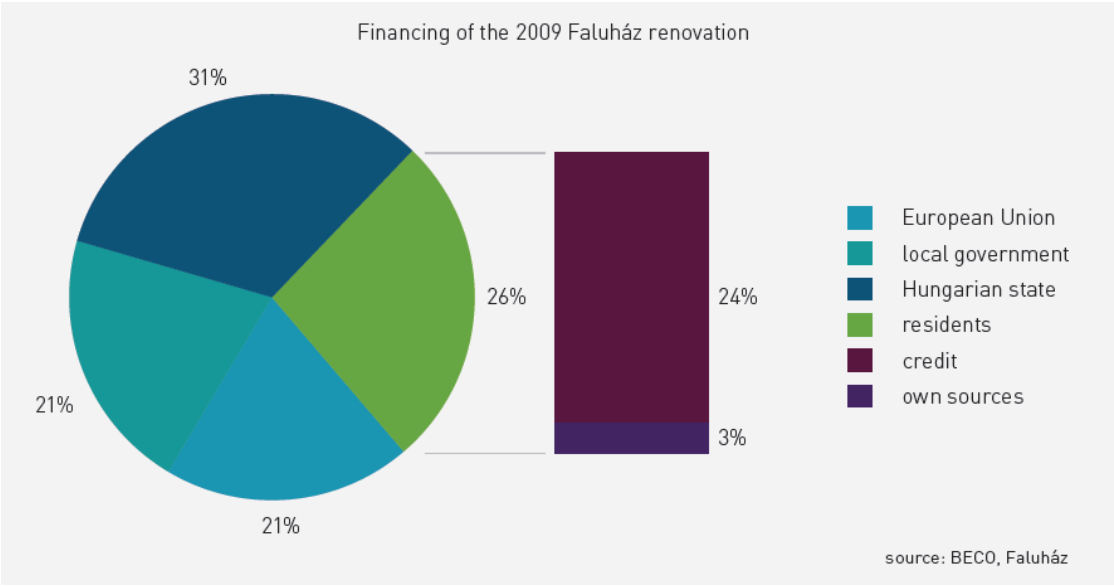


Figure 8. *Financing of the 2009 Faluhaz renovation under STACCATO, Hungary*

A whole number of technological measures was taken to improve building's energy efficiency, such as improvement of insulation of the main building components, replacement of windows and installation of individual meters. The renovation was complemented by installation of 1515 m^2 of solar collectors on the block's roof. The total costs of the renovation were divided in the following way: the most expensive measure was application of thermal insulation (44% of allocated budget), while 28% and 26% of the budget correspondingly were spent on installation of solar collectors and replacement of windows, and 2% on heat cost allocators.

Among the financial challenges on the way to successful realization of STACCATO-like projects in Hungary is involvement of ESCOs in the residential sector. The companies should be provided with the appropriate legislation and administrative support, as they have a strong potential to play an important role in energy efficient renovations. And as STACCATO could possibly not be replicated in the absence of the large EU contribution, development of well-functioning funding mechanisms could enhance the number of successful projects.

Bulgaria

In Bulgaria it soon became evident that the majority of owners-occupiers of the residential blocks, which were to be renovated, were not in the financial position to be able to invest in the maintenance of their apartments, let alone in a major retrofit of their dwellings. Apart from the financial crisis, the situation was aggravated by low level of organization on different levels (from personal and local to the mismatch between national and municipal plans and operation). It was also initially planned that ESCOs would take a part in the project's co-financing scheme to add some 65% of the funding. However, the estimated results appeared to be not efficient and attractive enough for the partner ESCO, which then left the project.

To resolve the financial problems, the Bulgarian STACCATO partners focused on smaller blocks in Oborishte area of Sofia, which helped to improve the issues with organization. The National Residential Renovation Programme funds were attracted to support the project. As a result, the residents of the three pilot blocks[14] at the Oborishte had to contribute 15 to 20% of the total renovation costs. In this way, financing of renovation of facades, insulation and replacement of windows came from the National Renovation Programme, while solar thermal systems were co-financed by the STACCATO project (EU funding). The total project implementation costs werearound EUR 30 million (BGN 60 million)[15].

At the same time, as the socio-economic status of the residents of some of the retrofitted blocks at Oborishte was relatively high, they could largely contribute to project financing. Residents of one of the blocks (at Cherkovna 75) were rather entrepreneurial: they were funding a significant part of

[14] Four residential blocks were renovated: three blocks at Oborishte (*Aleko Konstantinov 2*, *Assen Zlatarov 4* and *Chataldzha 54*) were co-financed by the National Residential Renovation Programme and one block (*Cherkovna 75*) received funding from private resources of the owners, credits, loans and rents of the common part of the building as described further in text.

[15] Along with the RES/RUE retrofit of the four residential blocks, two public buildings (a kindergarten and a hospital) were renovated

their renovation costs through the revenue received from a telecommunication company for hosting a GSM mast on the building roof. In addition, the residents applied for and received a loan from a local bank which participates under EBRD's REECL programme. Integration of the solar heating system in the project in this building was funded by STACCATO funds. From this perspective, there is a certain contrast with the Obuda site in Hungary where the average economic status of the residents was rather low and the utilities bills were a significant problem.

The Bulgarian STACCATO partners observed a general lack of systematic support for financing and management of energy retrofit projects in the country. The government support in Bulgaria is inconstant and inconsistent. For example, the programme involving collaboration with UNDP which was involved in the STACCATO pilot project no longer exists. And although there are in principle new state support measures available, as one of the latest studies has shown (EEW 2013), there is a lack of political will to execute them. In addition to this, the current interest rates on loans for residents make as much as 8-12%, which is a huge obstacle for the majority of Bulgarian households to receive a loan for substantial renovations. Thus, without a major intervention and actions taken by the state to improve the situation, low-income households would never participate in STACCATO-like retrofits. In contrast to the Bulgarian situation, the Netherlands use revolving loan funds and have a greater activity from private funders, which creates a more positive and stimulative environment for energy retrofit investments.

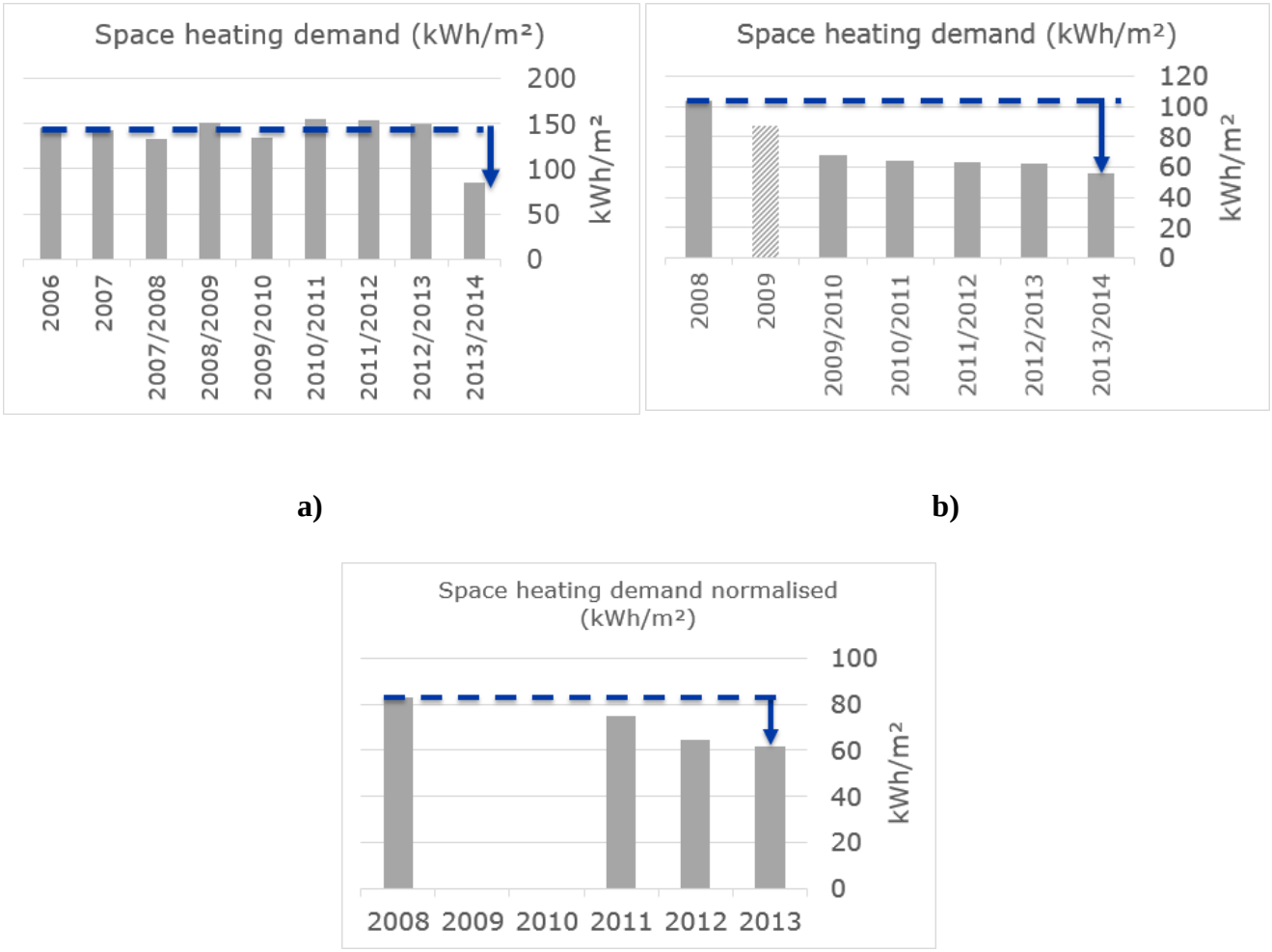
The state support, however, is expected to improve in the upcoming years. The updates of the National Strategy for Housing Renovation are expected to include provision of bigger budget for the Operational Renovation Programme of MRD in 2016-2020, which would lead to increase in housing renovation activities. It is also planned that a special municipal fund for renovation of buildings will be created, based on the Hungarian and Romanian models.

As far as STACCATO results are concerned, they are unique for Bulgaria. The project implied the use of diversity of financial models, their development and implementation, together with capacity building in the so far rare large-scale energy retrofits in residential sector. The knowledge and experience gained can be used further for implementation of future STACCATO-like energy efficiency retrofits, as well as similar comprehensive projects combining both energy efficiency measures and application of renewable energy sources.

Economic savings and other related benefits

The main STACCATO achievements include economic, environmental, social and technical benefits, all of which are closely interconnected. The data presented in this section will briefly touch on all of these aspects. In order to evaluate financial benefits of the project for residents of the renovated blocks, results of social surveys will be presented and used to analyse how residents' post-renovation energy expenditures compare to the national average. It should be noted however that the available data for the Netherlands and Bulgaria are limited and do not allow to make final conclusions on financial benefits from the respective retrofits. As monitoring of results is still ongoing, after the data become available it will be possible to make a more comprehensive evaluation of all the economic benefits of the project.

One of the main objectives of the project was to cut energy consumption (with the main focus on consumption of hot water) and thus CO_2 emissions. Consequently, residents' energy bills were expected to go down. Lower energy consumption indeed resulted in reduction of CO_2 emissions to approximately 50%. This was achieved by application of a number of energy efficiency measures and installation of solar thermal collectors on the roofs of renovated blocks reducing space heating demand (see figures below) and increasing hot water consumption from a renewable CO_2-free energy source.



a) **b)**

c)

Figure 9. *Changes in space heating demand during STACCATO implementation and beyond in:* ***a)*** *Het Breed, Amsterdam,* ***b)*** *Obuda, Budapest and* ***c)*** *Oborishte, Sofia*

Source: ECOFYS

At the **Het Breed** project site in **the Netherlands**, savings of final space heating demand in the last 2013/2014 heating season were 37% (see Figure 9a) with an upward potential for future savings[16]. Savings on final domestic hot water demand, which was supplied by solar thermal systems, reached approximately 11%. Preliminary CO2 savings currently make 48% and expected to rise well above 50%.

The residents of Het Breed used to pay a standard part of energy cost based on the costs of the complete complex (collective) energy use. However, after the individual meters were installed, they started paying only their own use. While this is an advantage for most of the residents, it is a simultaneous disadvantage for the consumers who use energy more intensively or often have a larger number of people living in one household.

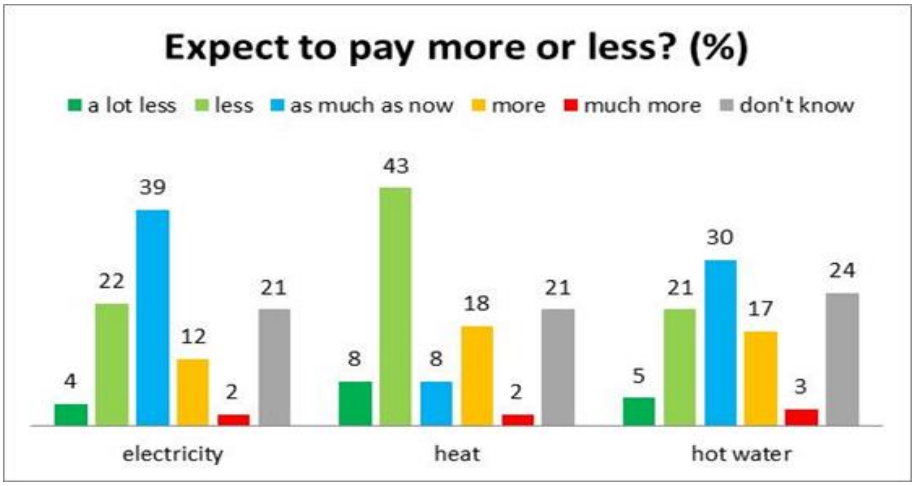


Figure 10. *Expectations of the residents of Het Breed about the outcomes of the renovation in regard to changes in energy costs*

Until now the residents see little difference in their pre- and post-renovation energy consumption, since the renovation took place only recently and less than a year passed since it was finished. However, changes in service costs are already becoming visible. Boiler No.4 was changed in 2014 and the residents whose dwellings are heating with this boiler are now receiving service costs back. Meanwhile, other residents, whose dwellings and related technological systems are under other renovation phases, pay more money in comparison (IVAM 2014). As the post-renovation survey conducted in 2014 has shown, more than 50% of respondents expect that their costs for heat to drop and 26% that the electricity and hot water bills will also decrease (see Figure 10 above).

In **Obuda**, the **Hungarian** renovation site in Budapest, 47% savings on heating was reached in 2013/14 compared to 2008 reference (see Figure 9b) and 33% of domestic hot water was supplied by solar thermal system. Implementation of the retrofit also resulted in visible reduction of energy costs paid by the residents and increase in their comfort level. More than 80% of post-renovation survey respondents stated that their heating bills dropped and they started paying less for heating. More than 20% of the respondents also saw a decrease in their electricity bills (see Figure 11).

[16] more savings expected because of lower heating temperature since March 2014 and full implementation of insulation measures in heating season 2014/15

Respondent expectations about cost savings proved that 88% of respondents were saving what they expected or more/significantly more in utility charges. In addition to these cost savings, approximately 82% of respondents believed that the renovation increased the value of their apartments (with 58% estimating that the value of their apartment has gone up by more than 10%).

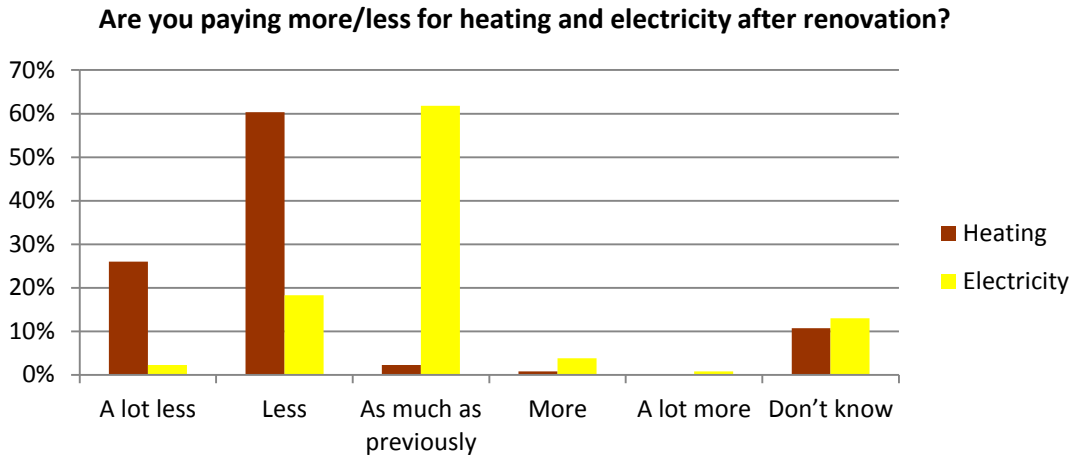


Figure 11. *Obuda post-renovation survey results*

The surveys showed that an average price that Faluhaz residents spend on heating decreased by as much as 30% in two years: from 275 HUF/m^2 in 2009 to 192 HUF/m^2 in 2011. The latter figure is not only much smaller than an average cost of heating paid by households in Budapest (258 HUF/m^2), but also represents only two thirds of an average cost of heating paid by panel block households in the Hungarian capital (300 HUF/m^2)[17]. These savings, coupled with the increased awareness about energy efficiency and energy consumption which stimulates practicing energy-saving measures, provide the residents of Obuda with a chance to experience major economic benefits related to reduction of heating costs.

In **Oborishte**, the project site in **Bulgaria**, 25% of savings on heating were reached in 2013 compared to 2008 reference (Figure 9c). Implementation of the retrofit resulted in reduction of energy costs paid by the residents and increase in their comfort level. However, some of the residents expressed concern about the steep increase in tariffs by the Sofia District Heating Company[18].

More than a half of respondents taking part in post-renovation survey[19] said that their heating bills dropped and they started paying less for heating. More than 30% of the respondents also saw a decrease in their electricity bills (see Figure 12). Respondent expectations about cost savings showed that 67% of respondents were saving what they expected or more in utility charges. In addition to these cost savings, approximately 73% of respondents believed that the renovation

[17] Data source: NegaJoule 2014
[18] see Section 6 for more information on the issue
[19] the presented data represent summary results of post-renovation surveys carried out at two renovated Oborishte blocks

increased the value of their apartments (with 37% estimating that the value of their apartment has gone up by more than 10%).

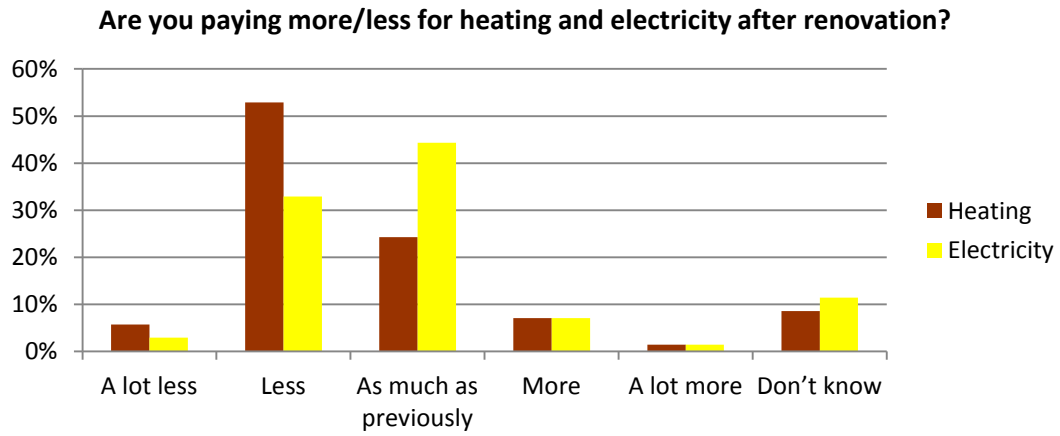


Figure 12. *Oborishte post-renovation survey results*

To sum up, overall economic benefits of STACCATO project include: lower bills for residents, higher property value for owners of renovated dwellings and better reputation of the neighbourhood. The benefits are coupled with social achievements, such as increased environmental awareness of residents, as well as fair distribution of energy costs between the apartments. The last section of the report will provide further assessment of STACCATO results by comparing the successful Obuda renovation (where the realised project most nearly approximated the STACCATO plan) with another deep retrofit project, SOLANOVA.

9. Comparative study: SOLANOVA vs. STACCATO

Taking into account that the project has been fully implemented only in Hungary it was decided to compare STACCATO with a similar practice which took place earlier in the country. Therefore the SOLANOVA ("Solar-supported, integrated eco-efficient renovation of large residential buildings and heat-supply-systems") project, implemented in Hungary in 2003, was selected as a comparative example.

SOLANOVA was the first project on large energy efficient refurbishment of an existing building in Eastern Europe and one of the first practical attempts to develop an optimal solution for energy saving in panel block buildings. Aiming to achieve 80% energy savings the SOLANOVA approach was based on the following strategies. First, the design of the project was focused on the needs of residents (living conditions and everyday comfort). Second, the main goal of the project was to enhance and optimize efficiency of the building. And third, besides energy efficiency measures the project was complemented with installment of renewable energy sources (solar panels). The ultimate goal of the project was to implement reconstruction with energy efficiency rates close to passive house levels.

As a project site the project developers selected a 7-storey panel house consisting of 42 apartments located in Dunaújváros (Hungary). The original estimated energy consumption in the building was 220 kW/m$^{2.}$ Through the retrofit and upgrade of internal communications it was expected to reach 80% reduction of energy consumption in the building or about 40 kW/m^2 of annual space heat consumption. SOLANOVA was implemented in two stages: research and demonstration reconstruction. On the basis of the follow-up monitoring it was calculated that due to the drastic decrease of space heat consumption during the second year after the end of the project the level of annual consumption had reached 20 kWh/m^2 or more than 90% reduction. Thus, already in 2005 the SOLANOVA building was recognized as the most energy-efficient building in Hungary and has been awarded internationally. The total budget of the project was HUF 198.3 mln or HUF 2.8 mln (c. 10,000 Euro) per apartment. The funding scheme of the project was in many ways similar to STACCATO.

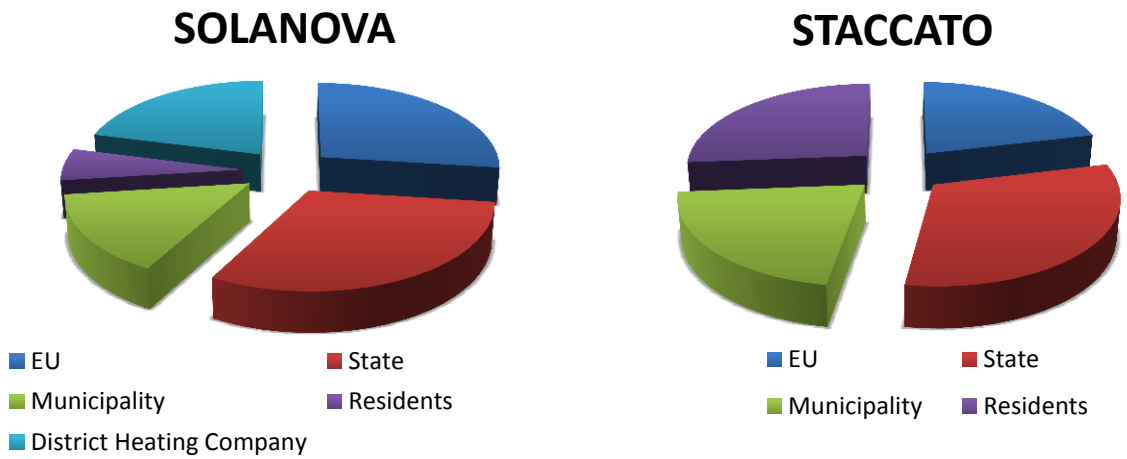


Figure 13. *SOLANOVA and STACCATO projects budget share*

SOLANOVA gained co-financing from a variety of sources: the EU, the local municipality, the state budget (Ministry of Environment), the district water, wastewater and heating company, and the condominium. The main difference in the SOLANOVA funding scheme as compared with STACCATO was the share of the residents and district heating company in the budget. In STACCATO, emphasis was placed on the willingness of tenants to be involved in the project financially. In this regard the investment of home owners was 27% of the total project costs compared to 6% in SOLANOVA. The district heating company FŐTÁV operating in Óbuda did not participate in STACCATO financially while in SOLANOVA the local district heating company's share was 21%.

In general financial involvement of heating distributors in modernization of residential buildings is not a common practice. However FŐTÁV already has experience of implementing energy efficiency projects. The ÖKOPlusz programme that was established by the company and which was funded from the state budget offers the owners of apartments the opportunity to modernize their heating system, primarily via the installation of thermo regulators. The size of the investment is 50% of the total project cost, and it cannot exceed HUF 77,000 per apartment. In total, 512 residential buildings have used the programme in FŐTÁV's area of operation.

From the consumers' point of view, the disadvantage of the programme is the pricing policy. There is a complex heating tariff system in Hungary and in case of absence of individual meters in the house, the payment is made on the basis of average annual consumption for the house in general, with costs divided among all residents depending on the size of the heated area. Prior to the activities within the ÖKOPlusz programme, the fare was 3548 Ft/GJ (c.12 Euros/GJ). The installation of thermostats on radiators reduces power consumption in the flats, however in the public space (common corridors, stairwells) energy consumption remains the same. In order to cover the costs of heating of the shared space, the company raises rate to Ft/GJ 4612. According to the calculations of FŐTÁV, in the houses which were upgraded, the annual energy consumption is reduced by an average of 10-19%, while the energy tariff after the upgrade increases by 30%.

In terms of technical solutions the SOLANOVA retrofit was much deeper than STACCATO's. It involved energy efficiency solutions for internal elements of the building while in STACCATO the main focus was on external insulation and replacement of windows. This has definitely affected the overall costs (see Table 5).

Table 5. *Comparative technical and financial characteristics of SOLANOVA and STACCATO projects*

	SOLANOVA	**STACCATO**
Location	Dunajvaros	Budapest
Started	2003	2006
Number of dwellings	42 apartments	886 apartments
Energy demand	220 kWh/m^2	-
EE measures	• 16 cm PS for external	• 10 cm PS for external insulation

	SOLANOVA	STACCATO
	insulation • 29 cm roof insulation • Triple/double glazing • Ventilation system • Blinders • Water saving taps • Radiators with thermostatic valve	• 12cm thick rock wool for attic floor insulation • 10 cm roof insulation • 90% of window surface is being replaced with five chamber UPVC
REW/kWh	72 m^2 solar panels	1500 m^2 solar panels
Total budget	198,3 million HUF (2,8 Mft per apartment)	1126,2 million HUF (1,27 Mft per apartment)
Budget share (%) ***EU*** ***state*** ***municipal*** ***district heating comp.*** ***residents***	 27% 31% 15% 21% 6%	 20% 33% 20% - 27%
Energy savings ***planned*** ***gained***	 80 % 80 – 90%	 40-60% monitoring in progress

Evaluating SOLANOVA in terms of funds invested and results achieved the project can be characterized as successful. However, the purpose of this report is to analyze the replication possibility of the project's financial scheme. From this point of view, SOLANOVA is a more problematic option than STACCATO. As Table 5 shows, due to the costly and complex technologies used the SOLANOVA project's cost per apartment was more than twice that of STACCATO. These technologies allowed a greater level of energy savings to be achieved,but because of the tremendous budget of the project SOLANOVA is challenging to replicate.

For in the first instance, existing state subsidy programmes do not provide grants that would cover even 30% of total costs. The only programme that offers HUF 1 million per dwelling of subsidy for reconstruction with use of renewable energy for generating heat and / or electricity is National Energy Conservation Programme (NECP), and clearly the budget of one state programme cannot cover all the needs for renovation of prefabricated houses in Hungary.

Second, as mentioned earlier, one of the most important profitability factors for investors is the payback period. Currently existing credit lines (of lakaskassa) do not allow accumulation of sums which would be enough for SOLANOVA-type investment during the deposit period set by legisaltion. In accordance with the law the maximum saving period is 10 years, while the payback

period estimated for SOLANOVA is at least 20 years. This fact makes the project very unattractive for private investors as well as for the apartment owners.

It should be noted that with such a big budget due to one year project delay the initially planned SOLANOVA project activities were significantly revised. During this year there was a great increase of prices for construction materials and services, as a result of which the SOLANOVA project developers were forced to introduce changes to the initial technical solutions. It was initially intended that during the reconstruction process an additional level of the building would be added and investments could be partly covered by the revenues from the planned new apartments: this plan had to be canceled. There were also some modifications to the insulation work, with triple glazing of windows introduced only on one side of the house. Moreover it is important to note that at that time it was rather difficult to find a qualified constructor for this type of work

The main cause of the delay was difficulty in communication with the apartment owners. In 2003, when SOLANOVA was started, the level of awareness on energy efficiency among the general population was extremely low. Residents were not willing to cooperate due to lack of understanding of the project goals and benefits. Of course, communication with the home owners required considerable effort. At this point in connection with the increased spread of information on energy-saving measures in the media it would probably be much easier to initiate such a project, as has already been seen from the STACCATO experience.

Analysing financial and technical characteristics of both projects it has to be noted that from the point of view of improving energy efficiency indicators in the retrofitted house the SOLANOVA approach can be considered the more attractive one. The renovation there allowed a 90% reduction of energy use as a result of energy efficiency measures applied. The STACCATO scheme with lower per apartment budget is aiming to gain up to 60% energy savings through applying a less ambitious approach, with greater risk of a lock-in effect.

There is an opinion (e.g. Herrero and Ürge-Vorsatz 2012; Urge-Vorsatz *et al.* 2010) that if, during the energy efficiency retrofit of a multi-apartment building, the energy saving potential of the house is not fully achieved and the applied measures aim to reduce energy consumption on a smaller scale in a relatively short term perspective, this is extremely unfavourable in terms of energy efficiency. Taking into consideration the size of the costs and scope of works involved in such renovation it is not possible to attract additional investment for modernization/further improvement of the same building for decades after the reconstruction. But it has to be admitted that less ambitious project ideas are usually more realistic in the given financial circumstances as in the case of STACCATO. For better or worse, this makes the STACCATO experience more likely to be replicated. Existing subsidy schemes and socio-economic conditions in the project countries do not make SOLANOVA-like projects realistic unless governments are ready to play a significantly more pro-active role than they have done to date. In order to maximize energy efficiency potential in buildings there would be a need for much greater government intervention in the market to support high-end solutions of the SOLANOVA type, and much greater financial outlay, at least in the early years[20].

[20] It is argued that with a steep learning curve the costs of deep SOLANOVA-type retrofits will drop dramatically within a few years if a mass programme of deep retrofits is introduced, and soon approximate the current costs of STACCATO-type retrofits (see for instance Urge-Vorsatz *et al.* 2010, and Herrero & Ürge-Vorsatz 2012 on this point).

Conclusions

On the basis of analysis of the financial schemes used for STACCATO funding in terms of its replication and further improvement and development the following conclusions can be made. In **the Netherlands** there is no doubt that the potential already exists for replicating STACCATO-type projects. The existing legislative framework, the current practice of preferential loans and the maturity of the society in general with regards to energy efficiency is the result of a well-designed long-term strategy realized in the country since the 1990s . As discussed in this report, the STACCATO project site was used as a demonstration and could be implemented without European funding. This is facilitated by governmental programmes, the variety of economic incentives, the status and active participation of housing corporations, and the support of local authorities. In fact, the EU funding has been involved only for testing the project scheme and in the future it can be replicated without additional grant funds. Using the STACCATO experience, project parties have identified the main problems, which were more of an organizational and communicational nature and rooted in the "split incentives" problem than related to the financing as such. The main lessons to be learned in the Dutch case are to pay more attention to working with residents in the future, to prevent possible conflicts.

Hungary can be characterized as a country with a fairly favourable market for financing energy efficiency projects. The liberalization of the financial sector has already reached a level which allows various financial instruments to be developed in the field of energy saving. In terms of further improvement of national policy for financing of energy efficiency in Hungary, special attention should be paid to legislation and administrative support of ESCOs. At the moment there is no regular practice of financing energy efficiency projects for housing with participation of ESCOs: despite the fact that the Hungarian ESCO experience has been celebrated as one of the most successful in Europe there are actually not that many examples of ESCO involvement in the residential sector (Bertoldi *et al.* 2007). Due to lack of practice, the success of projects currently depends largely on the specific project scenario and the financial capabilities and connections of the particular company. It should also be noted that banks are actively developing in this direction and seem increasingly willing to participate in long-term energy efficiency investments, which is a hopeful sign.

The availability of banking organizations as financial sources for individuals and their representatives (condominia) is substantially limited in Hungary. According to the prevailing practices in the housing sector, OTP Bank is now practically a monopoly in the field of credits for refurbishments. On the one hand, the existence of a credit institution whose credibility has been proven by years of positive experience is an advantageous factor. At the same time, limited choice of funding resources greatly reduces the opportunities for development of the energy efficiency market and the market for loans could be extended if other banks provide their own credit lines. However, it should be taken into account that credits secured to a mortgage are not popular. In projects where a multi-apartment building is involved residents will usually not be willing to take responsibility for their neighbours and any successful financing scheme has to take this into account.

In **Bulgaria** there has been a significant development of financing sources for energy efficiency projects in recent years. Largely, this process is supported and promoted within the framework of EU accession. In previous years the main funding was coming from foreign donor programmes and grants. Recently the government has paid greater attention to state financial resources and their availability for implementing local energy saving initiatives. Apart from EU structural and cohesion funds and the state budget there are interesting funding schemes based on public-private partnerships, e.g. the Bulgarian Energy Efficiency Fund. Currently Bulgarian policy supports investment in sustainable energy at the national and regional levels, but preference is given to projects aiming to improve energy supply, facilitate competitiveness of the energy market and which are consistent with the goals of environmental protection. Unfortunately, energy efficiency in buildings is not a priority, as preference is given to investment projects in the field of energy infrastructure. The lack of commercially viable funding and interest from private investors in Bulgaria can be explained by the high investment related risks and low awareness of potential project partners. Possible solutions to overcome these barriers may be state guarantees for energy efficiency projects, creating opportunities for public-private partnerships, and preferential commercial loans.

There are certain difficulties with the choice of appropriate financial instruments for energy efficiency projects in the residential sector that can be applied to all project countries. First, energy efficiency retrofit requires rather small scale investment in comparison to industrial projects, making it intrinsically less attractive as an investment proposition. At the same time, the complexity of standards lead to high transaction costs. Furthermore, in addition to common project related risks such as profitability, the state of the energy market and regulatory uncertainties, residential retrofit is characterized by illiquidity and irreversibility of investments.

Using the STACCATO experience we are able to analyze what are some of the major barriers to broader spread of retrofit financing for residential buildings. One of the basic reasons is the immaturity of the investment climate for energy efficiency in general. This is the first impediment faced by the project developers, especially in Bulgaria and Hungary. Energy conservation is not a priority for the business sector, or even the local energy companies, and the lack of viable financial instruments, the disadvantages of the regulatory system, centralized administrative systems and state-oriented energy markets further constrain the capacities of possible project partners. Even when business representatives do recognize the benefits of energy efficiency investments they often cannot fully realize their potential due to limitations of the system. Most private companies - potential investors - assess any business plan from the point of view of opportunities to reduce operating costs and provide short-term profits. This position makes it very hard to sell the very idea of energy efficiency projects, the financial value of which can be assessed only in a long term perspective. Current policies and incentives are not sufficient to change an approach to evaluation and assessment of energy-saving investments as well as traditional ways of doing business. This is however not the case in the Netherlands where long-term experience of successful public-private partnership allows investors and project developers to choose among varieties of funding opportunities that better satisfy their project goals.

In also should be marked out that for projects in the residential sector ESCO schemes potentially offer viable solutions that can deliver additional funding opportunities, take over the project risks, and provide qualified manpower and information technologies. In the Netherlands, where the energy efficiency market is well-developed and residential projects are supported with various state programmes, an ESCO is just one more option available for retrofit projects, so further development of the ESCO market in the country will probably not greatly affect realization of energy efficiency projects in the residential sector. But in Hungary and Bulgaria ESCOs may become an efficient economic instrument to achieve energy efficiency improvement, as the residential sector in these countries becomes more attractive for project developers. As a rule this sector is considered to be a complicated area for ESCOs due to the complexity of the decision making process, significant transaction costs and rather small-scale project sizes. ESCOs have capacities to overcome these barriers especially when ESCO guarantees are combined with state subsidies or other support schemes for modernization of residential buildings. However, in Bulgaria inparticular the necessary financial and regulative support would still have to be provided, as well as a comprehensive information campaign on the nature and benefits of ESCOs.

Moreover, it should be noted that retrofit projects are significantly affected by the low level of understanding and awareness of end users. In comparison with the houses where privatized apartments are predominant, the buildings owned by housing corporations (as in the Netherlands) are usually characterized by better energy efficiency performance. The owners of corporations are interested in investing in their property as it significantly reduces their energy supply costs. In buildings where most of the apartments are the private property of tenants, initiatives targeted at a particular owner will tend to have bigger success, since as a rule, residents give more weight to improvements in their own apartments than in the house as a whole. This should be considered in case of issuing a long-term credit for reconstruction and one option could be to register loan agreements with each apartment separately. Of course, this is more troublesome in terms of administrative costs, but it can help ensure the fulfillment of the loan's conditions. The significant efforts that are required to ensure a certain level of reduction of energy use in residential buildings often deter owner-occupiers from initiating projects, and individual differences among end users complicate the implementation of any voluntary collective action. In countries such as Bulgaria and Hungary where private ownership is the norm, great attention therefore needs to be given to supporting collective action, which may well need to go beyond straight financial incentives.

Based on the evaluation of the effectiveness of existing financial mechanisms we can conclude that public-private partnerships may represent a promising way of overcoming the existing financial barriers. Projects based on the public-private partnerships (with involvement of investors from private business sector, debt financing secured by state guarantees, and participation of residents) have shown they can be successful in generating significant energy reductions. Participation of the private sector in energy efficiency projects can be a key factor both in providing initial capital and in pushing forward the actual implementation of the programme, and public-private partnerships may thus offer the best path towards large-scale and sustainable thermo-retrofitting in the residential sector in countries such as Hungary and Bulgaria where there is still much need and scope for further development.

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