Energy-related policy in the housing sector of Bulgaria: in search for a meeting point of social and technical dimensions

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Abstract. Understanding the way in which a policy framework put into action supports or hampers stakeholders’ energy-related action in the field of housing renovation could provide meaningful insight on needed respect for stakeholders’ needs, expectations, motivations and capacity for action. The paper presents a study undertaken on the case of Bulgaria as part of ongoing ECHOES research project (EU-funded under the Horizon 2020 Program). It discusses the complex challenges faced in linking policy and technical to social and cultural considerations in renovating the existing residential stock in Bulgaria while meeting energy-efficiency requirements with an explicit focus on predominant apartment buildings in multiple ownership. The refurbishment process requires, on one hand, considerable investment, which is in most cases hardly accessible for the homeowners; on the other hand, collective decision-making with numerous stakeholders involved, often with diverse social and economic status. The presented two national case studies illustrate two alternative approaches applied – one searching to benefit from the national energy market peculiarities, and the other taking the opportunities provided by European and national grant schemes introduced in the country. Based on contacts and semi-structured interviews with various actors involved in the two initiatives, the dynamics of the situation throughout the projects’ life cycle and in the longer term and the changing personal estimations of costs and benefits are analysed. Conclusions are drawn about the importance of continuity in implemented energy-related policies. The authors claim that specific paths to EU energy policy goals under varying economic, technical and sociocultural context should be well continually informed by comprehensive interdisciplinary research.

1. Introduction

Energy transition has been acknowledged as a key policy area at the EU level for more than three decades [1]. It has been also among the major research challenges addressed by the EC framework research programmes [2]. Research has repeatedly addressed technical as well as social dimensions of the process; yet understanding and influencing stakeholders’ energy-related behaviour still seems a challenge that needs a deeper study of interacting technical, social and cultural factors. ECHOES research project, funded under Horizon 2020 programme, [3] provided a chance for studying stakeholders’ needs, motivations and capacity for action under the multidimensional context in eight participating countries. Undertaken within the common methodological framework of the project, the research presented hereafter addresses the peculiarities of the process in Bulgaria and discusses the complex challenges faced in linking economic and technical to social and cultural considerations during the implementation of the national policy on the renovation of multi-family residential buildings with
an explicit focus on energy efficiency (EE). The renovation process required, on one hand, considerable investment, which was not in most cases accessible for the homeowners, and, on the other hand, collective decision-making of numerous stakeholders, often with diverse social and economic status.

The developed two case studies illustrate different approaches chosen and applied by two homeowners’ collectives when addressing energy issues in a multifamily building in multiple ownership – one searching to benefit from the national energy market development, and the other taking the opportunities provided by the introduced EU-funded and national grant schemes. Based on literature review, personal contacts and semi-structured interviews with actors involved in the two initiatives, the study traces the practical steps undertaken by institutions, homeowners’ collectives and individuals, their outcomes and follow ups, and the actors’ estimations of costs and benefits throughout the process. It aims at identifying general and peculiar enabling and hindering factors to the ongoing process in the country but also at drawing the attention of policy makers on the importance of contextually sensitive research in formulating and implementing effective policies for energy transformation.

2. Research questions and methodology
Residential buildings are nowadays responsible for about 25% of the overall energy consumption in Europe [4]. Their energy efficiency is, therefore, of key importance to the process of energy transition aimed at. European policy documents acknowledge that enhancing EE goes beyond the implementation of technical measures [5]. At a city and regional scale, large-scale housing retrofit programmes have the potential to significantly reduce energy demand and CO2 emissions, whilst at the same time, having other positive impacts such as affordable warmth, improving health and quality of life; therefore, a more systematic and holistic approach integrating technological and environmental issues with social, economic and political ones has been recommended to ‘low carbon’ research [6]. The interpretation of energy behaviours from the point of view of social practice theory has outlined that the behavioural patterns of a group of people sharing common culture or lifestyle can only be properly understood and changed, if also the material and meaning component of this behaviour is understood [7]. Research in the field has outlined that enhanced inhabitants’ participation, decreasing power imbalances and awareness rising on individual and group level have been also identified as important motivating factors in implementing energy efficiency measures in a residential building [8, 9]. The barriers rooted in the socio-cultural context in multifamily residential buildings are often related to the urgency of action required and the limited owners’ capacity to invest and to expected inconveniences caused by the refurbishment [10]; the choice of technical options is often limited by the length of the administrative approval procedures or raises conflicts between various stakeholders [11,12]. The processes of mutual learning of the actors involved in a housing renovation initiative is outlined as an important peculiarity of a dynamic sociotechnical system [13]. All these aspects are, however, largely uncovered yet by systematic research under the Bulgarian context despite the acknowledged urgency of undertaking EE measures in the housing sector [14] and the practical efforts undertaken since mid-1990s [15].

The research questions addressed by the current study concern the meeting points of three types of factors in the housing renovation process: policy and management (PM), spatial and technical (ST), and social and cultural (SC) ones, with an explicit focus on their meeting points under the Bulgarian context. The case study-based approach followed ECHOES general research methodology; it was expected to provide a deeper understanding of the sociocultural context of the implemented innovations and the enabling/hindering factors rooted in actors’ values and attitudes, their perceptions of benefits and uncertainties, while responding to technical challenges and active renovation rules (figure 1).

Three groups of stakeholders were identified in the two case studies, and their representatives contacted: homeowners, public authorities and energy exerts/service providers. Information on the process in case study 1 (CS1) was retrieved through personal contacts with a member of a specialized NGO providing methodological support to EE initiatives, and with an expert from the Energy Efficiency Agency in Sofia. Five semi-structured interviews were conducted with individuals involved in the two consecutive projects shaping case study 2 (CS2) - one with an ex deputy mayor of the administrative
district concerned (R1), one with an energy agency expert (R2) and three with flat owners in two different buildings renovated through the project (R3, R4 and R5).

3. Case studies description
The two case studies follow the same structure, outlining as follows: location and technical parameters of the buildings; technological challenges and innovations considered; type of funding chosen, actors involved, undertaken action and interactions among the respondents, their personal estimations of outcomes and follow-up - achievements and failures, success factors and bottlenecks, lessons learned.

3.1. Case study 1 (CS1): Homeowners’ energy cooperative
Location and technical parameters of the building and the installation: A 28-kW photovoltaic system for electricity generation with an estimated output of 35.00 MWh/year, was installed in 2013 on the roof of a recently constructed 15-storey multifamily building with two entrances and a total of 120 apartments, located in a dynamically developing neighbourhood of Sofia.

Technological challenges and innovations. The electricity to be produced by the solar system installed on the roof of the building was to be sold to the energy supplying company and expected to bring profit to the homeowners as the market price of green energy was considerably higher than the subsidized energy provided by the company. The revenue was to be distributed among the owners and used for covering the maintenance costs for the common parts of the building.

Funding scheme. The construction of the building had been jointly funded by the owners through a multi-step collection of needed resources. After the construction was over, part of the money remained unspent and the owners had to decide on how to utilize it. They voted for installing a photovoltaic system for electricity generation on the roof of their building.

Actors involved. The investment idea came from one of the owners with expertise in the renewable energy field, who was member of the Bulgarian Solar Association. The Head and the Managing Board members of the Homeowners’ Association (HOA) had the major contribution in collecting all the requested 120 homeowners’ signatures under the formal agreement. They initially acted as a volunteering team and were later authorized by the HOA to officially take the responsibilities.
Actions and procedures. The final decision on the investment in the photovoltaic system came after a long and heated debate with numerous clarifications and proofs provided on possible benefits and risks. The information campaign was followed by lengthy negotiations; in line with the legal requirements all the owners had to sign the formal agreement; finding the missing owners (some of them being abroad) was a next challenge. The owner with the relevant technical competence in the energy field took the responsibility for defining the installation technical parameters, obtaining the permission for installing it and preparing the documents for connecting it to the national electricity grid.

Relations between the actors. The considerable number of owners with various socio-cultural and economic profiles was a first difficulty in initiating the process. Yet, the major bottleneck proved to be signing the contract with the private company providing electricity to Sofia. The process of linking the building to the energy supply system was considerably delayed in the last stage of negotiations. The delay coincided with a change in the national regulatory framework on the conditions for generating energy from renewable sources and, thus, with the reduction of the purchase price per MWh. According to the signed contract, the final price of the sold energy was over 40% lower than the initially estimated one. Thus, the investment payback period was extended from 5 to 10 years, which was highly disappointing for the owners and had a negative effect on their relations with HOA Managing Board.

Outcomes and follow-up. After the photovoltaic installation was set into operation, the project was broadly promoted in media and received considerable publicity. There was considerable interest in realizing such an urban project and many inquiries about practical implementation requirements. The need for HOA’s own funding was, however, considered a serious barrier by most of the interested homeowners. After the photovoltaic modules started bringing revenue to the owners’ association from the electricity produced by the solar system and sold to the energy supply company, a second collective decision was taken, and the money was invested in energy saving windowpanes for the staircases of the two entrances. The owners realized that the benefits of a collective investment bringing guaranteed revenue in future would be far higher than the ones of distributing small amounts of already devaluated money among numerous individual stakeholders.

3.2. Case study 2 (CS2): Grant-based complex renovation of residential buildings

Location and technical parameters of the building. Three residential buildings in a traditional quarter at a closer proximity to the city centre of Sofia were successfully renovated through two consecutive projects providing 100% grants in support of EE measures implementation. The in-depth study was focused on a 5-storey building with 10 apartments, built in 1930s under less restrictive regulations on energy efficiency than the current ones.

Technological challenges and innovations. The renovation responded to the estimated EE deficiencies in the building as a result of undertaken energy audit; the full refurbishment of the building included upgrading of the building installations, the underground parts and the roof structure; a solar system for water heating was installed on the roof and the building was certified as one of energy class A+. Analyses on the real-life functioning were then carried out in order to identify needed adjustments and improve the operational efficiency of the building. Trainings were organized, and guidance was provided on ways for reducing energy and resource consumption in everyday households’ activities.

Funding scheme. Funding was provided through two grant-based projects: Demonstration Project for the Renovation of Multifamily Residential Buildings (DPRMRB) [16], the grant of which covered 100% of the construction work expenses for the renovation of the common parts of the buildings and 80% for each dwelling (20% of the expenses were funded by the owners and the municipal authorities funded the upgrading of the adjacent area); and Staccato project (an international project funded under the 6th EU Framework Program) [17] for installing solar systems for hot water in residential buildings.

Actors involved. The person elected by the homeowners to head the association, was the real driving factor in applying for the DPRMRB grant - he enabled the collective decision for joining the project and took the responsibility for communicating with the local and central administration responsible for the project. He also played a leading role during the construction process by providing investor’s control
and acting as a mediator between the construction company and the homeowners. Other owners with specific expertise also contributed in different phases the project.

**Actions and procedures.** In 2010 The Ministry of Regional Development and Public Works (MRDPW) signed a Memorandum with *Staccato* project consortium on reconciling the activities of the DPRMRB and *Staccato* Project. As a result, the homeowners’ associations of three residential buildings, renovated under the Demonstration Project, could be involved in the *Staccato* project and receive solar hot water installations on the building roofs for free. In Phase 1 of the project the homeowners made a collective decision for joining the project; in Phase 2 the solar system was installed, and the building was certified as energy class A+. In Phase 3 the real-life operation of all the installations was analysed and needed precise adjustments to improve its operational efficiency were identified; work continued with the HOAs on capacity-building for reducing everyday energy and resource consumption; two elderly homeowners - engineers with expertise in the energy field, took the leadership in this phase.

**Relations between the actors.** The small number of owners who had known each other for many years was a key enabling factor in the collective decision-making on joining the project. Due to the persistent efforts of the HOA head, all the signatures for the contract and the financial contribution requested were collected in quite a brief time span; the preparation of the application was based on solidarity with the people lacking the financial resources needed for signing the contract.

**Outcomes and follow-up.** Owners’ satisfaction with the renovation results in CS2 continued until the end of the first heating period when the unwillingness of the local monopolist company, responsible for the district heating in the city of Sofia, to change the calculation methodology resulted in a prolonged debate on the method of calculating the energy prices for A+ energy class buildings. Looking for a solution, the owners introduced smart technology for distance reporting of the actual energy consumption. Regrettfully, that did not solve the problem. Additional spending caused by a failure of the water heating system at the end of the first operating year brought next disappointment among the homeowners. The poor maintenance and the resulting improper operation of the installation raised a next challenge to the inhabitants: either to acquire additional knowledge and skills themselves or hire a specialized maintenance company. The first option was expected to place additional burden on some of the owners; the second questioned the economic feasibility of the installation. The repair of a circulation pump was organized with the help of the specialised NGO involved in the initiative, yet the search for acceptable long-term solution was still going on by the time of the interviews.

4. **Discussion**

The enabling and hindering factors identified in the two case studies were related to the meeting points linking the three aspects of the housing renovation process through ten topics, as follows: (a) Policy & Management with Spatial & Technical (PMST) aspects - availability of funding; relevance of the legal and regulative framework; grant applications and institutional channels; communication and dissemination of technical competence; (b) Policy & Management with Social and Cultural (PMSC) aspects - the role of local administration; homeowners’ proactive role in implementing EE measures; HOAs empowerment; and (c) Spatial and Technical with Social and Cultural (STSP) aspects - homeowners’ diversity of relations; HOA’s decision-making: awareness, technical expertise and risk estimation; HOAs’ communications with service providers (see Fig. 1).

4.1. **Policy and Management to Spatial and Technical (PMST) aspects**

*Availability of funding for energy saving measures.* Funding programmes proved to be crucial factors for the implementation of EE policy in the Bulgarian housing sector with more than 92% private ownership and minor financial capacity of the homeowners for investing in energy efficiency. In CS1 the availability of ‘own’ funding by the homeowners was a key enabling factor as it eliminated loan-related risks for people, who were capable and willing to take the initiative with all the risks and benefits provided by the just emerging energy market in the country. In CS2, the proactive attitude of the homeowners to implementing energy efficiency measures helped them in consecutively capturing different opportunities provided by the variety of grant funding schemes in the country.
Relevance of active legislation and regulations. CS1 proved the importance of good knowledge about the legislation and regulation changes under the dynamically changing policy context in Bulgaria. Relying on that, the homeowners were able to sign the contract for selling the electricity produced at a favourable price. In parallel, the currently active market-based financial mechanisms of implementing EE measures, although limited in scope, encountered serious implementation difficulties, e.g. concerning the contracts with the energy supply companies. CS2 outlined the need for simplifying the administrative procedures when installing the solar collectors for water heating. Both case studies provided insights that synchronizing all the rules and regulations on the implementation of EE measures but also the long-term management of the buildings and installations afterwards would result in a more positive attitude and greater confidence among the owners implementing their own collective decisions.

Grant applications and institutional channels. The availability of an energy expert among the homeowners in CS1 was estimated as a key success factor for the initiation of the project as information and knowledge on project opportunities, application procedures and profitability of measures in the energy field is currently neither widespread nor easily accessible and understandable.

Communication and dissemination of technical competences. Attracting expert non-profit organizations working in the field of energy efficiency proved to be a strong supportive factor in CS1. The renovation process went smoothly in CS2, due to the long-term personal commitment and responsibilities voluntarily taken by homeowners with technical and other relevant expertise.

4.2. Policy and Management to Social and Cultural (PMSC) aspects

The role of local administration. The support of local administration was of core importance in the preparatory stage of the renovation process in CS2 – it comprised dissemination of information, awareness raising and training. The visibility and accessibility of public experts and employees was commented as very important for building and maintaining trust throughout all the stages of the process. The further empowerment of local authorities and the real governance decentralization could be expected to provide better conditions for collective EE-related action in residential buildings.

Homeowners' proactive role in implementing EE measures. In both case studies well-educated active members of the owners’ collectives put a lot of voluntary effort and time in the process. In CS1 a team of initiators also took various roles in implementing the collective decisions; actors with access to needed legal information on required procedures joined in promoting the initiative among the homeowners and organizing the communication during the installation of the solar system. Homeowners with specific expertise actively joined in the preparation and submission of the application documents in CS2. The experience there proved that communicating possible benefits and building a clear homeowners’ vision on desired outcomes provides for continuity in implementing a complex model for overall energy renewal of the residential buildings by consecutively using different funding schemes.

Empowerment of homeowners’ associations. The establishment of homeowners’ associations followed the legal requirements introduced in the country; in both case studies HOAs played crucial role in initiating the renovation and in legally communicating with all the institutions on behalf of the owners. In CS2 the HOA registration provided for formalizing the existing long-term informal relationships. A further empowerment of homeowners’ collectives throughout the whole lifecycle of an energy-related project could be achieved by clearly defining their rights and obligations in selecting the contractors for the construction works and the building materials, and in controlling the interventions.

4.3. Spatial and Technical to Social and Cultural (STSC) aspects

Homeowners’ diversity and rules of interaction. An identified major challenge to the EE-related housing renovation in the country was embedded in the housing typology - multifamily high-rise buildings with numerous privately-owned dwellings and shared ownership on the common parts of the buildings - roofs, entrances, staircases and basements. The collective decision-making on undertaking a renovation initiative required that homeowners with a variety of social and economic profiles could come to a shared vision on future action in rather short period of time. The estimated difficulties for coming to a decision in CS1 stemmed from the large number of owners but also from the lack of community spirit.
caused by the frequent change of homeowners and the feeling of the uninhabited of anonymous neighbours next door. “Apartments are continuously sold and rented in these blocks we do not even know half of the people there”. (R1). The smaller number of inhabitants in CS2 and the established long-term relations contributed for their sense of belonging to a small community: “Some people could not provide the money, and the neighbours helped through the fund accumulated among themselves” (R3).

**HOAs’ decision-making.** Information, technical expertise and adequate risk estimation proved to be important enabling factors in both case studies. The uncertainty about future energy-related conditions negatively influenced the homeowners’ investment intentions. All the reforms in the energy field should be therefore introduced in a coherent and transparent manner and clearly communicated in advance; a comprehensive preliminary study of their potential short, medium, and long-term effects on all stakeholders should be requested.

**Communication between HOAs and service providers.** The HOA’s initial trust to the specialised service providers in CS2 due to the good quality of the accomplished construction works was expected to guarantee the continuity of their positive attitude to EE measures. Yet, the owners then accumulated negative experience with the companies providing maintenance services for the common parts of the building and were often reluctant to using their services. Through the improper exploitation resulting in generated additional expenses, the initial effort for achieving higher energy efficiency often turned to be useless as either the saved money was used to cover repair expenses. Thus, although the renewal required complex technical measures and the meeting of high building standards, signing a maintenance contract with requested too high payment was difficult to accept for the association (R2).

### 4.4. Relevance and effectiveness of the research methodology applied

**Relevance to the research objectives.** The two case studies illustrate two different proactive approaches in addressing energy efficiency in the multifamily residential buildings in Bulgaria. Proactive voluntary action and collective decision-making contributed in both cases to building urban social capital. Despite currently being of rather limited applicability in the country, CS1 approach provided an insight that activating private investment resources and expertise on energy efficiency in the housing sector could provide for motivating well-educated communities of relatively high-income individuals to take collective decisions on increasing the energy efficiency of their homes. The process in CS2 addressed the current complex social and technological challenges in the country. Due to the applied grant scheme it contributed to improving the living conditions of a broad target group, while preventing social exclusion. Regretfully, the experienced difficulties resulted in the next national programme on energy efficiency of multifamily residential buildings [18] only in the introduction of 100% grants for the dwellings refurbishment at the expense of reduced interventions covering minimum EE measures.

The research approach of the current study could be considered an important step in identifying the mutual influences among numerous factors in the EE field and in enhancing the national policy sensitivity to the social and cultural dimensions of the process. It should be further combined with expert qualitative and quantitative estimations on the overall mid- and long-term effects of the implemented EE measures on energy savings and GHG emissions at the urban and national level.

### 5. Conclusion

Functioning residential buildings are complex socio-technical systems. Throughout their lifecycle they undergo numerous changes depending on multiple factors. The technical and technological aspects of the EE-aimed interventions there need to be related to the variety of inhabitants’ needs and behaviour, changing ownership, economic capacity and perceptions of comfort and discomfort. The combination of private and collective ownership in multifamily buildings in Bulgaria raises the challenges of varying economic capacity of different households and the resulting different estimations of costs and benefits by the owners. Relevant technological expertise is required throughout the life of the building in support of an informed decision-making process at the level of the owners’ collectives; it is not always available or practically accessible. Providing such an expertise needs an explicit well-focused effort. Activating the available expert knowledge and skills among the owners themselves could be the way to a continuous
learning process but also to more sustainable local communities. The coordination and continuity of efforts for the implementation of effective energy-related housing policies need to be also sensitive to the peculiarities of an evolving economic, technical and sociocultural local and regional context.

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References
[1] Langsdorf S 2011 EU Energy Policy: from the ECSC to the Energy Roadmap 2050. Green European Foundation; http://archive.gef.eu/uploads/media/History_of_EU_energy_policy.pdf. Accessed: 28/05/2019.
[2] EC, COM (2006) 847 final. Towards a European strategic energy technology plan. Brussels, 10.1.2007.
[3] ECHOES project, Horizon 2020 programme 2016-19), www. https://echoes-project.eu/.
[4] Eurostat. https://epthinktank.eu/2016/07/08/energy-efficiency-in-buildings/.
[5] Friege, J. & Chappin, E. (2014). Modelling decisions on energy-efficient renovations: A review. Renewable and Sustainable Energy Reviews, 39, 196-208.
[6] COST Action TU1104 – Smart Energy Regions 2014 ISBN 978-1-899895-14-4.
[7] Hargreaves T 2011 Practicing behavioural change: applying social practice theory to pro-environmental behavioural change, J Consumer Culture, 11,1
[8] Šahović N and da Silva P P 2016 Community renewable energy - research perspectives. 1st Energy Economics Iberian Conference, EEIC|CIEE, Lisbon; Energy Procedia 106, pp 46-58.
[9] Heuts E and Versele A 2016. RenoseecC: Renovating with a social, ecological and economic benefit through a collective approach. SBE16 Tallinn and Helsinki Conference; Build Green and Renovate Deep, 5-7 October, Tallinn and Helsinki. In Energy Procedia, 96, pp 540-550.
[10] van Doren D, Driessen PJP, Runhaar Hens and Giezen M 2016 Scaling-up low-carbon urban initiatives: Towards a better understanding. Urban Studies. 55 1, pp 175-194
[11] Cabinet Office Behavioral Insights Team 2011 Behaviour change and energy use, Ref:06537/0711; Available at: www.nationalarchives.gov.uk/doc/open-government-licence/, Accessed: 01042019
[12] World Business Council for Sustainable Development (WBCSD), 2007; Energy Efficiency in Buildings (EEB) project, Summary Report
[13] Andersen HT, Dimitrova, E and Schmeidler K 2013 Urban knowledge and large housing estates in Europe. eds HT Andersen and R Atkinson Production and use of urban knowledge. European experiences chapter 6 (Springer) pp 103-132.
[14] The World Bank 2018 Bulgaria: National Program for Energy Efficiency in Residential Buildings. Program Design Report for the Second Phase.
[15] Nakova K 2007 Energy Efficiency Networks in Eastern Europe and Capacity Building for Urban Sustainability. The experience of two municipal networks. Indoor and Built Environment, 16, 3 pp 248-254
[16] Ministry of regional development and public works (MRRB) 2007 Demonstration project for renovation of multi-family residential buildings (DPRMFRB) (2007-2011). Available at: https://www.mrrb.bg/en/energy-efficiency/proon/demonstration-project-for-renovation-of-multi-family-buildings-2007-2011/. Accessed: 20/05/2019
[17] Refurbishment of multifamily buildings, Staccato project. Available at: https://www.concertoplus.eu/reducing-co2/sofia/ Accessed: 20/05/2019.
[18] Energy Efficiency of Multi-Family Residential Buildings National Programme. Available at: https://www.mrrb.bg/en/energy-efficiency/energy-efficiency-of-multi-family-residential-buildings-national-programme/. Accessed: 05/07/2019