

ENERGY EFFICIENCY RETROFIT IN THE EUROPEAN SOCIAL HOUSING STOCK AND THE SPLIT INCENTIVE PARADOX¹

A comparative behavioural study

Anikó Dobi-Rózsa – Adrian Balaci²

ABSTRACT

The social housing stock represents a considerable segment of the residential housing pool across Europe, as such, therefore, investing in its energy performance is of great importance. Furthermore, social housing provides affordable homes for the economically vulnerable, which adds urgency to the issue. Yet despite the social and environmental targets European states have agreed upon, the split incentive paradox has led to a widespread failure in advancing energy efficiency in the sector. Taking a comparative behavioural approach, this study investigates the social housing sector in three European countries with different governance and rent-setting structures (representative of their respective regions) revealing distinct forms of split-incentive related market and behavioural failures. We find the failures are most pronounced at the top of the social housing provision pyramid, where provider and tenant interests often clash, leading to inefficient policies and suboptimal refurbishment rates. In terms of solutions, we find the split incentive challenge is effectively addressed when rent setting allows retrofit cost recovery, tenants are involved in decisions and can carry forward energy efficiency benefits when they change residence. To this effect, the introduction of alternative cost recovery mechanisms is proposed, increasing the democratic legitimacy of the process through active tenant participation, and developing regulations that protect the tenants' confirmed rights post refurbishment.

JEL codes: D1, D7, H3

Keywords: behavioural failures, climate finance, energy efficiency, social housing, split incentive

¹ Acknowledgment: the authors would like to thank *Avilia Zavarella* for her contribution to this paper.

² Anikó Dobi-Rózsa, Corvinus University of Budapest, Hungary. E-mail: anikordobirozsa@gmail.com.

Adrian Balaci, independent expert. E-mail: adrianbalaci-rd@gmail.com.

1 INTRODUCTION

Achieving energy efficiency in the building sector, which accounts for more than 40% of the energy consumption and 36% of greenhouse gas emissions of the European Union, and in the residential building sector in particular, which is responsible for two thirds of such consumption (European Commission, 2020; Enerdata, 2021), has become a necessity whose urgency has grown more and more pressing as demonstrated by the passing of the Energy Performance of Buildings Directive in 2002 (revised in 2024) and the Energy Efficiency Directive in 2012 (confirmed/amended in 2023), envisioning all building stock achieving zero-emission status by 2050 (European Commission, 2024; European Parliament, 2022:3; Economidou et al., 2020).

Within the building sector, the European housing stock is predominantly old, with around 85% of buildings constructed before 2000, which often exhibits poor energy performance, with about 75% classified as inefficient (European Commission, 2024). Primary energy consumption in residential buildings is for heating, accounting for 64.4% of total energy use in 2021, followed by water heating (14.5%) and electricity for lighting and appliances (13.6%) (European Commission, 2023). Social housing, which comprises approximately 6% of the total housing stock in Europe, often accommodates low-income and vulnerable populations who are more likely to experience energy poverty. This can result in lower energy consumption in the sector as residents might sacrifice thermal comfort to reduce costs (Desvallées, 2022; Escandón et al., 2017). Therefore, it is crucial to focus on this sector.

Social housing has been found to present one of the most difficult environments to promote energy efficiency renovations. (Monteiro et al., 2017). It faces challenges to reach the optimal refurbishment pace needed to achieve the aforementioned national and European targets despite the sector typically falls directly under national, regional, or local government purview, which is assumed to be more capable of implementing comprehensive energy investments compared to the private sector, where profit motives often overshadow environmental concerns. Moreover, energy efficiency retrofit in these type of dwellings facilitates a number of additional benefits, which include, besides the obvious environmental outcomes, also improved economic opportunities for local communities as a result of demand for labour, materials and additional services, as well as social benefits such as reduction in energy poverty and social exclusion (Monteiro et al., 2017). The latter are clearly relevant today, in the context of the current inflationary and uncertain energy price environment in Europe, where low income groups, who are on average the ones most likely to live in social housing reported by OECD (2020), are the ones suffering the most from the increased costs of energy bills

(Eurofound, 2022) and who would thus also benefit the most from energy efficiency improvements (Bird et al., 2012; Desvallées, 2022).

Yet, despite the documented benefits, there are a number of constraints which continue to limit energy efficiency investments in social housing (Monteiro et al., 2017). One of the most relevant barriers to energy efficiency in social housing, however, remains behavioural linked to the split incentive problem, a widely recognised issue in the energy efficiency literature, which refers to the situation where the benefit of a transaction does not accrue to the actor who pays for it. Alongside conflicting economic interests, other behavioural problems also appear, incapacitating the players so that they lead to the current systemic failure, preventing the social housing sector in achieving the sufficient volume of energy efficient investments. Studying the split incentive paradox in a comparative behavioural context offers valuable insights and supports policy makers to address the issue more effectively.

The objective of this research paper is to analyse the economic and behavioural constraints affecting energy efficiency investments in the social housing sectors of Denmark, Italy, and the United Kingdom. It aims to evaluate three different governance and regulatory frameworks, identifying different types of conflicting economic interests, and corrosive behavioural patterns between tenants and landlords, and evaluate their (mis)management by policy makers, whose role as a third party to the conflict is often overlooked, despite they are expected to address and manage market failures and stakeholder conflicts.

2 LITERATURE REVIEW

2.1 Situational analysis

For the purpose of this study, social housing is defined following the OECD (2020:4) definition of the same, namely as “residential rental accommodation provided at sub-market prices that is targeted and allocated according to specific rules, such as identified need or waiting lists”. In line with the OECD (2020) social housing definition, moreover, and for simplification, “affordable housing” is not considered in this paper, that is, “rental and owner-occupied dwellings that are made more affordable to households through a broad range of supply- and demand-side supports (including housing allowances or vouchers, subsidies or tax relief to first-time homeowners)” (OECD, 2020:4). Nonetheless, it is recognised the definition and characteristics of social housing differs to some extent across Europe.

Social housing constitutes more than 28 million dwellings and about 6% of the total housing stock in the European Union (OECD, 2020). Denmark in particular stands out for the size of its social housing stock, one of the largest in Europe with 21.4% of total dwellings in the country belonging to the category (Housing Europe, 2021). Social housing in Denmark seeks to offer affordable housing to a wide spectrum of the Danish populace, while the UK, on the other hand, has a moderately sized social housing sector which corresponds to 16.8% (2021) (OECD Affordable Housing Database, n. d.) of its total dwellings, and, similarly to most Western European countries, relies on a more targeted and residual approach, whose end beneficiaries are usually vulnerable groups (Braga et al., 2013). Italy, by contrast, constitutes an example of a typical Southern European country with a small social housing stock (2.4% of total dwellings) (OECD Affordable Housing Database, n.d) whose social housing system is based on a targeted but generalist model (Costarelli et al. 2019), where allocation to social housing depends on households falling below a certain income level (Braga et al., 2013).

Regional and municipal authorities account for about 50% of social housing provision in Europe, while the rest is divided up between other types of actors – e.g. non-profit, limited-profit and for-profit providers, housing cooperatives, national governments and more - (OECD, 2020). In Denmark, for instance, private non-profit housing associations, working under strict municipal supervision, have historically been the main providers of social housing (Vestergaard et al., 2014; Housing Europe, 2021; Norris & Birne, 2020). In Italy, on the other hand, it is municipalities and regions which tend to own and manage the social housing stock, especially dedicated to the lowest-income households, although other actors, such as housing cooperatives as well as private entities like bank foundations, have also entered the social housing scene. In the United Kingdom private non-profit housing associations dominate the sector. While social housing was historically owned by local councils, starting from the 1974 Housing Act, housing associations progressively took over to become the main providers of social housing (National Housing Federation, n. d.; Regulator of Social Housing, 2021).

In all three countries social housing rental fees are lower than those on the private rental market, but the mechanisms and levels of affordability vary. Denmark's fees are based on actual operating costs and are estimated to be significantly lower than market rates. However, specific percentages relative to market rents are not typically detailed in public reports (SPUR, 2022). In the United Kingdom, rental fees are set as a percentage of market rates - subsidized by the government – that can be up to 80% of market rate (UK Parliament, 2022; UK Government, 2022). In Italy, fees are locally determined based on household income and maintenance costs, resulting in significant regional variation but remaining in the range of around 50–60% of market rates (Idealista, 2022).

The physical condition of housing in Europe is characterized by an aging building stock with widespread structural issues (such as the presence of leakage, damp and rot) and varying sizes and energy consumption patterns (Dobi-Rózsa et al., 2023). Around 85% of buildings in the EU were constructed before 2000, with 75% of them having poor energy performance (European Commission, 2024). The lack of accessible, high-resolution consumption data in the housing sector makes it challenging to investigate energy use and behaviour (Karatasou et al., 2018). However, in 2021 energy use in the residential sector was dominantly heating related: 64.4% of the total energy consumption was used to heat homes, followed by water heating (14.5%) and electricity for lighting and appliances (13.6%), cooking, other uses, while space cooling accounted for 6.0%, 1.1%, and 0.5% respectively (European Commission, 2023). Furthermore, studies have shown that energy poverty is more prevalent in social housing, where less affluent people often compromise on thermal comfort, leading to lower energy consumption compared to average households (Desvallées, 2022; Escandón et al., 2017). Therefore, using general consumption data in energy performance models might mislead studies on energy performance in the social housing sector. Nonetheless, the State of Housing in Europe report emphasizes that social, public, and cooperative housing often has better energy performance than private housing (Housing Europe 2023).

2.2 Split incentive

Despite the increasingly recognized importance and policy emphasis on promoting energy efficiency in buildings, the sector has still remained largely affected to date by what the academic literature refers to as the energy efficiency gap, that is to say, actual investments in energy efficiency remain at suboptimal levels and do not meet their potential (e.g. Hirst et al., 1990; Uihlein et al., 2009). The reasons for the phenomenon have been extensively studied, with a number of barriers that hamper investments in energy efficiency practices and measures identified and categorised by scholars in different ways (e.g. Voget et al., 2015; Palm et al., 2018; Wilson et al., 2015). Performing an extensive review of the existing literature on the subject, in his recent study Bertoldi (2022) summed up the main obstacles to energy efficiency investment under different categories, including behavioural, financial, and economic.

However, the split incentive paradox is understood as the current major obstacle to energy efficiency in the residential rental market. Split incentives occur when the benefits of a transaction do not go to the party who pays for it. In the context of energy efficiency in buildings, split incentive refers to the difficulty of recovering costs from energy efficiency upgrades (Castellazzi et al., 2017). It is landlords

who are responsible for and entitled to carry out energy efficiency retrofits in social housing, and it is them who have to bear the costs of such investments, while generally they cannot pass on to or recover the costs from the tenants. At the same time, it is tenants who benefit most from the investments, both as a result of improved comfort and lower energy bills, since they are the ones responsible for paying for them (Palmer et al., 2018). On the other hand, they are the ones who have to endure the considerable disruption that follows such building works. As a result, both parties may choose not to act, even though many of the upgrades have a positive net present value.

Table 1
Types of split incentives

Efficiency-related Split Incentives (ESI)	When tenants pay energy bills but can't make improvements, and landlords can make improvements but cannot raise rent to cover the costs because government regulations prevent them from charging higher rents for renovation works. So, there is no incentive for landlords to invest in energy efficiency.
Usage-related Split Incentives (USI)	When landlords pay energy bills, tenants lack incentive for energy efficiency renovations, as benefits mainly go to landlords.
Multi-tenant/ Multi-owner Split Incentives (MSI)	When energy efficiency in buildings requires consensus among decision-makers, as well as when the benefits and costs of the upgrade are not distributed equally among all the apartments.
Temporal Split Incentives (TSI)	When occupants are uncertain about how long they are going to live in the property, making energy efficiency upgrades is unappealing due to high upfront costs that may not pay off before they move.

Source: own design based on Economidou et al., 2015

Economidou et al. (2015) identify several types of split incentives described in *Table 1* that can affect the residential building sector, some of which depend on the type and occupancy structure of the building. Specifically, the author identifies split incentives which may occur when the tenant is in charge of the energy bills but has no power to perform the energy efficiency improvement, or, on the contrary, when the landlord pays the energy bill and tenants have little incentive to adopt energy saving behaviours, or when energy efficiency can only be realised if consensus is reached. In the context of the residential building sector and in particular the private and social rental market, the split incentive issue is mainly linked to the problem of cost recovery that is, to the failure of distributing effectively the financial costs and rewards of energy efficiency investments between

the actors involved – landlords and tenants (Monteiro et al., 2017; Economidou et al., 2015).

Evidence of the relevance of split incentives as a current major impediment to energy efficiency in buildings is found in the policy sphere at European Union level. Article 19(a) of the European Union Energy Efficiency Directive, in fact, calls on member states to take appropriate measures to remove regulatory and non-regulatory barriers to energy efficiency with a particular focus on split incentives, and, while it does not mandate any specific policy solution, it proposes a number of options which can be implemented by governments, including rules for dividing the costs and benefits of investments, as well as measures to regulate decision-making processes in multi-owner properties (Economidou et al., 2020). However, since the Energy Efficiency Directive does not require any obligatory action from member states, an assessment carried out in 2019 of the actions taken by member states to tackle split incentives has revealed uneven and unsatisfactory progress across Europe (Economidou et al., 2019). This fact in turn suggests a need for further research and action (Economidou et al., 2020).

3 METHODOLOGY

Based on the literature reviewed, it is assumed that in addition to the obvious economic constraints, such as the problem of cost recovery, there are also behavioural problems regarding the relevant stakeholders that prevent them from acting in a concerted fashion and that is why they hinder energy efficiency investments. Studying the phenomenon with a comparative behavioural approach is somewhat novel in the field of energy efficiency research. This study thus aims to offer a valuable contribution in this regard.

To gain a comprehensive understanding of the barriers to energy efficiency refurbishment in the sector, the paper offers an analysis and comparison of the social housing sector in Denmark, Italy and the United Kingdom, selected due to their distinct governance and rent-setting structures. In particular, the choice of our three countries is linked to the fact that they reflect well the typical social housing frameworks of their respective sub-regions – Northern, Southern and Western Europe. Denmark, for one, represents well the Scandinavian/Nordic model, which historically relied on a strong welfare state to ensure adequate housing for their populations, adopting a universalistic approach to social housing provision (Scanlon et al., 2015).

Based on the collected data, the social housing market is first introduced in general terms describing the different actors and their relational context. Based on the eligibility criteria used to provide social housing, a snapshot of the segment of

the population that relies on it is generated. The different mechanisms used to set rental fees and the formulas used to increase them are reviewed and compared, exploring the possibility of recovering the cost of energy efficiency investments through rent. It includes reviewing the typical models used to pay energy bills. Based on the findings, the collective action problems caused by economic, structural, relational, and behavioural failures are explored. Next, the particular policies and financial mechanisms in place in each of the three countries meant to address the cost recovery and conflicting interest issues are concentrated on and compared based on the level of the involvement of tenants in the decision-making process, and whether or not (and in what form) energy efficiency benefits can be carried forward by the tenants when they change residence. Based on the findings, the author provides country and region-specific applicable policy solutions which might be essential to unlock the split incentive paradox.

4 FINDINGS

4.1 Institutional framework and rent-setting mechanisms

In Denmark, social housing is defined as “general housing”, reflecting its “universalist” system, which aims to provide affordable accommodation to a broad range of the population, and is governed by the 2011 Act on Social Housing. While in principle open to anyone above the age of fifteen who legally resides in the country, the system has become more targeted towards marginalised groups and those with special needs (OECD, 2020; Vestergaard et al., 2014). In Denmark, three specific types of “general housing” exist, namely social family dwellings, social dwellings for the elderly, and social dwellings for youth (OECD, 2020; Housing Europe, 2010).

In Italy the Law 80/2014 defines social housing as “housing units used for residential use when they are built or recovered by public and private entities” and rented out for at least fifteen years with the aim of reducing “the housing hardship of disadvantaged individuals and households who are unable to access rental housing at market conditions” (par. 3, art. 10). In this regard Italy belongs to the groups of European countries with a targeted but generalist social housing system, which tends to allocate accommodation to vulnerable households that are below a certain income threshold (OECD, 2020; Braga et al., 2013). Traditionally, social rental housing includes three types:

- i) subsidized housing for the poorest households, with 60% to 100% of costs covered by public entities and rents based on tenants' income, provided by municipalities and public housing agencies;
- ii) assisted housing for low- and medium-income households, sponsored by cooperatives, with public subsidies covering 20% to 60% of rental costs and incentives for tenant home purchases;
- iii) agreed housing by private operators, such as cooperatives and building companies, with costs set by agreements between municipalities and housing providers (Caruso, 2017; OECD, 2020).

Priority access to social housing is given to people in poor living conditions, to families with several children and to people experiencing enforced cohabitation (Caruso, 2017).

In the United Kingdom social housing is defined by the Housing and Regeneration Act 2008, as “low-cost rental accommodation” and is understood as a more targeted and need-based (residual) system, where housing is made available to people whose needs are not adequately met on the commercial housing market. In particular, while application is open to all British citizens as well as to those who have the right to stay in the United Kingdom for an unlimited time, and the 1996 Housing Act allows local authorities to set their own rules about who can apply to be on a housing register or waiting list, local authorities must respect basic common rules for housing allocation by giving ‘reasonable preference’ to people “who are officially classified as homeless; people living in overcrowded, unsatisfactory or insanitary accommodation; people who need to move on medical or welfare grounds, including relating to a disability; and people who need to move to avoid hardship to themselves or others” (OECD, 2020:9).

Table 2
Actors in the split incentive dilemma, allocation models
and eligibility criteria

	Denmark	Italy	the United Kingdom
Landlord	private non-profit housing associations under strict municipal supervision	public authorities, municipalities and regions	private non-profit housing associations dominate the sector, registered with the regulator of social housing
Regulation, policy	municipal, national	municipal and regional	national, sub-national
Model for allocation of social housing	universalist	targeted - generalist	targeted - residual
Eligibility criteria	available to all but targeted towards marginalised groups, does not impose income threshold for eligibility	allocate accommodation to vulnerable households that are below a certain income threshold, some income criteria applies	housing is made available to people whose necessities are not adequately met in the commercial housing market; income criteria apply

Source: authors' own design

4.2 The cost recovery dilemma

The economic motivation in the social housing sector hinges on the cost recovery dilemma: how to equitably and profitably split costs and benefits among different players to incentivize energy efficiency investments. Reviewing rent-setting mechanisms, including whether energy bills are included in the rent, helps determine if energy efficiency costs can be covered by raising the rent.

The Danish model operates on the “rental balance” principle, set out in legislation, according to which the rent should only cover housing providers’ costs, without generating surplus. The Social Housing Rent Act (Law n. 928, Section 10) also allows housing providers to increase rent to the extent necessary to meet the “balancing” requirement. Equally, once tenants repay the mortgages on their housing estates, their rent does not decrease. (I don’t understand this sentence. Why do tenants have mortgage? Have they bought their flats?) Instead, two-thirds of their rent is redirected to the National Building Foundation, which allocates half of the savings for renovations, including climate mitigation and adaptation

measures. The remaining one-third is channelled to the local “disposition fund”, which is also essential for the stability of the cost-based system in Denmark, as it helps cover any unforeseen expenses and plays an important role in the renovation and rehabilitation activities of non-profit providers (Noring et al., 2022; Housing Europe, 2021; Blackwell et al., 2022).

In Italy, regions specify rents for subsidised housing, usually based on the beneficiaries’ income level and other regionally set criteria. Since subsidised housing is meant for the poorest strata of the society, the public sector bears almost the totality of the cost of both rent and utilities, with rental charges being more symbolic than substantial. The rents for assisted and agreed housing are stipulated by the municipalities in agreement with social housing providers (Presidenza del Consiglio dei Ministri, 2014). In the case of assisted and agreed housing, utility bills tend to be excluded from the rent and paid separately by the tenants to the energy providers, although social landlords may at times, when a dwelling is served by a central heating system, pay the utilities on behalf of tenants before recovering the costs from them (Santangelo, 2020). Social landlords - who are regulated at the regional level - usually are not allowed by regions to charge higher rents to carry out or after performing energy efficiency retrofits, since rents tend to be calculated based on household income, and not based on the characteristics of the dwelling (Santangelo, 2020; Santangelo et al., 2017).

In the United Kingdom, maximum social housing rents are set within the regulatory framework. In 2020, following pressure from the social housing sector, a new inflation-linked rental settlement was introduced, according to which social housing rents’ increase would be capped based on the Consumer Price Index (CPI) +1% for 5 years. However, further changes were temporarily applied to the policy for the 2023-24 financial year, in light of the spiking inflation, capping social rent increase at 7% for that year (rather than the 11.1% that would have resulted from the inflation-based formula) (Wilson, 2022). While rents in the United Kingdom may be increased yearly according to the government-set formula, in order to guarantee affordable rents for vulnerable households, national rent setting standards prevent social landlords from charging higher rents for refurbished properties, including more energy efficient ones. Finally, social rents in the United Kingdom tend not to include tenants’ utilities (electricity, heating and water), which are paid directly by the tenants through contracts with utility companies (Housing Europe, 2018).

Table 3
Rent-setting, models of paying energy bills

	Denmark	Italy	the United Kingdom
Rent-setting	cost-based, set annually based on the operating budget of the housing association	income-utility based, regionally set, income based; charges are symbolic	market-income based, set based on income level, dwelling size and property value
Rent-increase system	possible to increase rent to meet the cost-based approach	not relevant due to symbolic charges	possible to increase (set yearly, based on the CPI or inflation), capped by regulator
Energy bills paid by	by tenant	central heating paid by the landlord and charged to tenants; other utilities can be part of the rent or paid directly by tenants	by tenant

Source: authors' own design

4.3 Current policy solutions

The complexity and diversity of the social housing systems in the three countries also reflect their different abilities to promote energy efficiency renovations in the sector. While all three countries, in line also with European Union's strategies, recognise the pressing need to promote such investments to fight climate change, address energy poverty and improve the living conditions of the most vulnerable in society, how much each country has managed to promote such investments varies, also depending on the extent to which tenant-landlord dilemmas arise in each system and whether they have been addressed through public intervention.

In Denmark the landlord-tenant dilemma is arguably the least severe compared to Italy and the United Kingdom, and also compared to the Danish private rental sector. It is because the social housing system in the country is characterised by a newer building stock, a more homogeneous ownership structure and a higher degree of alignment of interests between landlords and tenants (Jensen et al., 2009; Ástmarsson et al., 2013). Furthermore, the Danish model foresees at its core the idea of tenants' democracy where tenants themselves govern their housing system through elected board representatives. A board is composed mostly of ten-

ants. External auditors or supervisors with elected politicians such as mayors or members of the municipal government among them, are also part of the boards. (Noring et al. 2022; Housing Europe, 2021).

In fact, its innovative solutions have made Denmark a global leader in the field (Klitmose Holm, 2022), allowing it to reduce energy consumption by 45% per square metre since 1975 (The Danish Energy Agency, 2015). Following the achievement of the 2018 Energy Agreement for the 2020-24 period and the establishment of the Climate Act (Danish Ministry of Climate, Energy and Utilities, 2020), the government redoubled its efforts to promote energy efficiency in the sector by adopting sustainability strategies (Ministry of the Interior and Housing, 2021) and, in the context of social housing in particular, reaching the 2020 Green Housing Agreement with most political parties in Denmark. The agreement entails a structural shift in the Danish Building Fund's support system for social housing renovation, introducing a new green transition emphasis via three instruments, namely a new green support criterion, a new green guarantee, and an experimental fund to provide a greener general sector in the future (Ministry of Transport, 2020). The Danish government estimates it will result in 85-90% of new projects including green actions.

When it comes to Italy, the landlord-tenant dilemma is smaller compared to the United Kingdom, nonetheless, split incentive has been highlighted by several recent studies (D'Alpaos et al., 2021; Martini, 2021). Some Italian regions have attempted to address split incentive issues, with Emilia Romagna proposing that for each social housing unit an objective rental fee should be calculated and agreed to include the characteristics of the unit, of the dwelling and of its location (Santangelo et al., 2017). Nonetheless, the lack of public financing for energy efficiency retrofit in recent decades has been an obstacle to incentivise investments in this regard (Santangelo, 2020). It is only as part of the European Union's 'Renovation Wave' that the Italian government has started again to allocate public resources for the retrofit of existing social residential housing.

It is promoted by incentives such as the Ecobonus (Ministero dello Sviluppo Economico, 2019), which allows investors to recover up to 65% of the upfront investment in ten years and also makes tax credit transferable to third parties. Martini (2021) has pointed out, however, that the Ecobonus might not solve the split incentive dilemma since tenants will be the ones who continue to enjoy the benefits of energy efficiency while landlords still have to bear, at least partially, the cost of the investment. More recently, the Ecobonus was temporarily expanded with a new measure, the Superbonus, a subsidy which raises the tax deduction rate of expenses to 110% (Agenzia Entrate, n.d.). An additional program called 'Programma Sicuro, Verde e Sociale', in the total value of 2 billion Euros, to be assigned to regions and provinces for the 2021-26 period, with the aim to further accelerate

energy retrofit in social housing units has also been launched. (Ministero delle Infrastrutture e dei Trasporti, 2022).

In the United Kingdom energy efficiency-related split incentives are being widely recognised as a major current barrier to energy efficiency (Palmer et al., 2018). Here, in fact, it is the landlords who are legally responsible and entitled to carry out energy efficiency retrofits, and it is them who have to bear the costs of such investments by law, while due to national rent-setting standards social housing providers are prevented, as already mentioned, from charging tenants higher rents after a retrofit (Housing Europe, 2018). At the same time, it is the tenants who benefit most from investments, both from improved comfort and lower energy bills, since they are the ones responsible for paying for them (Palmer et al., 2018). The current social housing policy results in a system that fails to encourage energy efficiency investments, where social tenants would benefit from it but have no power to make such improvements to their housing, while landlords, who have the ability to act, find investments in energy efficiency unappealing, since national regulation prevents them from sharing the benefits and costs of the investments with the tenants equitably.

In terms of policies, while some government funding can be accessed by social landlords, such as the Social Housing Decarbonisation Fund, grant funding alone cannot cover the full costs of retrofitting the entire social housing sector (National Housing Federation, 2021; Green Finance Institute, 2022). Hence, landlords interested in investing into energy efficiency, can only do so through a combination of government grants and the housing association's own means, and potentially additional bond and loan finance raised from the market (Housing Europe, 2018). However, the former are often scarce and, as emerged from a study carried out in 2021, the energy performance of providers' housing stock is typically a secondary consideration in planned maintenance works, while keeping resident disruption to a minimum remains a primary consideration (BEIS, 2021:9; see also: House of Commons, 2021:15). At the same time, when it comes to access to capital from the market, while the amount of sustainable and sustainability-linked loans and bonds raised by social housing providers has been growing rapidly in the country, it is not an option for smaller housing associations, who do not have the size and resources to raise money from the capital market (Green Finance Institute, 2022).

Table 4
Financing and recovery of cost of energy efficiency investments

	Denmark	Italy	the United Kingdom
Recovering costs of energy efficiency through rent increase	possible: cost based, self-sustainable approach	utilities typically covered by the landlord; by regional regulation landlord is not able to increase rent to cover energy efficiency investment	by regulation social landlord in general is not able to pass on to or recover the costs from tenants
Tenant involvement in decision making	democratic system, full involvement	no	no
Benefits carried forward	yes, through a dedicated national fund	no	no

Source: authors' own design

Comparing the three countries on how energy efficiency investment costs are recovered through increased rent, you find that only Denmark uses a cost-based, self-sustaining rent-setting approach, allowing housing providers to recover investment costs. In Italy, social housing rent is symbolic and often includes utilities, eliminating the incentive or possibility to recover energy investment costs through rent, with regional regulations typically prohibiting it. In the United Kingdom, tenants pay market-rate utility bills, so they would be motivated to reduce costs, but regulations generally prevent passing investment costs on to tenants. Additionally, unlike Denmark, where tenants participate in energy efficiency decisions, there is no such mechanism in Italy or the United Kingdom. In the latter countries, tenants cannot carry forward long-term benefits when changing residence, creating a disincentive since they have no say in decisions affecting their homes and finances and lose all benefits upon moving.

4.4 Comparative analysis

This research has found energy efficiency investments in social housing succeed when rent-setting mechanisms allow cost recovery, tenants are involved in decisions and rent negotiations, and can carry forward the benefit from improvements when they move. In this context Denmark's model, which addresses the above factors, is more successful in solving the split incentive dilemma than the United Kingdom's and Italy's.

Denmark uses a community-centric, cooperative, and democratic approach to managing social housing, ensuring strong tenant involvement in improving housing quality and efficiency. In contrast, the United Kingdom and Italy have top-down processes, concentrating power at the government and social housing management levels, with minimal tenant input. This disconnect is a key issue. Concentrated power and lack of action create a dilemma for governance while management failures and issues of democratic legitimacy hinder implementation. Furthermore, governance in Italy is fragmented at the city or regional level, with local governments setting low, often symbolic rents.

Households changing social housing residence or provider are an additional concern when it comes to who benefits from the retrofit. Solving the disconnect currently experienced by people who frequently change social housing residence taking the benefits accrued from energy efficiency retrofit projects with them is necessary if you are to find a sustainable mode of investment that is supported by both the owner and the tenant. In this regard you can see that in Denmark income from social housing rents and investment, such as energy savings, is partially redistributed nationally. Thus, any investment made by the owner or tenant is universally returned into a common fund used for further improvements. In contrast, there is no mechanism for such redistribution of benefits in the United Kingdom or Italy.

Furthermore, even if tenants were motivated to implement and share the benefits of energy efficiency investments in the United Kingdom, rent capping prevents landlords and tenants from doing so. Additionally, the pressing housing shortage and expensive housing market make tenants more concerned about rent levels than energy-saving options. Such contradictions make shifting to a cost-based rent-setting scheme difficult and lock in the split incentive dilemma in the United Kingdom.

In Italy, in addition, due to frequent merging of rent with utility costs, tenants have no incentive for energy efficiency upgrades, because the public landlords paying the energy bills and for the retrofit earn most of the benefits from such investments. Although it would be an obvious choice for the landlords to implement energy efficiency investments, fragmented decision-making and financing hinder large-scale investments. The particular issue can only be solved at the highest level, given the way social housing is organised in countries like Italy. Thus, the behavioural problem and its solution is not so much a question of a conflict of interest of tenants and landlords, but a question of responsible and mature public management.

5 DISCUSSION

The first finding is that Denmark appears to have solved, for the most part, the split incentive conundrum in its social housing sector. In fact, its sustainable economic and investment policy, along with its democratic decision-making process, has become best practice for other countries. Nonetheless, there are other housing market segments where the Danish authorities could potentially improve their practice. While the split incentive paradox is most often discussed in the light of the social housing stock, the private rental market suffers from the same ailment, compounded by additional variables, such as profit maximization and competitiveness to name but a few. Both in Denmark and outside of it, policy making should address the challenge, potentially transposing valuable know-how from the social housing market. Clear legislation should be formulated to facilitate the energy efficiency refurbishment of the whole residential rental market.

It is also obvious that while the Danish example is recognized as a best practice, the Danish authorities, and other stakeholders responsible for its implementation have not managed to export their model successfully outside their region. Part of the reason is assumed to be that translating and adapting a good practice may bog down in a failure of generalizing rules that can be adopted by other states and stakeholders there without getting lost in the peculiarity of the differences between different states and their unique systems. Further research of the topic could benefit the scholarly community and policy makers from across Europe and beyond.

And lastly, while the Danish model seems effective, the speed and depth of its refurbishment rate could be improved upon. One drawback derived directly from the Scandinavian type of welfare state is the loss of efficiency and speed at which change can be implemented due to the control exercised by public authorities. Under such circumstances it may be beneficial to explore further market-based approaches to advancing energy efficiency in the sector at higher speed and deeper level compared to what has been uncovered so far, even if such an exploration is beyond the scope of this paper.

Our findings contradict the notion that in Italy energy efficiency investments in the social housing stock are precluded by a clear-cut split incentive conflict between landlord and tenant. Italy has assigned one major role to its social housing stock, namely, the provision of housing to a social stratum that is unable or is excluded from providing adequate housing for itself in addition to being deprived from the option in the long run. As such the Italian state, at all three levels of government, national, regional, and local, has made it its task to provide housing, at almost all costs. Rents are either considerably below market prices, or they are merely symbolic, utility bills are either paid for directly, subsidised, or paid for through other forms of aid directed at the household or individual in need.

Italy is a clear example of a multitude of state interventions targeted at the same household or individual, where studies and policy recommendations often fail to take into consideration the cumulative effects of the direct and indirect subsidies. When taken together, the interventions may in fact cover all such major costs. This is an area of research in which untangling the various interventions and quantifying their cumulative effects should be further explored. Due to the current high fragmentation of the policies and interventions at the three levels of government, the sector may create the deceptive impression that no state-wide solution may be possible. Notwithstanding, several actionable policy changes can be proposed based on the literature reviewed and our own findings.

Given the heavy-handed state intervention in the sector, the ownership of the question lies squarely with the state. If rents and utilities are covered either directly or indirectly, it is in the interest of the housing provider and subsidy provider(s) to improve the quality of their property stock, with its impact on valuation, and reduce the energy consumption and bills incurred by the tenants. If the goal of the social housing sector in Italy is a general reduction in poverty, the reduction in energy consumption is the long-term benefit of the state. By investing in their social housing stock, national, regional and local authorities could increase the value of their properties allowing them to raise further funds, and most importantly reduce the amount funnelled to households directly or indirectly in order to cover their energy bills. Naturally the state would benefit from a social housing stock that is better adapted to climate change and has a lower carbon footprint.

In the instances where the various state interventions do not cover the utility bills energy efficiency intervention is still warranted. For one, energy efficiency improvements can be implemented as per the golden rule, with the investment being paid, in greater part at least, from the savings accrued, with the difference being covered by subsidies. Such a step would reduce the burden on public spending considerably over the years. Italy regulates the sector taking into consideration that economically deprived households and communities often face long-term challenges. The sector is set up in order to provide long-term housing. Such a long-term policy approach could allow returns accrued from savings to materialize over time, benefiting both the households in need and the public spending.

Among the various conflicting interests, the disruption caused to households by energy efficiency related building works can represent a substantial challenge for housing and subsidy provider(s) if they face strong opposition from the tenants. As we could see from the Danish example, the involvement of the households and communities in the decision-making process can reduce the major source of friction, by raising awareness and creating a sense of shared ownership. This sense of ownership could be further enhanced by allowing tenants that have passed through such a refurbishment process to move into other similar social

properties, in line with the efficiency level of their old homes post retrofit if they need to change residence. The sense of ownership would allow the tenant to carry forward the benefits of their efforts and sacrifices, instead of having to endure the whole process all over again after changing residence. The new policy would require greater coordination between the three levels of government vertically as well as between housing providers horizontally. Such coordination is possible if enshrined in new legislation that results in clear and simple regulations to be followed by all housing and subsidy providers to the limits of their capacity. Given that tenants in the social housing sector change residence either because their economic prospects have improved or have deteriorated, either way, it would benefit them greatly if such extended ownership could be conferred upon them by the state. If their economic prospects have improved, it only follows that in their new home they should not be burdened with additional energy costs that could eat away at their newly found (fragile) improved economic condition. If their economic prospects have worsened, it is equally reasonable not to burden them, and the public purse, any further by moving them into a home that is less efficient.

Of the three countries studied in this research paper the United Kingdom represents the most clear-cut example of the split incentive as understood by most scholars, as a conflict of interest between landlord and tenant, which results from the interactions detailed earlier in this paper. In this case, and in other similar countries, both landlords and tenants are placed into an impossible situation, where neither party can solve the issue on their own, thus, solution must lie in necessary shifts and changes in the policies that currently govern the sector.

The most obvious solution to the challenge is a shift in the interpretation of the law that governs how rents are set and how market value is determined. The legislation we cited earlier clearly states that the cost of the investment cannot be transferred to the tenant by the landlord by raising the rent. Yet this interpretation fails to take into consideration the monetization of the energy efficiency investment, and the profit earned by the tenant post retrofit through the savings they enjoy. The law currently fails to take account of the profit, allowing it to be enjoyed by the tenant free of charge. Whether such savings are made possible by the landlord investing in the energy efficiency of their property or through full or partial subsidies, the fact remains that tenants are set to gain for as long as they reside in the retrofitted property. Allowing for this status quo to persist is ethically irresponsible and economically unfair, since it either prevents investments into energy efficiency from materializing to begin with, or it allows an unfair distribution of public resources to tenants that happen, by pure chance, to live in a property that is being or has been refurbished.

We propose that one feasible way of solving the issue, without a fundamental change in the legislation governing rent-setting, is to attach the profit where it

would be due were it to remain a cost, and that is to the utility bill. A three-party financing scheme could be structured that would allow the utility companies to collect an average of what they used to collect pre-retrofit based on previous energy consumption patterns, taking into consideration energy price fluctuations, inflation etc. Next, the monetized savings could be reimbursed to both tenants and landlords as rebates. Due to the initial burden suffered by the landlord it would be fair and sustainable to split the profits unevenly in favour of the landlord., The rate could then be moved into the opposite direction over time. For example, a 70/30 split in favour of the landlord could be, over time and progressively, shifted to a 30/70 split.

The creation of supervisory boards, or steering committees is recommended, which would be tasked with the promotion and supervision of energy efficiency retrofits in the housing communities they represent, boards that would have ordinary tenants as majority members along with other key stakeholders. They would enhance the legitimacy and transparency of the process, and could remove behavioural obstacles created by the disruption caused to the tenant during the whole retrofitting process, as well as maintaining a connection between the decision of taking part in such a process, suffering through the disruption, and enjoying the profits thereof, thereby creating a sense of ownership.

It is also recommended to formulate a policy which allows tenants to carry forward their savings by giving them priority of choice when it comes to moving out of the homes they help refurbish and into new residences. The new homes should be in the same range of energy efficiency that is in line with the savings they would have made over the years in case they were allowed to remain in the same retrofitted property long-term. We argue that such policies are necessary in all countries, regions, and localities where tenant mobility is substantial, the greater the mobility the more urgent the need. The policies should be formulated in a manner so that they should not pose an obstacle to either refurbishment or tenant mobility, by operating within the realm of the possible, not of the ideal.

6 CONCLUSION

The research concludes the split incentive issue is effectively managed when rent-setting mechanisms permit the recovery of retrofit costs, tenants are actively engaged in decision-making, and can retain the benefits of energy efficiency improvements upon relocation. Although exemplary practices, such as the Danish model, successfully address these aspects and significantly mitigate the split incentive problem, the split incentive paradox persists as a major impediment to energy efficiency advancements in social housing across Europe, due to the

difficulty faced by stakeholders in transplanting and adapting best practices from countries such as Denmark. Distinct cultural, normative and legal traditions result in behavioural failures across the spectrum, especially at the top where governments fail to address competing public priorities and conflicting private interests effectively.

Implementing policies that facilitate the redistribution of energy savings that benefits tenants and landlords in an equitable fashion through a third party, in particular utility companies, is both feasible and could be highly advantageous in countries such as the UK, with inflexible social rent-setting mechanisms. Furthermore, when it comes to countries like Denmark that have already addressed the issue effectively, we recommend adapting some of the solutions to the private rental market. It clearly lags behind and would need similar regulations to the ones we propose for the UK to incentivise both owners and tenants for investing in energy efficiency without coercion. Coercion would have unintended market distortion effects, in the rise of rent prices or in the reduction of the number of properties on the rental market, just to mention a few. In countries like Italy, where the government is responsible for most or all energy costs along with providing social housing or subsidy of the same, the split incentive is for the most part not economic in nature, it is rather coordination and disruption related. In such governance structures, practical measures, such as establishing boards or committees with tenant representation to promote and oversee energy efficiency projects addressing disruption related conflicts, developing a unified national strategy that considers the cumulative nature of various simultaneous state interventions, could significantly incentivize energy efficiency investments. - Such measures could increase tenant participation and decrease the fragmentation of governmental decision-making, which is an easy way to avoid responsibility. Overall, the split incentive issue involves more than two stakeholders and more than conflicting economic interests. There are behaviour failures at play, triggered by cultural habits and normative expectations, often enshrined in laws and governance practices, or in a lack of the same, that must be identified in each country. They must be addressed simultaneously across the board. Some of the solutions, as seen in this paper, could be counterintuitively simple and thus easily overlooked.

REFERENCES

- Agenzia Entrate (n. d.): Superbonus 110%. <https://www.agenziaentrate.gov.it/portale/web/guest/superbonus-110%25> (accessed: 14.01.2023).
- Ástmarsson, B. – Jensen, P. A. – Maslesa, E. (2013): Sustainable renovation of residential buildings and the landlord/tenant dilemma. *Energy Policy*, 63, 355–362. <https://doi.org/10.1016/j.enpol.2013.08.046>.
- BEIS. (2021): Department for Business, Energy and Industrial Strategy: Social Housing Decarbonisation Study. Views from Social Housing Providers, BEIS Research Paper 2021/056. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1023608/social-housing-decarbonisation-study-report.pdf (accessed: 14.01.2023).
- Bertoldi, P. (2022): Policies for energy conservation and sufficiency: review of existing policies and recommendations for new and effective policies in OECD countries. *Energy and Buildings*, 112075. <https://doi.org/10.1016/j.enbuild.2022.112075>.
- Bird, S. – Hernández, D. (2012): Policy options for the split incentive: Increasing energy efficiency for low-income renters. *Energy Policy*, 48, 506–514. <https://doi.org/10.1016/j.enpol.2012.05.053>.
- Blackwell, T. – Bengtsson, B. (2021): The resilience of social rental housing in the United Kingdom, Sweden and Denmark. How institutions matter. *Housing Studies*. <https://doi.org/10.1080/02673037.2021.1879996>.
- Braga, M. – Palvarini, P. (2013): Social Housing in the EU, Policy Department A: Economic and Scientific Policy, European Parliament. [https://www.europarl.europa.eu/RegData/etudes/note/join/2013/492469/IPOL-EMPL_NT\(2013\)492469_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/note/join/2013/492469/IPOL-EMPL_NT(2013)492469_EN.pdf) (accessed: 14.01.2023).
- Caruso, N. (2017): Chapter 2 Housing Policies in Italy: From Social Housing to Neo-Liberalism. In: *Policies and Practices in Italian Welfare Housing Turin, up to the Current Neo-Liberal Approach and Social Innovation Practices*. Cham: Springer. <https://doi.org/10.1007/978-3-319-41890-2>.
- Castellazzi, L. – Bertoldi, P. – Economidou, M. (2017): *Overcoming the split incentive barrier in the building sectors: unlocking the energy efficiency potential in the rental & multifamily sectors*. EUR 28058 EN, Luxembourg: Publications Office of the European Union, 2017, ISBN 978-92-79-58837-2. <https://doi.org/10.2790/912494> (accessed: 16.06.2024).
- Comité Européen (2020): In focus: Energy efficiency in buildings. https://commission.europa.eu/news/focus-energy-efficiency-buildings-2020-02-17_en (accessed: 14.01.2023).
- Comité Européen (2022): Energy Efficiency. Fact Sheets on the European Union. https://www.europarl.europa.eu/ftu/pdf/en/FTU_2.4.8.pdf (accessed: 13.01.2023).
- Comité Européen (2023): Energy use in households up 6% in 2021. <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/DDN-20230613-1#:~:text=Compared%20with%202020%2C%20in%202021,final%20consumption%20of%20households%20increasing> (accessed: 15.06.2024).
- Comité Européen (2024): *Energy Performance of Buildings Directive*. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en (accessed: 2024.06.15.).
- Costarelli, I. – Kleinhans, R. – Mugnano, S. (2019): Reframing social mix in affordable housing initiatives in Italy and in the Netherlands. Closing the gap between discourses and practices? *Cities*, 90, 131–140. <https://doi.org/10.1016/j.cities.2019.01.033>.
- Danish Ministry of Climate, Energy and Utilities (2020): Climate Programme 2020 Denmark's Mid-century, Long-term Low Greenhouse Gas Emission Development Strategy – submitted under the Paris Agreement https://unfccc.int/sites/default/files/resource/ClimateProgramme2020-Denmarks-LTS-under-the%20ParisAgreement_December2020_.pdf (accessed: 14.01.2023).

- Desvallées, L. (2022): Low-carbon retrofits in social housing: Energy efficiency, multidimensional energy poverty, and domestic comfort strategies in southern Europe. *Energy Research & Social Science*, 85, 102413. <https://doi.org/10.1016/j.erss.2021.102413>.
- Di Felicianantonio, C. – Aalbers, M. B. (2018): The Prehistories of Neoliberal Housing Policies in Italy and Spain and Their Reification in Times of Crisis. *Housing Policy Debate*, 28(1), 135–151. <https://doi.org/10.1080/10511482.2016.1276468>.
- D'Alpaos, C. – Bragolusi, P. (2021): *Energy Retrofitting in Public Housing and Fuel Poverty Reduction: Cost-Benefit Trade-Offs*. In Bisello, A. et al. (eds.) (2021): *Smart and Sustainable Planning for Cities and Regions – Results of SSPCR 2019*. Cham: Springer.
- Dobi-Rózsa, A. – Balaci, A. (2023): Demand side limitations of financing household energy efficiency investments. A Regional approach. *Economy and Finance*, 10(4), 340–368. <https://bankszovetseg.hu/Public/gep/2023/340-368%20E%20Dobi%20Balaci.pdf>.
- Economidou, M. – Bertoldi, P. (2015): Practices to overcome split incentives in the EU building stock, ECEEE summer study proceedings. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2015/6-policies-and-programmes-towards-a-zero-energy-building-stock/practices-to-overcome-split-incentives-in-the-eu-building-stock/ (accessed: 14.01.2023).
- Economidou, M. – Ribeiro Serrenho, T. (2019): *Assessment of progress made by Member States in relation to Article 19 (1) of the Directive 2012/27/EU*. EUR 29653 EN, Publications Office of the European Union. <https://doi.org/10.2760/070440>.
- Economidou M. – Todeschi, V. – Bertoldi, P. – D'Agostino, D. – Zangheri, P. – Castellazzi, L. (2020): Review of 50 years of EU energy efficiency policies for buildings. *Energy & Buildings* 225, 110322. <https://doi.org/10.1016/j.enbuild.2020.110322>.
- Enerdata (2021): Evolution of households energy consumption patterns across the EU. Residential buildings: Energy Efficiency & Consumption evolution in Europe. (enerdata.net) (accessed: 2023.01.13.).
- Eurofound (2022): The cost-of-living crisis and energy poverty in the EU: Social impact and policy responses – Background paper. https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef22077en.pdf (accessed: 14.01.2023).
- Green Finance Institute (2022): Retrofitting Social Housing: A Model for the UK. <https://www.greenfinanceinstitute.co.uk/programmes/ceeb/retrofitting-social-housing-a-model-for-the-uk/> (accessed: 14.01.2023).
- Hirst, E. – Brown, M. (1990): Closing the efficiency gap: barriers to the efficient use of energy. *Resources, Conservation and Recycling*, 3(4), 267–281. [https://doi.org/10.1016/0921-3449\(90\)90023-W](https://doi.org/10.1016/0921-3449(90)90023-W).
- House of Commons (2021): Environmental Audit Committee: Energy Efficiency of Existing Homes – Fourth Report of Session 2019–21. <https://committees.parliament.uk/publications/5171/documents/52521/default/> (accessed: 14.01.2023).
- Housing Europe (2010): Social Housing in Europe – Denmark. <https://www.housingeurope.eu/resource-102/social-housing-in-europe> (accessed: 2023.01.14.)
- Housing Europe (2018): The financing of renovation in the social housing sector. A comparative study in 6 European countries. <https://www.housingeurope.eu/resource-1124/the-financing-of-renovation-in-the-social-housing-sector> (accessed: 14.01.2023).
- Housing Europe (2021): Cost-based social rental housing in Europe. A new report by the Housing Europe Observatory outlines the cases of Austria, Denmark, and Finland. <https://www.housingeurope.eu/resource-1651/cost-based-social-rental-housing-in-europe> (accessed: 13.01.2023).
- Housing Europe (2023): The State of the Housing in Europe 2023 – Social housing between a fair energy transition and dealing with crisis. *Future of the EU & Housing*. <https://www.housingeurope.eu/resource-1811/the-state-of-the-housing-in-europe-2023> (accessed: 23.06.2024).

- idealista (2022): Italy home rental market: 2022 trends and 2023 outlook. <https://www.idealista.it/en/news/property-for-rent-in-italy/2022/12/28/185683-italy-home-rental-market-2022-trends-and-2023-outlook> (accessed: 15.06.2024).
- Jensen, J. O. – Clementsen, A. (2009). Barrierer for energibesparelser i private udlejningsboliger. https://vbn.aau.dk/ws/portalfiles/portal/16649659/Notat_VfM.pdf (accessed: 14.01.2023).
- Karatasou, S. – Laskari, M. – Santamouris, M. (2018) Energy in Buildings Determinants of high electricity use and high energy consumption for space and water heating in European social housing: Socio-demographic and building characteristics. *Energy and Buildings*, <https://doi.org/10.1016/j.enbuild.2018.04.019>.
- Klitmose Holm, G. – Lind Arlaud, M. (szerk.) (2022): *Energy renovation of buildings. Realising the untapped potential of the built environment*. White Papers for a Green Transition, State of Green. https://ens.dk/sites/ens.dk/files/Globalcooperation/final_web_sog_wp_energyefficiencyinbuildings_210x297_v06_web.pdf (accessed: 14.01.2023).
- Martini, C. (2021): The Ecobonus Incentive Scheme and Energy Poverty: Is Energy Efficiency for All? In Bisello, A. et al. (eds.) (2021): *Smart and Sustainable Planning for Cities and Regions – Results of SSPCR 2019*. Cham: Springer.
- Ministero Delle Infrastrutture E Dei Trasporti (2022): *PNRR: erogati alle Regioni 400 milioni del Programma di edilizia pubblica residenziale „Sicuro, verde e sociale”*. <https://www.mit.gov.it/index.php/comunicazione/news/pnrr-erogati-alle-regioni-400-milioni-del-programma-di-edilizia-pubblica> (accessed: 14.01.2023).
- Ministero Dello Sviluppo Economico (2019): *Piano Nazionale Integrato Per L'energia E Il Clima*. https://www.mise.gov.it/images/stories/documenti/PNIEC_finale_17012020.pdf (accessed: 14.01.2023).
- Ministry of the Interior and Housing (2021): *National Strategy for Sustainable Construction*. https://im.dk/Media/637602217765946554/National_Strategy_for_Sustainable_Construktion.pdf (accessed: 14.01.2023).
- Ministry of Transport (2020). *Bred politisk aftale om grøn renovering af almene boliger*. <https://www.trm.dk/nyheder/2020/bred-politisk-aftale-om-groen-renovering-af-almene-boliger/> (accessed: 14.01.2023).
- Monteiro, C. S. – Causone, F. – Cunha, S. – Pina, A. – Erba, S. (2017): Addressing the challenges of public housing retrofits. *Energy Procedia*, 134, 442–451. <https://doi.org/10.1016/j.egypro.2017.09.600>.
- National Housing Federation (2021): *Decarbonising the housing association sector – costs and funding options*. <https://www.housing.org.uk/resources/decarbonisation-costs-funding/> (accessed: 14.01.2023).
- National Housing Federation (n. d.): *About Social Housing*. <https://www.housing.org.uk/about-housing-associations/about-social-housing/> (accessed: 14.01.2023).
- Noring, L. – Struthers, D. – Grydehøj, A. (2022): Governing and financing affordable housing at the intersection of the market and the state: Denmark's private non-profit housing system. *Urban Research & Practice*, 15(2), 258–274. <https://doi.org/10.1080/17535069.2020.1798495>.
- Norris, M. – Byrne, M (2021): Funding resilient and fragile social housing systems in Ireland and Denmark. *Housing Studies*, 36(9), 1469–1489. <https://doi.org/10.1080/02673037.2020.1777944>.
- OECD (2020): *Organisation for Economic Cooperation and Development: Social housing: A key part of past and future housing policy, Employment, Labour and Social Affairs Policy Briefs*. <http://oe.cd/social-housing-2020> (accessed: 13.01.2023).
- OECD (2022): *Organisation for Economic Cooperation and Development: Ph4.3 Key Characteristics of Social Rental Housing*. <https://www.oecd.org/els/family/PH4-3-Characteristics-of-social-rental-housing.pdf> (accessed: 14.01.2023).

- OECD Affordable Housing Database (n. d.): *Policies Towards Affordable Housing, PH4.2 Social rental dwellings stock*. <https://www.oecd.org/housing/data/affordable-housing-database/housing-policies.htm> (accessed: 13.01.2023).
- Palm, J. – Reindl K. (2018): Understanding barriers to energy-efficiency renovations of multifamily dwellings. *Energy Efficiency*, 11, 53–65. <https://doi.org/10.1007/s12053-017-9549-9>.
- Palmer, J. – Poku-Awuah, A. – Adams, A. – Webb, S. (2018): What are the Barriers to Retrofit in Social Housing? Report for the Department for Business, Energy and Industrial Strategy. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/787361/Barrier_to_Retrofit_in_Social_Housing.pdf (accessed: 14.01.2023).
- Presidenza Del Consiglio Dei Ministri (2014): *Prima Relazione Biennale Servizi di Interesse Economico Generale – Sieg 2014*. <https://www.politicheeuropee.gov.it/media/1538/relazione-sieg-2014.pdf>. Hozzáférés: (accessed: 14.01.2023).
- Regulator of Social Housing (2021): Local authority registered provider social housing in England – stock and rents, 2020–2021. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1028721/LARP_briefing_note_FINAL_V1.o.pdf. (accessed: 2023.01.14.).
- Regulator of Social Housing (n. d.): *About us*. <https://www.gov.uk/government/organisations/regulator-of-social-housing/about> (accessed: 14.01.2023).
- Santangelo, A. – Tondelli, S. (2017): Equità e qualità degli interventi di rigenerazione del patrimonio ERP: dallo studio del caso olandese, verso la definizione di un modus operandi. In Atti della XX Conferenza Nazionale SIU. Roma (pp. 12-14) https://www.researchgate.net/publication/324416055_Equita_e_qualita_degli_interventi_di_rigenerazione_del_patrimonio_ERP_dallo_studio_del_caso_olandese_verso_la_definizione_di_un_modus_operandi (accessed: 14.01.2023).
- Santangelo, A. (2020): Povertà energetica ed edilizia residenziale pubblica. Possibili azioni per nuove politiche abitative a partire dal ruolo attivo degli utenti. Atti della XXII Conferenza Nazionale SIU – L’urbanistica italiana di fronte all’Agenda 2030. https://www.researchgate.net/profile/Angela-Santangelo-2/publication/342349748_Poverta_energetica_ed_edilizia_residenziale_pubblica_Possibili_azioni_per_nuove_politiche_abitative_a_partire_dal_ruolo_attivo_degli_utenti/links/5eefcbo299b91faac68aff/Poverta-energetica-ed-edilizia-residenziale-pubblica-Possibili-azioni-per-nuove-politiche-abitative-a-partire-dal-ruolo-attivo-degli-utenti.pdf (accessed: 14.01.2023).
- Scanlon, K. – Fernández Arrigoitia, M. – Whitehead, C. M. E. (2015): Social housing in Europe. *European Policy Analysis*, 17, 1–12. <http://eprints.lse.ac.uk/62938/>.
- SPUR (2022): *Housing for Everyone, the Danish Way*. <https://www.spur.org/news/2022-08-31/housing-for-everyone-the-danish-way> (accessed: 23.06.2024).
- The Danish Energy Agency (2015): *The Danish Energy Model – Innovative, efficient and sustainable*. <https://stateofgreen.com/en/solutions/the-danish-energy-model-innovative-efficient-and-sustainable/> (accessed: 14.01.2023).
- Uihlein, A. – Eder, P. (2009): *Towards additional policies to improve the environmental performance of buildings*. European Commission Joint Research Centre, Institute for Prospective Technological Studies. <http://www.eurogypsum.org/wp-content/uploads/2015/05/N59.pdf> (accessed: 13.01.2023).
- UK Parliament (2022): *Rent setting: social housing (England) House of Commons Library*. <https://commonslibrary.parliament.uk/research-briefings/sn01090/> (accessed: 23.06.2024).
- UK Government (2022): *Policy paper, Policy statement on rents for social housing*. <https://www.gov.uk/government/publications/direction-on-the-rent-standard-from-1-april-2020/policy-statement-on-rents-for-social-housing> (accessed: 20.06.2024).

- Vestergaard, H. – Scanlon, K. (2014): Social housing in Denmark. In SCANLON, K. et al. (eds.) (2014): *Social housing in Europe*. Chichester: John Wiley & Sons, Ltd.
- Wilson, C. – Crane, L. – Chryssochoidis, G. (2015): Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy. *Energy Research & Social Science*, 7, 12–22. <https://doi.org/10.1016/j.erss.2015.03.002>.
- Wilson, W. (2022): *Rent setting: social housing (England)*. *Research briefing*. House of Commons Library. <https://commonslibrary.parliament.uk/research-briefings/sno1090/> (accessed: 14.01.2023).