UTS ePRESS

Construction Economics and Building

Vol. 20, No. 2
June 2020

RESEARCH ARTICLE

An investigation of barriers and enablers to energy efficiency retrofitting of social housing in London

James Peel[1], Vian Ahmed[2], and Sara Saboor[3]*

[1] University College of Estate Management, England, United Kingdom, Email: jimbopeel@yahoo.co.uk
[2] Department of Industrial Engineering, American University of Sharjah, United Arab Emirates. Email: vahmed@aus.edu
[3] Department of Industrial Engineering, American University of Sharjah, United Arab Emirates. Email: g00080300@aus.edu

***Corresponding author:** Sara Saboor, Department of Industrial Engineering, American University of Sharjah, United Arab Emirates. Email: g00080300@aus.edu

DOI: 10.5130/AJCEB.v20i2.6746
Article history: Received 8/26/2019; Revised 3/03/2020; Accepted 3/26/2020; Published 22/06/2020

Citation: Peel, J., Ahmed, V., and Saboor, S. 2020. An investigation of barriers and enablers to energy efficiency retrofitting of social housing in London. *Construction Economics and Building*, 20:2, 127-149. http://dx.doi.org/10.5130/AJCEB.v20i2.6746

ISSN 2204-9029 | Published by UTS ePRESS | https://epress.lib.uts.edu.au/journals/index.php/AJCEB

Abstract

Carbon emissions, being hazardous, are triggering social concerns which have led to the creation of international treaties to address climate change. Similarly, the United Kingdom under the Climate Change Act (2008) has committed to reducing its greenhouse gas emission by at least 80% over 1990 levels by 2050. However, being the oldest member of the EU states (before Brexit), the UK has the oldest housing stock, which contributes to 45% of its carbon emissions due to the older dwellings. To address this issue low carbon retrofitting is needed. Therefore, this paper seeks to investigate the barriers and enablers to energy efficiency retrofitting in social housing in London, UK based on the perception of experts employed in National and construction companies with an experience that ranges between 6 to 16 years. Initial literature suggested that the problem of energy efficiency retrofitting in the general building stock has been addressed, however little has been reported on its application to social housing. This paper, therefore, groups the barriers and enablers into seven categories that include: financial matters, Technical, IT, Government policy and regulation, social factors (including awareness of the energy efficiency agenda), quality of workmanship and disruption to residents, using literature review, interviews and surveys with key stakeholders within the

DECLARATION OF CONFLICTING INTEREST The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article. **FUNDING** The author(s) received no financial support for the research, authorship, and/or publication of this article.

housing sector, and draws recommendations to enable effective and efficient retrofitting for social housing projects.

Keywords:

Energy efficiency, Retrofitting, Social Housing, and Construction industry.

Introduction

Carbon emission emerges as a significant factor that has a dangerous impact on climate change (Solomon et al., 2007). This issue has triggered social concerns that led to the creation of treaties such as the *United Nations Framework Convention (1992), Kyoto Protocol (1997), Climate Change Act (2008), the Energy Efficiency Directive (2012), and Paris Agreement* (Change, 2016)these are amongst the few treaties that address the issue of Climate Change. Under the 1997 Kyoto Protocol, the United Kingdom has committed to reducing its carbon emissions by 12.5% over the 1990 levels by 2012 and to achieve a 27% reduction in levels by 2011 (House of Commons, 2016). The initiative by the European Union (EU) includes mandatory carbon reduction targets, the *Energy Efficiency Directive (2012)* and the *Emissions Trading Scheme*. The *Climate Change Act (2008)* commits the UK to reduce its greenhouse gas emissions by at least 80% over 1990 levels by 2050 (House of Commons, 2016). In addition to this, adoption of the ratification of the Paris agreement (Change, 2016 enables the UK to set a target of net-zero emissions. However, being the oldest member of the EU members (before Brexit), the UK has the oldest housing stock (Davidson et al., 2012). Older dwellings often consume more energy to warm them adequately, compared with more energy-efficient new-built dwellings (Leal Filho et al., 2016). Similarly, Stafford et al (2011), argue that 45% of the UK's carbon emissions are the result of energy-inefficient buildings. In addition to environmental concerns, some other consequences of inefficient energy housing are; public health (physical and mental), social aspects, and fuel poverty which is a significant concern in the UK, with its cold weather and relatively high energy prices. Palmer and Cooper (2013) stated that, in 2011, approximately 10.9% of UK households (2.39 million) were in fuel poverty.

Therefore, a compelling case exists for Energy Efficiency Retrofitting (EER) to domestic buildings in the UK, and especially in the social housing sector. With its high rates of poverty and a higher level of government control over the sector, the national policy can influence retrofitting in social housing more than other forms of tenure. However, initial literature has suggested that the problem of energy efficiency retrofitting in the general building stock has been addressed to some extent whereas little existed on its application to social housing in the UK..

Thus, this paper intends to develop an understanding of energy efficiency retrofitting and common measures reported by the literature as well as the associated barriers and enablers for retrofitting. The paper also brings to light the relevant initiatives and policies set by the UK government, In an and seeks to investigate the barriers and enablers for implementing successful energy efficiency retrofitting in social housing in the London, UK based on the perception of the experts, and making recommendations towards increasing the uptake of such retrofitting.

Social Housing – London

The United Kingdom has the largest stock of social rental housing of about (20%) compared to Spain which merely has 2%. In their study, Arends and García-Almirall (2014) differentiate between the management model of London and Barcelona by focusing on the social and spatial factors to address the housing problem. Therefore, it can be concluded that a relationship between the housing problem, management models, and spatial context exists, and this influences its residents and policies, which is one of the reasons to why this study choses to focus on social housing in London.

Another study by Opoku and Guthrie (2018) argues that the social housing sector experiences an increasing pressure to provide more with less as a result of the UK Government's public debt reduction strategy. This study further explores the delivery of social value in terms of social, economic, environmental impacts in the social housing sector, arguing that organizations often fail to follow the Governmental initiatives and rules imposed, such as the *Social value Act (2012)* in developing their strategies, policies, and procurement.

Though the government has supported the development of social housing, there has been a substantial decline over the last decade as mentioned by Kleinman (1988). The decline has been uneven, causing differences between the regions and local authorities, where London has been at a disadvantage over the changes in the spatial distribution of lettings. Similarly, Fitzpatrick and Pawson (2007) also reports on the 32 percent decline in the supply of social housing and tenancy turnover for almost seven years until 2004 as seen in Figure 1, which has resulted in added pressure on the allocation system.

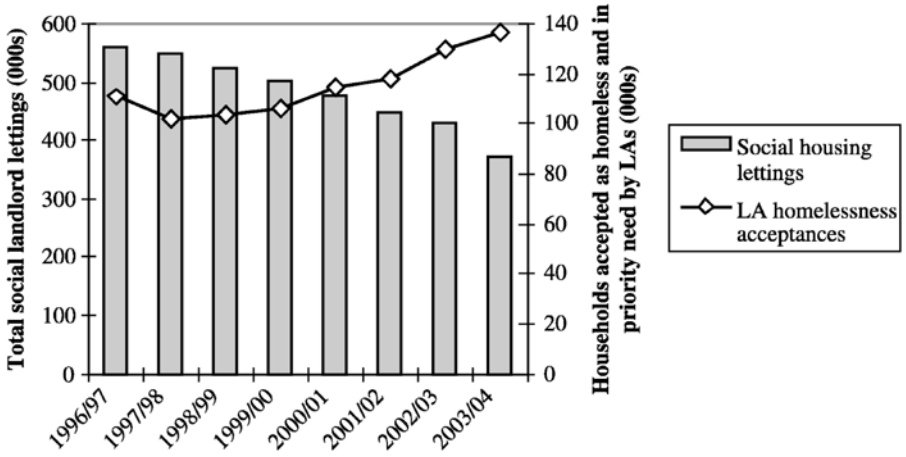

Figure 1 The Decline in Social Housing and Acceptance of Homelessness

Consequently, the limitation to social housing success as argued by Lux and Sunega (2014) is due to the historical and institutional factors such as privatization, informal economy, 'decentralization paradox', and a strong socialist legacy in housing policies.

Therefore, it can be concluded that the government supports social housing by enforcing laws such as the *Social Value Act (2012)* although there has been a substantial decline in the social housing sector in London due to various factors. Additionally, there exists limited literature that address the problem of energy efficiency retrofitting and its application to social housing in London, which is the main driver behind this research.

Energy Efficiency Retrofitting (EER)

The primary focus of this section is to establish a ground for practical understanding of retrofitting, by considering common measures and governmental initiatives that were considered to aid energy efficiency retrofitting.

According to Eames et al. (2014, p2) retrofitting can be defined as*: 'Providing something with a component or feature not fitted during manufacture or adding something that it did not have when first constructed. The term has been used in the built environment to describe substantial physical changes at the building level and has often been used interchangeably with terms such as 'refurbishment,' 'conversion' or 'refit.'*

This definition is the most accepted definition in the literature, as it provides a comprehensive, clear, and practical understanding of retrofitting, which helps guide this study to investigate Energy efficiency retrofitting and its barriers and enablers. Guided by this definition, this study intends to investigate the most commonly implemented measures of Energy efficiency retrofitting in social housing. In support of this literature reports on a study by Provan and Brady (2015), a sample of 13 housing associations was targeted to investigate the most common measure of energy efficiency retrofitting as shown in Table 1.

Table 1 **Common Measures of EER in social housing. Source (Provan and Brady, 2015)**

Measure	Associations Mentioning	Comments
Boilers and heating systems/ controls	12	Many had rolling programs of replacement of boilers with low EPC ratings
Loft insulation	All	Significant activity over past years, with considerable coverage
Cavity Wall insulation	12	Many had rolling programs, and two had done almost all
Double glazing	12	Three had almost all stock already done; most had rolling programs
External wall cladding	9	These were less common and less extensive; older London properties had problems with obtaining planning permission; internal cladding unpopular as loses room space
Solar/PV	6	Issues about roof space roofs not facing south, the extent of plumbing needs to be installed. Also, maintenance issues, but some good results, and issues of needing to secure lender consent, even for self-funded schemes.
Air circulations/ ventilation	5	Sources of some problems with tenants in using these
Other		This includes two with district heating/biomass systems, two with heat pump systems

These measures indicate that there has been a positive move towards integrating energy-efficient components within social housing. However, there are still certain measures that have not been effectively implemented to enable efficient retrofitting, such as Air circulation measures and Solar/PV, which is an indication of the need for retrofitting in social housing.

In addition to these measures, several studies in the literature report on several government initiatives that have attempted to integrate retrofitting in social housing as described in Table 2.

Table 2 Government EER Initiatives

Measure	Details
Decent Homes Standard (Urbed, 2016)	Intended to improve the condition of social housing. Included modest EE requirements.
Energy Efficiency Commitment (EEC) (Urbed, 2016)	Covered electricity and gas. Focused on disadvantaged households.
EEC replaced by Carbon Emissions Reduction Target (CERT) (Urbed, 2016)	Imposed carbon reduction targets from domestic premises on gas and electricity suppliers.
(Community Energy Saving Programme CESP) introduced (Urbed, 2016)	Required electricity and gas companies to deliver EE measures to homes in low-income areas. Promoted 'whole house' approach and high-volume retrofits
Phasing Out of Warm Front (Urbed, 2016)	Delivered basic insulation and heating improvements to vulnerable households.
A feed-in tariff (Ofgem, 2017)	Electricity suppliers must pay for electricity generated by small-scale renewables
Energy Companies Obligation (ECO) replaces CERT, CESP and Warm Front (Urbed, 2016)	Larger energy suppliers fund the installation of domestic EER measures. Applies to social housing and certain benefits recipients. Low uptake reduced the scheme's impact (Weisselberg, 2015). Intended to complement GD by subsidizing solid wall insulation
Green Deal (GD) launched (Urbed, 2016)	Lends money for domestic EER, paid back from savings on electricity bills.
ECO changed, targets reduced 30% (Urbed, 2016)	Substantial cut for solid wall insulation.
RHI introduced (Ofgem, 2017)	Payments based on renewable heat generated.
Zero carbon homes target and Allowable Solutions Fund scrapped (Urbed, 2016)	The Allowable Solutions Fund would have helped retrofit existing housing.

Table 2 continued

Measure	Details
Green Deal Home Improvement Fund closed (Urbed, 2016)	The 'Home Improvement Fund' added in June 2014 to kickstart GD. Offered £1,000s in cash, separate from other Green Deal loans, to help domestic EER.
Government ceases funding GD Finance Company (Urbed, 2016)	Funding ended due to low take-up and consumer protection concerns. Effectively ended scheme.
Government publishes consultation for changes to ECO in 2017-18 (Urbed, 2016)	Changes include a 26% reduction in funding, with focus only on 'affordable warmth' and 'low-cost insulation'
Bonfield Report published (Bonfield, 2016)	Numerous recommendations to encourage retrofitting, no GD replacement proposed.
Green Deal re-launches using private sector financing (The Green Age, 2017)	Additional audits to ensure quality workmanship. Concerns high (c.a. 10%) interest rates and scheme design will discourage uptake.

It is therefore evident from the table above that common measures and governmental initiatives of energy efficiency retrofitting for social housing exist. However, these measures are not integrated effectively due to several barriers and enablers that play a role in effecting the progress of Energy Efficiency Retrofitting in social housing. Therefore, this paper seeks to identify key barriers and enablers for social housing retrofitting as reported by literature.

Energy Efficiency Retrofitting: Barriers and Enablers

Several studies from literature report on a number of barriers and enablers for energy efficiency retrofitting which can be grouped into five categories that include: financial matters, Technical, Government policy and regulation, social factors (including awareness of the energy efficiency agenda), and quality of workmanship (including training for operatives and customer confidence), as presented in Table 3.

Table 3 Barriers and Enablers to EERSH

Category	Barriers	Enablers
Financial	• Lack of funds, poor cost-benefit appraisal (OPM, 2014) • High costs, transaction costs, poor access to finance (Webber, Gouldson and Kerr, 2015) • Split incentive whereby cost is upon the landlord, with savings accruing to the tenant.	• Sufficient resources. The prospect of savings (OPM, 2014) • More efficient homes reduce rent arrears, void durations, improving business case (Weisselberg, 2015) • Grant funding (OPM, 2014)

Table 3 continued

Category	Barriers	Enablers
	• The government imposed 1% rent cap on housing associations reducing available funds (Federation, 2016) • Hard to evaluate and price correctly (Better Building Partnership 2010) • Lack of funds (OPM, 2014) • Repeated changes to funding streams	
Technical	• Measures individually well established, but novel when done together, Measures implemented individually - Holistic strategies superior, owing to complex interactions, but financial constraints frequently prevent this, Not considering household sustainability generally- only physical works, Diverse UK stock requires tailored solutions, Technical solutions ineffective alone - absent behaviour change (Urbed, 2016); Takeback' effect – people increase heating when it becomes cheaper to rum following EER (Energy Saving Trust, 2016) • Many solid wall properties in pre-1919 stock – costly and difficult to insulate (Federation, 2016) and the way people use energy technology is poorly understood (Stafford, Gorse and Shao, 2011).	• I.T. systems are key, Effective monitoring to better understand performance, Economies of scale - as SHPs own many similar buildings and Post Occupancy Evaluation to understand better the use of technology installed (Stafford, Gorse and Shao, 2011); • Good stock condition data (Provan and Brady, 2015) and the 'performance gap' and 'takeback' not as bad as often thought (Webber, Gouldson and Kerr, 2015).

Table 3 continued

Category	Barriers	Enablers
Policy and Regulation	• Strong mandatory national policies (Eames et al. 2014). • Lack of replacement for the Green Deal, Chopping and changing regulations and schemes, Policy vacuum – little Government attention to energy efficiency matters and Right to buy makes retrofitting more (Weisselberg, 2015).	• Government creating greater access to finance (Bonfield, 2016); • Increasing the cost of inaction and helping spread investment cost (Stafford, Gorse and Shao, 2011). • Policymakers focussing only on new build, not retrofit, and Lack of regulation or incentives.
Awareness of social issues and energy efficiency	• Lack of concern (Webber, Gouldson and Kerr, 2015); Risk aversion from landlords; • Technical solutions ineffective alone, absent behaviour change (Urbed, 2016); • Official messaging too focused on financial savings (Energy Saving Trust, 2016); • Hard to follow advice, consumers required to be proactive in seeking advice and Lack of reliable information and advice (OPM, 2014)	• Designated role within the organization to plan and deliver EE; • Availability of advice and support to tenants, clarity of advice (OPM, 2014); • How to make energy efficiency seem relevant to residents' lives, Messaging focussed on warmth, reduction of draughts and mould and Householders' opinion of advice giver (Energy Saving Trust, 2016).
Quality and customer confidence	• Lack of confidence in suppliers (Webber et al. 2015); • Shortage of skills to carry out retrofit works (Vaughan, 2017); • Insufficient information on techniques and best practice for suppliers (Eames et al., 2016); • Loss of knowledge and skills between projects (Stafford, Gorse and Shao, 2011). • Insufficient training for operatives and suppliers and Lack of quality assurance schemes (Bonfield 2016).	• Create Information Hub and Data Warehouse (Eames et al., 2016); • Social housing projects drive innovation (Federation, 2016) • Create quality assurance schemes and systems of redress and Enhanced training and transferrable qualifications (Bonfield 2016).

It therefore seems apparent from the table above that there are no studies that report on the barriers and enablers of the financial, technical, regulatory, social, and quality categories in relation to UK social housing. Accordingly, this paper intends to seek stakeholder's views of the barrier and enablers within the context of London, UK social housing.

Methodological Steps

A qualitative approach based on semi-structured interviews and survey was used to identify the barriers and enablers for social housing retrofitting from the key stakeholders' point of view. The following methodological steps were therefore followed:

- **Interviews:** A set of interviews were conducted to understand stakeholder's view of the barriers and enablers of energy efficiency retrofitting in social housing , targeting a sample of 7 key London based professionals including; employed as sustainability consultant, development manager, and investment planning officer in companies like National consultancy, local authority, housing associations, and construction repairs & maintenance contractors
- **Ranking Survey:** Experts/professionals as such; consultants, contractors, large and small housing associations and local authorities were asked to rank the categories based on their perception. This approach is intended to corroborate and triangulate the findings from the literature and the interviews against the perception of Energy Efficiency Retrofitting for Social Housing experts based on the ranking generated by the survey.

These methodological steps will assist with developing an understanding of the stakeholder's perceptions of the barriers and enablers to energy efficiency retrofitting of social housing in London.

Data collection and analysis

This section explains how the methodology outlined above was put into practice to develop an understanding of Energy Efficiency Retrofitting challenges facing Social Housing from the perspective of key professionals.

INTERVIEWS

The semi-structured interviews assist the research in determining the barriers and enablers for each category, from the key professionals' perspective.

Profile of interviewees

The table below shows a summary of the interviewees' profiles, where 3 of the interviewees worked in National consultancies, 2 for a housing association, and others at the local authority. The interviewees mostly worked as sustainability managers or project managers with experiences ranging between 6 to 16 years, while being between at least 2 to 6 years in their current post.

Table 4 Interviewee Profile

Interviewee	Current employer	Job title & role	Time in post	Total experience (In Sustainability)
A	A national consultancy, working with SLs	Sustainability Consultant – consultancy and research for the housing sector	4 years	6-7 years
B	A local authority in London	Investment planning officer in the asset management section.	6 years	6 years
C	National consultancy. Seconded to social housing consultancy in Greater London	Energy consultant currently seconded as an engagement manager. Providing advice on domestic energy efficiency.	2.5 years	12 years
D	A housing association in London and Southeast England	Sustainability co-ordinator	3 years	More than 6 years
E	Construction, repairs and maintenance contractor in London	Energy and Innovation Commercial Manager in Sustainability Team. Works entirely on retrofit schemes and forward innovation in energy and efficiency	5 years	13 years
F	National construction, repairs, and maintenance contractor	Development support manager	4 years	16 years
G	A housing association in London and Southeast England	Project Officer. Overseeing the improvement of EPC ratings of employer's housing stock	5 years	More than 6 years

BARRIERS AND ENABLERS

Several studies from literature report on grouping the barriers and enablers into five most significant categories as shown in Table 3; however, the interviewees perceived IT and Disruption to residents as significant standalone categories, which resulted in identifying seven

main categories. This section, therefore, presents the interviewee's perceptions of the barriers and enablers for each of these categories, which include: financial matters, Technical, I.T, Government policy and regulation, social factors (including awareness of the energy efficiency agenda), quality of workmanship (including training for operatives and customer confidence) and other factors, as discussed below:

Financial

The interview results showed that 'Financial' issues are the biggest barrier. For example, interviewee A argued that *"The major barrier is definitely financial, and also again concerns about contractors' workmanship and quality of design and specification as well."* The rest of the interviewee's comments are summarised in Table 5a, highlighting the financial issues as barriers and enablers for retrofitting energy-efficient components in social housing.

Table 5a Financial Barriers

Barrier / enabler	Freq	Issue	Comments
Barrier	4		Financial is the biggest barrier
Barrier	4	1% rent cut	All participants were asked about this. 2 also stated it was not a barrier.
Barrier	4	Cuts and the difficult financial situation of SLs	Job losses, demoralization, lack of ambition and the difficulty of justifying EE in an era of cuts were consequences of this barrier
Barrier	4	The low level of grant funding	The levels of grant funding no longer trigger EERSH. Conversely, one participant did note that even low levels allow internal funding to stretch further.
Barrier	4	Split incentives between SLs and residents/ leaseholders	Landlords invest, but only residents see a financial benefit. Worse where leaseholders involved.
Barrier	3	The effort and complexity of obtaining grant funding	Lots of bureaucracy to obtain funding. Extra surveys, installations, and monitoring can be required. Some SLs do feasibility studies to determine if small amounts of grant funding justify the effort and expense. Conversely, one interviewee thought grant funding was not too difficult to obtain, and two opined the perception was worse than the problem.
Barrier	3	Hard to make a business case for internal funds	The perception that EE keeps on taking

Table 5a continued

Barrier / enabler	Freq	Issue	Comments
Enabler	4	Obtaining internal funding	Data needed to justify a request. Helps if the benefit to SL's balance sheet, or if EER brings in money, e.g. solar PV.
Enabler	3	Doing EER can benefit SLs financially	Research has indicated this. Explained, variously, by reduced voids, rent arrears, and maintenance costs.

Therefore, it can be concluded from Table 5a, that from the perception of key professionals, 1% rent cut, financial situations of SLs, low level of grant funding and split incentives between SLs and residents/leaseholders were considered as the most important barriers.

TECHNICAL

Some of the most highlighted technical issues of EERSH found from the interviews are the need for individual design, poor workmanship, and performance gap as described by Interviewee A: "*Definitely poor workmanship that would be one thing. Poor selection of products and in the worst cases not installing the specified products*.". Similarly, Interviewee E mentioned: "*I would say there are probably three elements you would look at. One aspect you would look at designs…. So, I would say design and client understanding is a really big one. On the back of that is budget …, so behavioural change is quite a difficult one, particularly in social housing. And maintenance is another one.*" The rest of the interviewee's comments are summarised in Table 5b, highlighting the technical issues considered as barriers and enablers for retrofitting energy-efficient components in social housing.

Table 5b Technical Issues

Barrier / enabler	Freq	Issue	Comments
Barrier	4	Need for individual design	SLs tend towards a one-size-fits-all approach
Barrier	3	The performance gap	Thermal bridging can cause this. One contractor noted reports of poor schemes could be due to poor commissioning and maintenance.
Barrier	3	Type and condition of the stock	Hard to treat properties are a barrier, easy to treat is an enabler. Stock in the poor structural condition is harder to retrofit. A wide range of stock types in the UK is a barrier; conversely, SLs tend to have large amounts of the same type. Victorian and solid wall properties are harder to treat.
Barrier	2	Need for individual detailing with EWI	Often where individual properties have had repairs and alterations

Table 5b continued

Barrier / enabler	Freq	Issue	Comments
Enabler	6	Integrating EE works with regular maintenance and other works.	Saves money, as does frequent boiler replacement. SLs often try to integrate with planned maintenance.
Enabler	3	Considering properties holistically.	One interviewee noted SLs often lack funds.
Enabler	2	Education to reduce the performance gap	It can be caused by residents not understanding EE measures fitted.

'Hard to treat properties' and 'the need for individual design' were ranked as the most important of these factors. This suggests that factors to do with 'building fabric' are viewed as more important. 'Effective co-operation' and 'co-ordination' were ranked least important. During the interviews, this point was raised more by contractors and consultants

IT

Interviewee E expressed his opinion of the importance and role of IT in energy efficiency retrofitting by stating that *"At a very high level then you are talking about stuff like Passive house and thermal bridging and the I-values, and you need to have quite a high-level experience, and quite highly trained people on the ITs (inaudible). On a basic level, if you are delivering large schemes and IT is more based around project management, moving forward they want, at least all government contracts to be BIM level 2 to move towards BIM level 3. But that has not picked up that much at the moment."*

The rest of the interviewee's comments are summarised in Table 5c.

Table 5c IT issues

Barrier / enabler	Freq	Issue	Comments
Barrier	3	BIM would not have an effect	Interviewees though it relates more to new build than retrofitting
Enabler	5	Good stock condition database	Interviewees noted, inter alia, an energy module and integration of EPC/SAP data is especially beneficial and helps build the business case
Enabler	3	Good I.T. systems in general	
Enabler	3	BIM	
Enabler	2	Modelling software	These can be useful. The Crohm program used by Re: New was regarded as good by one interviewee

The responses show a clear view that the availability of data - stock condition and Standard Assessment Procedure (SAP) data, are the most crucial factors. SL's data management skills can be viewed as integral to these factors. The availability of relevant programs – modelling software and Building Information Modelling (BIM) are viewed as much less important than the availability of data.

Government Policy and Regulations

Issues related to government policy and regulations for EERSH can be witnessed through the statement of Interviewee *D "I know there are pieces of legislation, as I say they keep chopping and changing and either getting rid of things altogether or if not, reducing them down so much so, like the FIT, which is not financially viable anymore"*. Interviewee D further commented on changes to Eco and government incentives by stating that *"ECO, directly, I haven't had much involvement in, but second hand through Axis. I think they found it quite frustrating, but I know there is a new round of funding at the moment, or there will be soon". Similarly, interviewee A stated: "I can't think of any policies to do with energy efficiency. There is one for private landlords….The government can choose to do it in different ways. It can choose just to ignore domestic emissions, and just focus on industrial and commercial, but obviously, they will do something for housing, but no-one knows what yet. So, we are just on standby right now to see what comes off the back of it"*.

The rest of the interviewee's comments are summarised in Table 5d, highlighting the 'government policy' and 'regulation issues' considered as barriers and enablers for retrofitting energy-efficient components in social housing.

Table 5d Government policy and regulation Issues

Barrier / enabler	Freq	Issue	Comments
Barrier	6	The start-stop nature of Government schemes	There is no longer trust in Government schemes after the repeated changes to ones such as ECO, GD, FIT, etc. which were major funding streams for EER. The changes prevent contractors from upskilling and investment in the supply chain.
Barrier	6	The difficulties caused by SLs having leaseholders under the right to buy	This limits SLs options when carrying out EER. The consultation process is lengthy and complicated. The 'patchwork quilt' effect of upgraded and un-upgraded properties has thermal and aesthetic implications
Barrier	4	The changes to ECO	These changes, in particular, have damaged EER and the supply chain
Barrier	3	The failure of the GD	
Barrier	3	Lack of compulsory national targets for EE standards	Legal requirements force organizations to fund EE. The EE(PRP) R 2015 is seen as valuable. The lack of an equivalent for the social sector is a barrier

Table 5d continued

Barrier / enabler	Freq	Issue	Comments
Barrier	3	Insufficient government incentives to EER	This would drive change
Barrier	3	Lack of policies and confused policymaking	Not enough being done by the government
Enabler	4	The 'Energiesprung' approach	This large-scale upgrade program developed in the Netherlands and being piloted in the UK. Has economies of scale and, crucially, increases the value of SLs' stock
Enabler	4	Policy regarding grant funding	Funding has been helpful. CERT and CESP helped. Two interviewees opined that more grant funding was needed, and one mentioned the use of infrastructure funding for EER
Enabler	3	The changes to ECO	Conversely, some interviewees believed there had been some positive changes to ECO and that it is effective at encouraging EERSH.
Enabler	2	Bonfield Review	Both contractors interviewed thought this was beneficial and was a step in the right direction. Conversely, one consultant had a low view of it and thought it a missed opportunity
Enabler	2	Local policies to encourage EER	Re: New and the London plan mentioned as good examples

The start-stop nature of Government schemes and the difficulties caused by SLs having leaseholders under the right to buy was ranked as the most important of these factors.

Social Factors and awareness of energy efficiency

Interviewee B highlighted the resistance and concerns related to energy efficiency retrofitting by stating *"Generally people welcome it as a good thing, but you know, it depends on the measure, it depends on the context, you will have, you might have a block with 20 residents, who look at doing (solid wall insulation?), you know 18 residents will be quite happy that they are, you know, the block is being given a new façade, you know, a new look, but you will have a couple of residents who just don't want the work because they may not want the disruption ….., it is a mixed picture."*. However, regarding the concern and demand of residents for energy-efficient retrofitting Interviewee D stated: *"I think they are interested, but they don't bombard me with requests and calls for support …. if they are struggling to pay their bills. They are always interested to learn ways in which they could help themselves reduce their bills etc."*

The rest of the interviewee's comments are summarised in Table 5e, highlighting the 'Social factor' and 'awareness issues' considered as barriers and enablers for retrofitting energy-efficient components in social housing.

Table 5e Social Factors and awareness issue

Barrier / enabler	Freq	Issue	Comments
Barrier	5	The balance of concern for fuel poverty vs. carbon reduction	Three interviewees thought fuel poverty was a major concern. Another thought the balance changes at different times, with another saying they were an equal concern. One interviewee thought they could not be addressed separately, and another thought they can conflict.
Barrier	4	Lack of concern from SLs	Fabric is a higher priority; EE is 'nice to have' not essential, a lack of awareness of the benefits to SLs of EE works
Barrier	3	Low social and national concern re EE	Not taken seriously at the national level and awareness has gone down recently
Barrier	2	Low levels of concern and awareness amongst SLs leaseholders	
Barrier	2	Resistance to works by residents	Some fear central heating will be more expensive to run or do not like changes to buildings' appearances.
Enabler	6	Concern from SLs	There is plenty of concern regarding EE, especially in terms of fuel poverty, lots of discussion of EE, having board-level buy-in and general concern is an enabler. Some SLs have targets.
Enabler	5	Support and advice for SLs re EE	Available from contractors, consultants, and other organizations. Interviewees broadly considered this sufficient, with room for improvement. One interviewee wished for more help with obtaining funding
Enabler	5	Demand from residents for EE works	Opinions varied on the reasons for this. Some participants thought financial reasons were more important, others that occupant comfort was the bigger issue. Some observed a preference for measures such as double glazing or loft and cavity insulation. The characteristics of buildings affected the demand for change from residents.

Table 5e continued

Barrier / enabler	Freq	Issue	Comments
Enabler	4	Providing advice to residents	Improves the effectiveness of works done. It is a low cost.
Enabler	3	Knowledge sharing between SLs	Various forums for this

Quality and Customers confidence

Issues related to quality and customers' confidence for energy efficiency retrofitting for social housing can be witnessed through the statement of Interviewee E "*I would say it is just as bad. Probably 2 years ago, because of the Green Deal, everyone thought it was something to get into, so you got a rush of trained people. Whether or not they are of particularly good quality is difficult, but in theory that is what the PAS 2030 was supposed to help with, but certainly before and now, a lot of the companies have gone out of business, so there is a lot smaller market it is probably better than the building industry as a whole, because it was so specialized, for a little while, and there is obviously not as many projects coming up.*". The rest of the interviewee's comments are summarised in Table 5f, highlighting the 'quality' and 'customer confidence' issues considered as barriers and enablers for retrofitting energy.

Table 5f Quality and Customers Confidence Issues

Barrier / enabler	Freq	Issue	Comments
Barrier	5	Shortage of skilled operatives	This varies with time and place and the measures being installed. The role of contractors in helping to develop this was mentioned, as was the role of the central government. Requiring PAS 2030 standard from subcontractors drives upskilling.
Barrier	5	SLs' ability to manage projects	Lack of staff, resources, and skills to effectively monitor works is a barrier. Two interviewees mentioned the overall lack of people with skills in EE and contract administration. One contractor state that the project is 'as good as the client.' One interviewee disagreed and believed SLs do have the skills needed.
Enabler	4	Availability of competent contractors	This split opinion – four interviewees thought there were sufficient, whereas two thought there is a problem. The need for due diligence to avoid problems was raised by two interviewees.

Table 5f continued

Barrier / enabler	Freq	Issue	Comments
Enabler	2	Contractors and consultants assisting clients with project management	Helps fill the skills gap

Other Factors

In addition to the above-mentioned categories that have been mentioned by the literature, the interviewee mentioned other factors that form barriers to energy efficiency retrofitting, which include 'disruption to residents' and 'concerns raised by Grenfell Tower fire'.

Table 5g Other Factors

Barrier / enabler	Freq	Issue	Comments
Barrier	6	Disruption to residents	Residents can oppose works due to actual or perceived disruption. Residents can refuse access to allow works. Residents' low concern for EE can lead them to refuse access. Communication and advance notice help this.
Barrier	5	Grenfell Tower fire	Has discouraged retrofitting and led to cancellation/suspension of some projects. Interviewees expressed views such as the need for improved communication with residents, reviews of Building Regulations, and trust-building with the public to overcome such problems.

Moreover, to improve the reliability of the findings gained through interviews, a ranking survey was constructed to aid corroborating and triangulating the opinions of energy efficiency retrofitting experts. The survey also determines the most significant issues already identified from literature and interviews, which will be discussed in the next section.

RANKING SURVEY

To understand the relative importance of the categories of barriers and enablers found from the literature and validated through semi-structured interviews, professionals were asked to rank these categories. For ease of interpretation, the ranking of the categories has been displayed graphically in Figure 2.

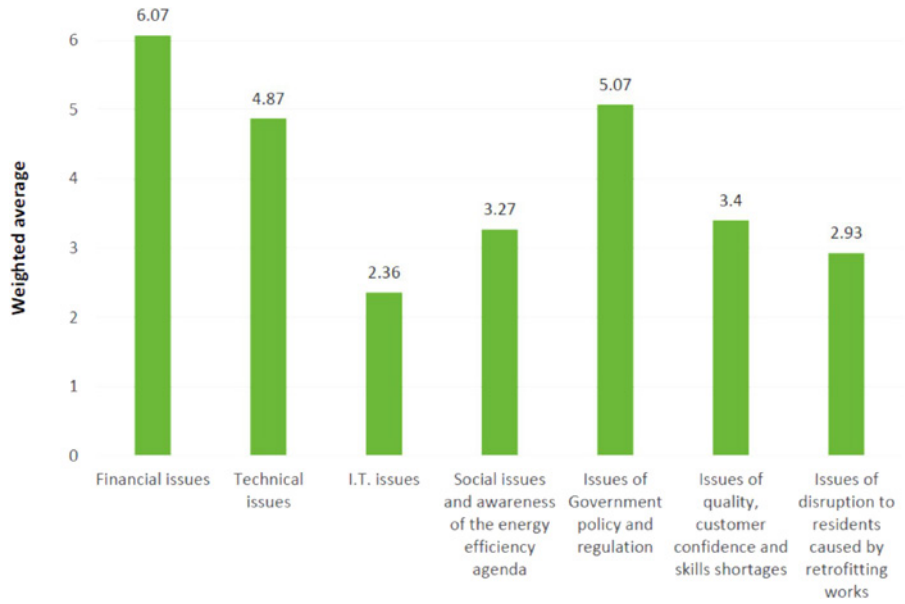

Figure 2 Weighted average rankings for survey data the categories of barriers and enablers

Furthermore, for a better understanding of the data collection and analysis phase, a corroborated and triangulated analysis are summarised in Table 6. The table summarises the ranking survey's results, linking categories' ranks with the three most important ranking factors in each category. This provides a useful summary from which conclusion can be drawn.

Table 6 The most prominent barriers to EERSH by category

Rank	Category	Weighted average	Sub-category	Rank	Weighted average
1	Financial	6.07	Low level of grant funding	1	3.64
			1% rent cut	2	3.21
			The business case for internal funds	3	3.13
2	Government policy and regulation	5.07	Lack of compulsory national targets	1	4.00
			Repeated changes to policy & initiatives	2	3.71
			Level of Government engagement	3	3.00
3	Technical issues	4.87	Hard to treat properties	1	4.00
			Individual design for different properties	2	3.53
			Age and condition of SL's stock	3	2.71

Table 6 continued

Rank	Category	Weighted average	Sub-category	Rank	Weighted average
4	Quality and customer confidence	3.40	Ability to find competent subcontractors	1	3.67
			Ability to find competent contractors	2	3.60
			SLs' having skills to manage EE works	3	2.80
5	Social and awareness of EE	3.27	Society's level of concern re EE	1	3.93
			Residents' level of concern re EE	2	3.87
			SLs' level of concern re EE	3	3.27
6	Disruption to residents	2.93	Disruption	1	3.00
			n/a	2	-
			n/a	3	-
7	I.T.	2.36	Stock condition data	1	4.13
			Availability of SAP data	2	3.47
			SL's data management skills	3	3.14

Therefore, the most prominent findings that have been identified in relation to energy efficiency retrofitting are summarised below:

- Issues of finance, technical difficulties, and issues of government policy and regulation are considered the most significant barriers and enablers to EERSH.
- The low level of social concern for environmental and EE issues is a barrier to EERSH and the wider EE agenda.
- Government policy, while being deficient in many areas, has had considerable success in encouraging EERSH, notably through ECO and its predecessors, CERT and CESP and the Decent Homes Initiative.
- Government support and attention in terms of compulsory national targets for EERSH, potentially mirroring EE(PRP)R 2015, would drive change and are looked upon favourably by EERSH professionals.
- Repeated changes in Government policies, especially reduction/removal of promised funding streams (ECO, GD, FIT), have eroded trust and hampered development in the supply chain.
- Low levels of grant funding, including reductions to ECO, are regarded by most professionals in the field as a significant barrier to EERSH.

- The 1% rent cut is having a significant impact on SLs business plans, complicating their ability to carry out EERSH.
- Hard to treat properties are a significant barrier. This is an increasing problem as the 'low hanging fruit' of easy to treat properties are upgraded.
- Overall, there is not a great concern at the availability of competent contractors or the ability of SLs to manage works; however, continuing development is needed.
- The availability of good quality stock condition and SAP data is critical for SLs to target investment.

Conclusion

This paper has developed an understanding of retrofitting for social housing and its common measures. Government initiatives that integrate energy efficiency retrofitting in social housing have also been reported from literature, which showed that despite the numerous efforts and initiatives that have been taken, there still seems to be a lack of energy-efficient retrofitting in social housing in the UK. This paper has, therefore, targeted key stakeholders from the social housing industry to get a deeper insight into the barriers and enablers for retrofitting in the sector. The study concluded that 'financial' and 'government policy' barriers were the greatest barriers facing retrofitting for social housing.

Based on the above findings, the following recommendations can be made for key stakeholders within the Social Housing sector, to enable a more efficient and effective retrofitting.

- Introduction of legally binding national EE targets for the SH sector.
- Much greater stability in Government policies and funding.
- More grant funding for EE works.
- Developing better and more innovative ways of funding and retrofitting hard to treat properties, especially ones with solid walls.
- Research into innovative solutions for hard to treat properties.
- Research into the financial benefits to SLs of implementing EER to help make the business case for internal funds.

Although the problem of energy efficiency retrofitting in social housing has been addressed to some extent by this scoping study, future research intends to focus on a wider sample of stakeholders across the UK with more sophisticated data analysis techniques such as Delphi and Analytical hierarchy process (AHP), to increase the reliability and validity of the results and aid the stakeholders (decision-makers) to prioritize their efforts to overcome the barriers highlighted by this study.

References

Arends, L. and García-Almirall, P., 2014. A comparative view of social housing in Europe. The case of Barcelona and London. *Architecture, City and Environment*, 9(26), pp.177-200.

Bonfield, P., 2016. *Each Home Counts: An Independent Review of Consumer Advice, Protection, Standards and Enforcement for Energy Efficiency and Renewable Energy*. online: UK Department of Energy and Climate Change.

Change, C.o.C., 2016. *UK climate action following the Paris Agreement*. London.

Davidson, M., Nicol, S., Roys, M., Garrett, H., Beaumont, A. and Turner, C., 2012. *The Cost of Poor Housing in Northern Ireland*: IHS BRE Press.

Eames, M., Dixon, T., Lannon, S.C., Hunt, M., De Laurentis, C., Marvin, S., Hodson, M., Guthrie, P. and Georgiadou, M.C., 2014. Retrofit 2050: critical challenges for urban transitions, page 2 Available at: http://centaur.reading.ac.uk/36187/1/critical%20challenges%20briefing-March%202014.pdf [Accessed at 13 May 2017]

Eames, M., Dixon, T., Lannon, S., Hunt, M., De Laurentis, C., Marvin, S., Hodson, M., Guthrie, P. and Georgiadou, Jones B (2016) The Bonfield Review: Better late than never? [online]. Available at: http://www.sustainablehomes.co.uk/the-bonfield-review-better-late-than-never/ [accessed 13 May 2017]. Energy Saving Trust, 2016. *Connecting with homeowners: making energy efficiency relevant UK Pulse Report*. London.

Federation, N.H., 2016. *Taking Stock – Understanding the quality and energy efficiency of housing association homes*. London: National Housing Federation.

Fitzpatrick, S. and Pawson, H., 2007. Welfare safety net or tenure of choice? The dilemma facing social housing policy in England. *Housing Studies*, 22(2), pp.163-82. https://doi.org/10.1080/02673030601132763

House of Commons, 2016. *Home energy efficiency and demand reduction Fourth Report of Session 2015–16*. London: House of Commons Energy and Climate Change Committee.

Kleinman, M.P., 1988. Where did it hurt most? Uneven decline in the availability of council housing in England. *Policy & Politics*, 16(4), pp.221-33. https://doi.org/10.1332/030557388782454939

Leal Filho, W., Brandli, L., Kuznetsova, O. and Paco, A., 2016. *Integrative approaches to sustainable development at university level*. Switzerland: Springer.

Lux, M. and Sunega, P., 2014. Public housing in the post-socialist states of Central and Eastern Europe: Decline and an open future. *Housing Studies*, 29(4), pp.501-19. https://doi.org/10.1080/02673037.2013.875986

Ofgem, 2017. *About the Domestic RHI* [online]. Available at: https://www.ofgem.gov.uk/environmental-programmes/domestic-rhi/about-domestic-rhi [Accessed 2020].

OPM, 2014. *Warm Home Discount - Energy Advice Consumer Experiences - Report to Ofgem*. London.

Opoku, A. and Guthrie, P., 2018. The Social Value Act 2012: current state of practice in the social housing sector. *Journal of Facilities Management*, 16(3), pp.253-68. https://doi.org/10.1108/jfm-11-2016-0049

Palmer, J. and Cooper, I., 2013. *United Kingdom Housing Energy Fact File 2013*. London.

Provan, B. and Brady, A.M., 2015. *Energy Plus: Energy Efficiency in Social Housing CASEreport 89*. London: CASE London School of Economics and Political Science.

Solomon, S., Qin, D., Manning, M., Marquis, M., Averyt, K., Tignor, M.M.B., LeRoy Miller Jr, H. and Chen, Z., eds. 2007. *Climate change 2007-The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the IPCC New York: Cambridge University Press.

Stafford, A., Gorse, C. and Shao, L., 2011. *The Retrofit Challenge: Delivering Low Carbon Buildings*. York, UK.

The Green Age, 2017. Re: The Green Deal is back in 2017! Available at: https://www.thegreenage.co.uk/the-green-deal-is-back/ [Accessed 19 June 2017].

Urbed, 2016. *Retrofit Factfile - A short summary of facts and publications relevant to domestic retrofit*. Manchester, UK.

Vaughan, A., 2017. Re: 5 Barriers to Retrofit. *tracing green* [online]. Available at: http://tracinggreen.uk/technology-construction/5-barriers-retrofit/ [Accessed 15 February 2017.

Webber, P., Gouldson, A. and Kerr, N., 2015. The impacts of household retrofit and domestic energy efficiency schemes: A large scale, ex post evaluation. *Energy Policy*, 84, pp.35-43. https://doi.org/10.1016/j.enpol.2015.04.020

Weisselberg, D., 2015. Re: The Retrofit Performance Gap - Sustainable Homes Conference. *Bristol Green Doors* [online]. Available at: http://www.bristolgreendoors.org/blog/retrofit-performance-gap-sustainable-homes-conference.