



AUTHOR(S):

TITLE:

YEAR:

Publisher citation:

OpenAIR citation:

Publisher copyright statement:

This is the _____ version of proceedings originally published by _____
and presented at _____
(ISBN _____; eISBN _____; ISSN _____).

OpenAIR takedown statement:

Section 6 of the "Repository policy for OpenAIR @ RGU" (available from <http://www.rgu.ac.uk/staff-and-current-students/library/library-policies/repository-policies>) provides guidance on the criteria under which RGU will consider withdrawing material from OpenAIR. If you believe that this item is subject to any of these criteria, or for any other reason should not be held on OpenAIR, then please contact openair-help@rgu.ac.uk with the details of the item and the nature of your complaint.

This publication is distributed under a CC _____ license.



PLEA 2017 EDINBURGH

Design to Thrive

UK Government's Household Energy Efficiency Incentives and Social Housing Organizations' Perspective on Energy Efficiency Retrofit

Suraj Paneru¹, Amar Bennadji¹ and David Moore¹

¹The Scott Sutherland School of Architecture & Built Environment, Robert Gordon University, Aberdeen, United Kingdom

Abstract: The research looked at Social Housing organization's (SHO) perspective on energy efficiency retrofit criteria/benefits. Using Analytic Hierarchy Process (AHP) based questionnaire, research looked at importance given by SHO to overall criteria/benefits of energy efficiency. It was found that fuel poverty reduction, tenant health and environmental and climate change issue are given highest importance respectively by SHO while meeting government target and financial benefit to SHO has been the least priority in comparison. Looking at the consistency line, fuel poverty reduction is given higher importance by SHO although there is inconsistency in importance given whereas financial benefit to the landlord is given lower importance and also has very high inconsistency in importance given. Better understanding SHO ranking on various retrofit benefit will help policy makers to deliver better energy efficiency retrofit incentives/policies. It will also help SHO to make informed decision on their own retrofit project by visualizing and quantifying their own qualitative ranking of various benefit priorities.

Keywords: energy efficiency retrofit, SHO, AHP, benefits ranking, energy efficiency incentives

Introduction

Background of the research

According to Department of Energy and Climate Change (DECC) report household energy use (excluding transport) accounts for 27% of total energy use in the UK (Department of Energy and Climate Change 2015). There are now 27.9 million dwellings in England, Scotland, Wales and Northern Ireland (Department for Communities and Local Government 2015), but only around 160,000 new homes are built each year, and far fewer homes are demolished (Jason Palmer 2013). Since the household energy use accounts for more than a quarter of the total energy use, this sector has been taken as a major area to focus by the UK in order to cut carbon emission. UK government has identified the energy efficiency of the property (and therefore, the energy required to heat and power the home) as one of the drivers of fuel poverty. So, apart from carbon emission reduction issue, household energy efficiency is also related to reducing fuel poverty.

In Scotland the Climate Change (Scotland) Act 2009 (*Climate Change (Scotland) Act 2009*) sets an interim target of a 42% reduction in emissions (compared to 1990) by 2020, and an 80% reduction target for 2050, with annual targets set in secondary legislation. To achieve this goal Scottish government has Energy Efficiency Standard for Social Housing (ESSH) standard which the social landlords are expected to achieve by 2020 (GOV.SCOT 2016). According to the Scottish government the ESSH will support the social housing sector to lead

the way in the reduction of energy use and greenhouse gas emissions, help address fuel poverty levels in the social housing sector and help in achieving the Scottish Governments commitment to ensure that no-one in Scotland has to live in fuel poverty, as far as practicable by 2016.

According to (MILIN and BULLIER25 January 2011) lack of adapted funding is a major barrier to the energy retrofitting of social housing in Europe. Cost is playing central role in the social housing retrofit and there are various funding scheme which are focused on various criteria such as fuel poverty reduction, tenant health, environmental and climate change etc. are available (GOV.SCOT 2014) for the Social Housing Organization (SHO).

Research Question

The policies or incentives from UK and Scottish government are meant to help accelerate the retrofit in social housing sector, however, at the same time incentives are also one of the key factors/variables which influence the cost dynamics of the energy efficiency retrofit, the research looked at importance given by SHO to overall criteria/benefits of energy efficiency retrofits and criteria supported by government incentives. By looking at importance given by SHO to various benefits we can understand how and on what basis SHO make retrofit decision. This will be very important step towards understanding SHO perspective on energy efficiency retrofit.

Research Aims and objectives

The research aims to understand the SHO perspective on energy efficiency retrofit criteria/benefits. Better understanding SHO ranking on various retrofit benefit will help policy makers to deliver better energy efficiency retrofit incentives/policies. It will also help SHO to make informed decision on their own retrofit project by visualizing and quantifying their own qualitative ranking of various benefits.

Literature Review

Social housing and energy efficiency retrofit in Scotland

Green retrofit means “conducting interventions that would make buildings more “sustainable” and more “smart”, in terms of indoor environment quality, use of water, maintenance operations, energy uses control” (Filippi, 2015). In Scotland Social housing means mainly the housing provided by the Housing Associations, Registered Social Landlords (RSL) and Local Authorities. According to (GOV.SCOT2015), “Housing associations/RSL are societies, bodies of trustees, or companies established for the purpose of providing housing accommodation on a non-profit making basis. They also provide housing for special groups such as the aged, disabled, single persons, or housing on a mutual or self-build basisare heavily engaged in the regeneration of inner city areas through both rehabilitation and new building and Local Authorities housing means Dwellings owned by 26 of the 32 local authorities for social rent, i.e. Council housing”.

There are 2,508,000 houses in Scotland among which 596,000 (23.8%) are socially rented/ social housings (GOV.SCOT2015). Apart from being significant number, social housing is particularly important because the tenants living in the housing are mainly old age, low income and vulnerable by some means. Due to the tenant type, the retrofit of these houses are important and challenging. Social housing sector largely depends on the grants/incentives from the UK and Scottish government for its retrofit projects. And the SHO retrofit

investments are mainly driven by government legislation and SHO's duty to provide housing in modern/current standards.

Apart from providing housing to special need population of the society, the social housing sector also involves in retrofitting to maintain property, reduce energy consumption, and reduce fuel poverty and the emission of greenhouse gases. Retrofit is important obligation to SHO because the sector targets to make a significant contribution to reducing carbon emissions by 42 per cent by 2020 and 80 per cent by 2050 in line with the requirements set out in the Climate Change (Scotland) Act 2009 (*Climate Change (Scotland) Act 2009* 2009).

Energy efficiency incentives and social housing sector

When we look at the major household energy efficiency incentives in the UK in past 5 years (*Energy Act 2013*), (*EST 2015b*), (*Energy Act 2011* 2011), (*Energy Act 2010* 2010), (*The Home Energy Assistance Scheme (Scotland) Regulations 2009* 2009), (*Climate Change (Scotland) Act 2009* 2009), (*ofgem 2015b*), (*ofgem 2015a*); it shows that there is 'lack of political sustainability' (Lockwood, 2013) in energy policy and climate strategy which has led to series of new energy act, energy efficiency incentives, closure of the incentives within short period after launch and changes in the incentives many times a year. Policy makers and politician often consider popularity of the initiative rather than its sustainability, which is one reason there are so many changes and confusion. (Watson et al.) conclude that here is a need to move beyond narrow framings of public attitudes. Because all this frequent changes might be causing uncertainty in the retrofit market, failures of the programmes and search for new initiatives or more changes in the initiative.

Green Deal and ECO are the major household energy efficiency initiatives of the UK government that focus on the improving energy efficiency of the building via various installations and improvements. After the launch of Green Deal in 2012, and ECO in 2013 the initiatives saw series of changes and announcements. Green Deal, which is a market based framework, became a failure and this reached a point in November 2014, Green Deal Finance Company had to be bailed out due to very little sale of Green Deal plan.

The ECO has now been extended to September 2018 with some important amendment including; local authorities given role in determining eligible homes, Affordable Warmth scheme extended to SHO energy performance certificate (EPC) band E, F or G (*The Electricity and Gas (Energy Company Obligation) (Amendment) Order 2017* 2017). Social housing sector which are largely dependent on these incentives for the retrofit of their housing sector, therefore this type of changes and focus of incentive will have direct effect on SHO.

(Pennycook, 2007), (Martin and Gold1999), (Power, 2008) and (Ward1994) have mentioned about various benefits of retrofit. Combining those retrofit benefits, the focus of government incentives and the list of funding available for SHO housing retrofit (GOV.SCOT 2014), the following major retrofit benefit/criteria for SHO can be listed;

- Economic benefits to broader society
- Environmental and climate change benefits
- Financial benefits to the landlord
- Fuel poverty reduction
- Historical and preservation
- Meeting government regulation

- Tenant health
- Tenant satisfaction

Narrowing down/ generalising the various benefits makes it easy for research to compare wider range of benefits and in application level it also helps to SHO to understand their own key interest and focus on the available government funding incentives based on that. This also helps them to prioritise retrofit project on certain criteria and apply/get funding eligible for that criteria.

Research Methodology

Introduction

Based on the principle of Analytic Hierarchy Process (AHP) method the questionnaire was designed to generate the average weighting/ranking of various benefits/criteria of energy efficiency retrofit. In AHP, the decision maker carries out simple pairwise comparison judgments which are then used to develop overall priorities for ranking the alternatives (Saaty and Vargas, 2012). By adapting this method the research is able to identify the priorities of energy efficiency retrofit benefit/criteria within SHO.

For the purpose of quantifying participant's qualitative thinking process, the following fundamental AHP scale was used.

Table 1: AHP scale used in questionnaire

INTENSITY OF IMPORTANCE	DEFINITION	EXPLANATION
1	Equal importance	Two criteria contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favour one criteria over another
5	Strong importance	Experience and judgment strongly favour one criteria over another
7	Very strong or demonstrated importance	A criteria is favoured very strongly over another; its dominance demonstrated in practice
9	Extreme importance	The evidence favouring one criteria over another is of the highest possible order of affirmation
2,4,6,8	These are intermediate scales between adjacent judgements	
RECIPROCAL OF ABOVE	If criteria i has one of the above nonzero numbers assigned to it when compared with criteria j, then j has the reciprocal value when compared with i	If the criteria has lower value than compared criteria

Questionnaire Design

Questionnaire for this research was designed based on the literature review. Above mentioned eight benefits of retrofit were listed on the table both on row and column and they were compared with each other.

The participants were briefed that their goal was to carry out a refurbishment project within their housing stock. And eight benefits on the table were presented as the criteria they have to meet to fulfil the overall goal of the project. And they were asked to compare each criteria with rest and give it scale to show what their preferred criteria among the pair was. This was continued until every benefit was compared with rest.

Participants were asked how they compare the benefits of energy efficiency/thermal retrofit pairwise. And asked them to mark benefits 1-9, where, 1 is - two benefits being of equal importance and 9 is - one being extremely important than other benefit.

During the time participant filling questionnaire researcher was present there and helped them with use of scale and comparison. Presence of researcher worked as catalyst to transform participant’s qualitative measurement and comparison of two benefits into quantitative scale and weighting.

Sample data selection

The data sample was selected randomly from the professionals from Scottish SHOs. Among of 11 SHO representative’s responses, 2 were abandoned because of ambiguous response and 9 responses are used in the research. The job title of the participant are: Director, Housing Officer, Board Member, General Manager and Tenancy Support Officer. So, the research has representation of not just decision makers but also the operators who have everyday face to face reaction with the tenants and building stock.

These participants are the representative of Housing Association, housing, care and property-management group which own and/or manage over 63,000 housing stock in Scotland. As the participant range from the highest level to operational level, this seemingly small sample is a quality representation of the SHO in Scotland.

Results

The result of the questionnaire has been analysed on following two basis:

- Average importance given to the benefits
- Continued importance / consistency of importance

Average Importance

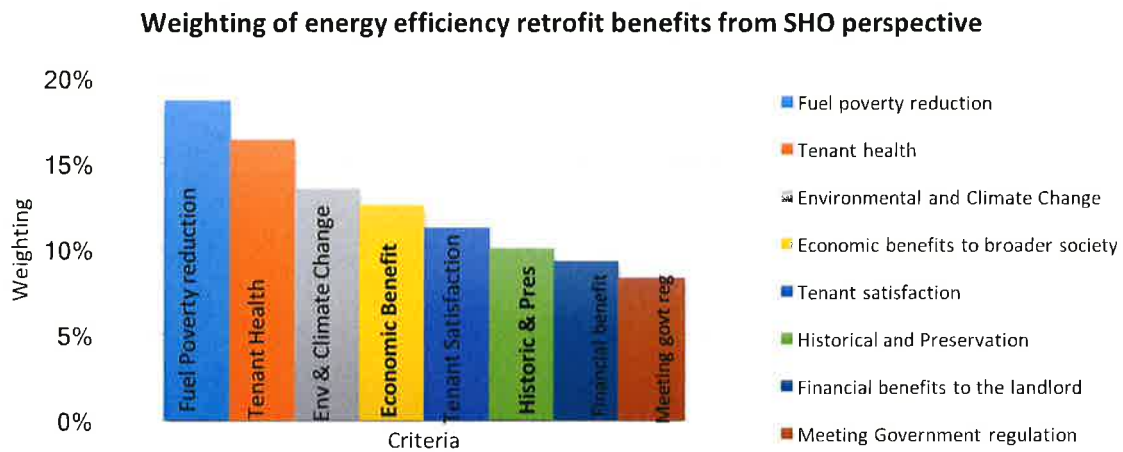


Figure 1: importance/weighting given to each criteria/benefits

Figure 1 shows that in average, participants gave highest importance to fuel poverty reduction followed by tenant health and environmental and climate change issues, whereas the lowest importance was given to meeting government target. Historical and preservation issues and financial benefits to the landlord were also given less importance

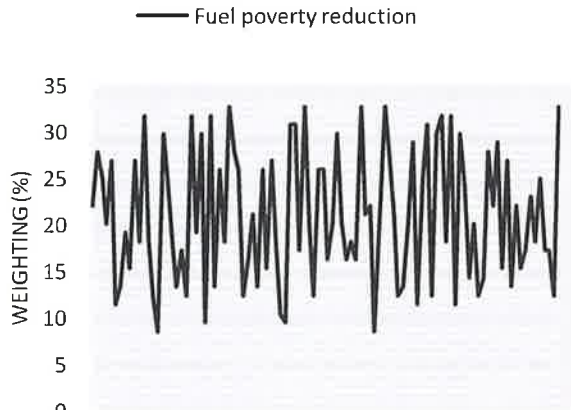


Fig. 2 A



Fig. 2 B

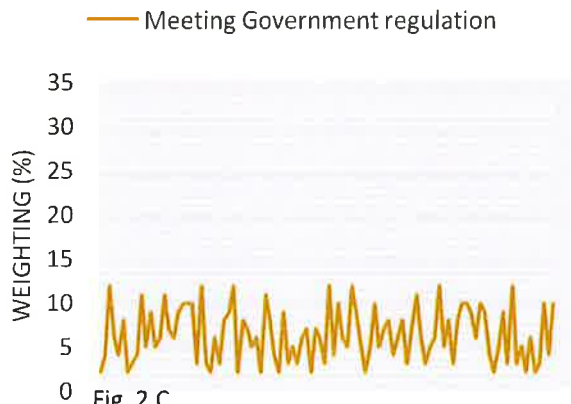


Fig. 2 C

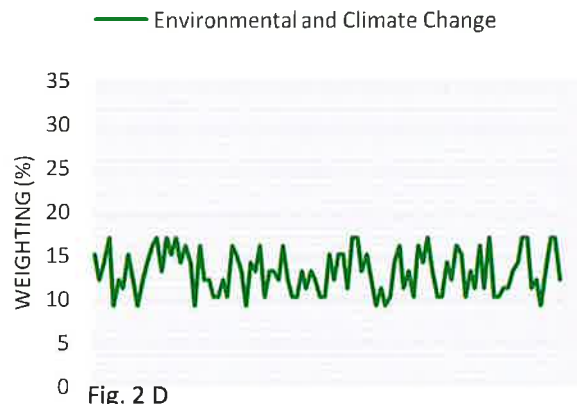


Fig. 2 D

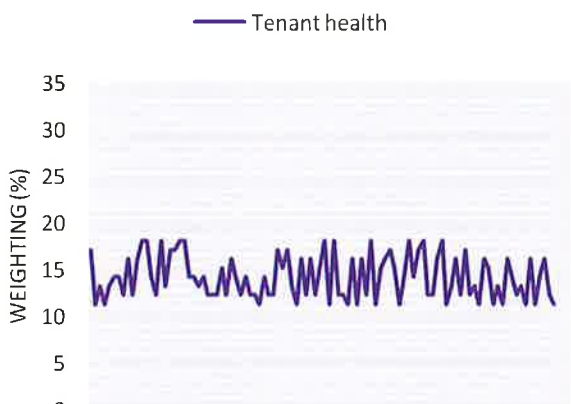


Fig. 2 E



Fig. 2 F

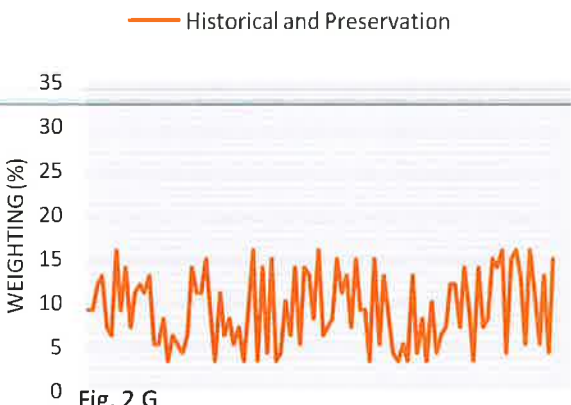


Fig. 2 G

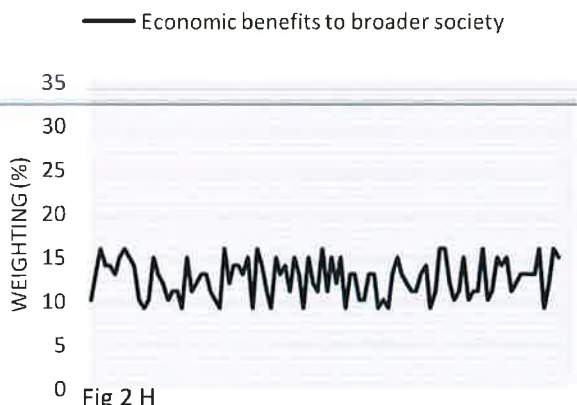


Fig. 2 H

Figure 2: Consistency of importance given by SHO to the benefit/criteria of energy efficiency retrofit

Continued importance / consistency of importance

To look at the continuity of the importance given to each criteria, using Monte Carlo simulation method, one hundred random weighting samples were generated in excel based on the actual weighting each participant gave to the criteria. And the random samples were used to produce graphs (figure 2).

In figure 2, greater vertical movement of the lines means higher inconsistency and the lesser vertical movement of the line means higher consistency of importance.

Figure 2 A shows that there were highest inconsistency in the importance given to fuel poverty reduction (8%-33%) followed by Figure 2 B, financial benefit to the landlord (1%-17%) and Figure 2 G, Historical and Preservation (3%-16%). This suggests the importance of those three benefits largely vary depending on the social landlord and SHO's tenant type or the area SHO operates. In contrast, environmental & climate change benefits (Figure 2 D), tenant health (Figure 2 E) and tenant satisfaction (Figure 2 F) are given very consistency importance (respectively; 9%-17%, 11%-19%, and 8.24%-13%) by all participants. This suggests that those three benefits are very important to all social landlords.

Discussion and Conclusion

From the average weighting of benefits (Figure 1) we can conclude that fuel poverty reduction, tenant health and environmental and climate change issue are given highest importance respectively by SHO while meeting government target has been the least priority in comparison. This gives a picture of how SHO look at the energy efficiency retrofit issue and what is their priority when making retrofit decision. Considering one example of Scottish government's target (GOV.SCOT 2015) (to eradicate fuel poverty by 2016) being unsuccessful, this result suggests there is more need for SHO and government to understand each other's priority and ways of working together towards achieving the same goal.

Looking at the consistency line (Figure 2), although both fuel poverty reduction line and financial benefit to the landlord line have greater vertical movements, fuel poverty line has vertical movement mainly concentrated above 15 % weighting in contrast the financial benefit to the landlord line has vertical movement concentrated below 15% weighting. This clearly suggests that fuel poverty reduction is given higher importance by SHO although there is inconsistency in importance given whereas financial benefit to the landlord is given lower importance and also has very high inconsistency in importance given.

Based on the result, following three criteria/benefits can be seen given both higher importance and higher consistency from the SHO.

- Benefit arising from tenant health
- Benefit from fuel poverty reduction
- Benefit from environmental and climate change impact reduction

Although targets set by government regulation such as EESSH and SHO priorities are basically the same about retrofit criteria, the above result suggests SHO perspective on government regulation is not consistently positive when compared to other criteria such as tenant health and tenant satisfaction. This could be mainly because the responsibility of SHO is focused on providing housing for special groups such as the aged, disabled, single persons etc. So it is important to further explore tenant views on those priorities and find common grounds where SHO's priorities and tenant priorities are mutually addressed by government policy and incentives and all three parties have common goals.

References

- Climate Change (Scotland) Act 2009 2009.
- DEPART OF ENERGY AND CLIMATE CHANGE, 2015. Energy consumption in the UK (2015). [online] London: DECC. Available from: <https://www.gov.uk/government/statistics/energy-consumption-in-the-uk> [Accessed 09/24 2015]
- DEPARTMENT FOR COMMUNITIES AND LOCAL GOVERNMENT, 2015. Live tables on dwelling stock (including vacants). [online] UK: Department for Communities and Local Government. Available from: <https://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants> [Accessed 24/09/2015 2015]
- Energy Act 2010 2010.
- Energy Act 2011 2011.
- Energy Act 2013. c.32.
- EST, 2015b. Green deal. [online] Available from: <http://www.energysavingtrust.org.uk/scotland/domestic/improving-my-home/green-deal> [Accessed 04/08 2015]
- FILIPPI, M., 2015. Remarks on the green retrofitting of historic buildings in Italy. *Energy and Buildings*, 95, pp. 15-22
- GOV.SCOT, 2014. EESSH - table of relevant funding sources - october 2014 . [online] Available from: <http://www.gov.scot/Topics/Built-Environment/Housing/sustainable/standard/funding> [Accessed 04/10 2015]
- GOV.SCOT, 2015. Housing Statistics for Scotland, Estimated stock by tenure. (<http://www.gov.scot/Topics/Statistics/Browse/Housing-Regeneration/HSfS>). Edinburgh: Scottish Governemnt.
- GOV.SCOT, 2015. Scottish government's fuel poverty policy. [online] Available from: <http://www.gov.scot/Topics/Built-Environment/Housing/warmhomes/fuelpoverty> [Accessed 04/16 2015]
- GOV.SCOT, 2016. Energy efficiency standard. [online] Edinburgh: Scottish Governemnt. Available from: <http://www.gov.scot/Topics/Built-Environment/Housing/16342> [Accessed 06/13 2016]
- JASON PALMER, I.C., 2013. United Kingdom housing energy fact file. London: Department of Energy and Climate Change.
- MARTIN, A. and GOLD, C., 1999. Refurbishment of Concrete Buildings: The decision to refurbish . Berkshire, UK: Building Services Research and Information Association.
- MILIN, C. and BULLIER, A., 25 January 2011. Energy Retrofitting of Social Housing Through Energy performance Contract. Paris: FRESH project.
- OFGEM, 2015a. Changes to FIT scheme: Comprehensive review phase 1, 2A and 2B. [online] Available from: <https://www.ofgem.gov.uk/publications-and-updates/changes-fit-scheme-comprehensive-review-phases-1-2a-and-2b> [Accessed 04/08 2015]
- OFGEM, 2015b. Energy company obligation (ECO). [online] Available from: <https://www.ofgem.gov.uk/environmental-programmes/energy-company-obligation-eco> [Accessed 04/08 2015]
- PENNYCOOK, K., 2007. Refurbishment for energy efficiency: an overview. London: CIBSE.
- POWER, A., 2008. Does demolition or refurbishment of old and inefficient homes help to increase our environmental, social and economic viability? *Energy Policy*, 36(12), pp. 4487-4501
- SAATY, T. and VARGAS, L., 2012. Models, Methods, Concepts & Applications of the Analytic Hierarchy Process. Second ed. New York: Springer.
- The Electricity and Gas (Energy Company Obligation) (Amendment) Order 2017 2017.
- The Home Energy Assistance Scheme (Scotland) Regulations 2009 2009.
- WARD, D., 1994. Financial benefits of energy efficiency to housing landlords. Watford: BRE.
- WATSON, J. et al., The impact of uncertainties on the UK's medium-term climate change targets. *Energy Policy*, (0)