

Implications of Energy Performance Certificates for the UK domestic building stock – Feedback from a Southampton homeowner survey

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Abstract

Energy Performance Certificates (EPCs) provide an opportunity for instigating energy efficiency improvements of the UK domestic building stock and reducing its carbon emissions. In order for the EPC scheme to be successful, there must be understanding and awareness amongst homeowners, as well as a willingness or incentive to implement the certificate's retrofitting suggestions and improve the energy efficiency of their property. This paper discusses the outcomes of a targeted household questionnaire survey of Southampton homeowners who purchased their properties between October 2008 and October 2009 – the year after EPCs became mandatory for all houses sold or rented out in England and Wales. The results of the survey which had almost 350 participants indicated homeowner awareness but also highlighted that the EPC and its recommendations for improving energy efficiency were often not seen as a priority. This was also reflected in the finding that, for the survey respondents, the scheme had a limited impact on decision-making or house price negotiation. Whilst the survey established that there has been some uptake of retrofitting measures, it was not clear from the data whether this was related to the recommendations given on the EPC. It appears as if retrofitting was often rather the result of planned interventions undertaken in conjunction with the house purchase. Overall the results of this study indicate that the scheme may require modifications in order to improve homeowner understanding and encourage them to make energy efficiency improvements.

Keywords

Energy Performance Certificate, EPC, energy efficiency, domestic buildings, household questionnaire survey

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1. Introduction

This paper summarises key findings of a household survey on domestic Energy Performance Certificates (EPC) conducted by the authors, the full results of which are to be published in Building Services Engineering Research & Technology (BSER&T), in November 2011.¹ The paper presented here complements this upcoming publication by focussing on qualitative responses given by the survey respondents in the open comments section of the survey. Furthermore, it relates these comments to the quantitative survey findings.

1.1 Domestic Energy Performance Certificates

Energy Performance Certificates have been implemented in England and Wales through the 'Energy Performance of Buildings (Certificates and Inspections) (England and Wales) Regulations 2007'² in order to comply with the 'EU Directive 2002/91/EC on the energy performance of buildings' (EPBD).³ They represent a compliance rating measure which provides calculated estimates for energy use and carbon emissions of a property in relation to a notional building. These estimates are based on the building's thermal elements, controlled fittings (windows), building services and controls. As highlighted in Figure 1 for a semi-detached house in Southampton the ratings for energy efficiency and environmental impact (carbon emissions) are given on a sliding scale between A and G, with an A representing the best performance rating. The ratings are derived from performance bands according to the government's 'Standard Assessment Procedure' (SAP) for dwellings.⁴

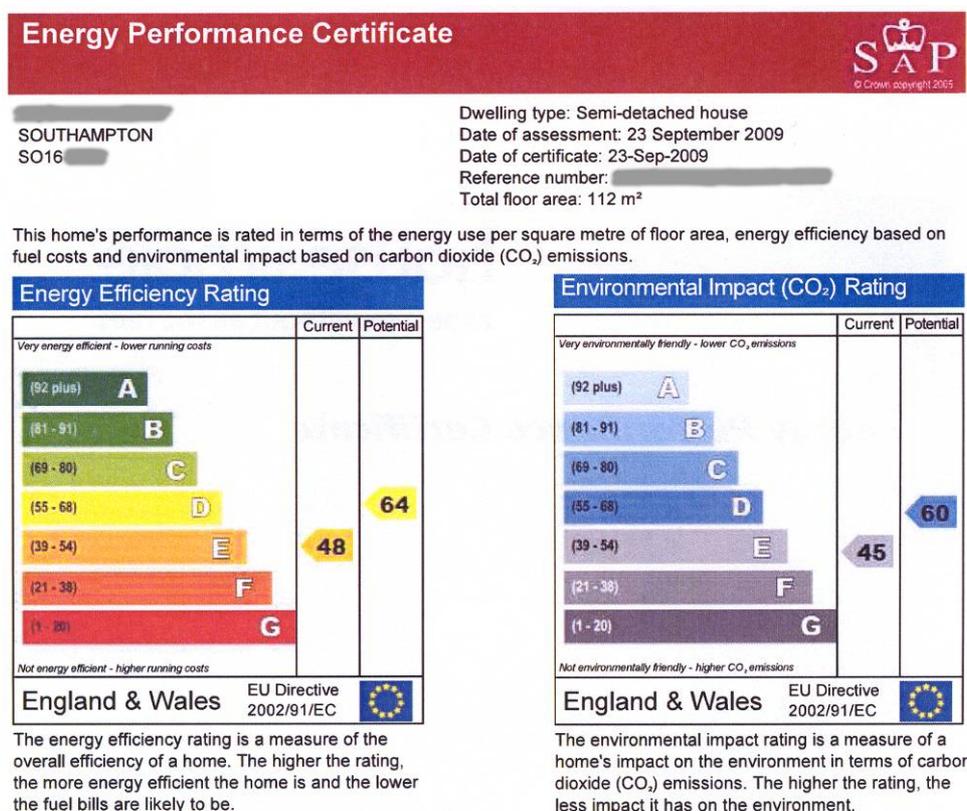


Figure 1 Energy efficiency and environmental impact ratings of a domestic EPC for a semi-detached house from around 1915 in Southampton

In addition to the ratings shown in Figure 1, EPCs give recommendations for reducing the energy consumption and carbon emissions of the building. These suggestions are split by cost and include the typical cost savings per year, potential rating increase and a more detailed explanation about implementing the measure. Additional links and contact details are provided on the EPC, in case the homeowner requires further advice or information. Since 1st October 2008 EPCs are mandatory for all houses sold or rented out in England and Wales.² Sellers and landlords must commission the EPC and make it available before the property can be sold or let. Failure to do so may result in a fine. EPCs for existing dwellings are usually generated using the 'Reduced Data Standard Assessment Procedure' (RdSAP)⁴ which is essentially based on a visual inspection of the building.

Domestic EPCs used to form part of the Home Information Packs (HIPs). However, with the suspension of the HIPs in May 2010⁵ EPCs have become a standalone document which is likely to have increased their visibility for the general public. An EPC is valid for 10 years and must be produced by an accredited assessor who logs it on a national register⁶.

1.2 The UK domestic building stock

In the 'Climate Change Act 2008' the UK government has committed to an 80% reduction in the country's carbon emissions, below 1990 levels, by 2050.⁷ Probably the most effective way to achieve this in the domestic sector is through replacing inefficient existing dwellings with new buildings built according to high energy performance specifications. The Sustainable Development Commission however estimates that 70% of the current UK domestic building stock will still be in use in 2050.⁸ Therefore, improving energy performance of existing domestic buildings is an important measure if the UK's 2050 emissions reduction target is to be achieved. The Energy Saving Trust (EST) estimates that for this the UK would need to be fully refurbishing 13 400 houses per week to an A or high B rating.⁹ As these ratings might not be possible with some properties, other properties would have to be improved to a higher rating, in order to compensate. In view of this the EPC scheme could be an important control measure for success and a mechanism in driving the required energy performance improvements. Therefore, it is important to examine the current uptake of the scheme by homeowners and their perception of its success.

2. Home owner questionnaire survey

A household questionnaire survey of Southampton homeowners who had recently bought their property was conducted in order to establish the EPC scheme's current impact on the house buying process and related refurbishment works, as well as to determine whether improvements to the scheme are required. A further aim was to analyse the scheme's potential for improving the energy efficiency of the existing domestic building stock in general. More specifically, the questions were developed and structured in order to investigate homeowner awareness of the scheme, to find out whether EPCs have any impact on the buyer's decision making process, price negotiation or sale price and to explore the extent of the EPC's influence on retrofitting and refurbishment as well as the associated barriers. Furthermore, it was

of interest to determine the current spread of the achieved EPC ratings in Southampton. Most of the questions were multiple choice closed questions, with an open comments section at the end.

Questionnaires were sent out by post in December 2009 to almost 2000 Southampton homeowners who bought their properties between October 2008 and October 2009, which was the first year of the scheme's operation. Address details and permission to use these for a targeted household postal questionnaire were acquired from the Land Registry.¹⁰ A freepost return envelope was included and all responses were anonymous; there was no way to identify individual properties from the returned questionnaire. 347 questionnaires were returned, a response rate of 17.4%, of which 10 responses were excluded. Validation of the representativeness of the returned EPC ratings for Southampton was undertaken by manually extracting property information from more than 450 homes advertised on the property search engine Rightmove.¹¹

3. Findings of the homeowner survey

The general knowledge of the EPC scheme was found to be reasonably high with 84% of respondents indicating that they had heard of EPCs before. However, as demonstrated by the following comment some of this awareness may be related to the fact that a number of people were probably selling their old property at the same time as searching for a new home: *'We first became aware of the EPC when we were searching for a house. We became more aware of it when we were selling our flat, as we needed to get an EPC as part of our HIP document.'*

Interestingly, only 67% of respondents stated that they had seen an EPC before they bought their property and a further 10% since they bought their property. This leaves 23% who had not or did not know whether they had received an EPC in the buying process. However, as EPCs are mandatory, there should be no homebuyers who are not provided with an EPC. As people who have seen an EPC might be more likely to answer a questionnaire related to this topic, there may even be a skew in the data towards people who have received one. All of this gives reason for concern regarding the effectiveness of EPC provision.

Six respondents specifically commented that they never received an EPC, even if they asked for one, as shown in the following two comments: *'When we purchased the flat we were told there was no EPC.'* *'I think the EPC is a good idea, but the government needs to enforce it more, I asked for one when I purchased this property 6 months ago, but have never received one.'* Five other comments made it clear that even though the respondents did receive the EPC before purchase, they received it too late or after an offer had been made. As a result, the EPC would not have been influential or useful to their decision-making: *'The EPC was supplied at the same time as the contract to exchange when negotiations had already occurred.'* Not all respondents who indicated they were aware of EPCs received one, which suggests that people are not always asking for them, as highlighted by this comment: *'It is worth saying that I am a lettings consultant and no tenants have asked to see an EPC.'* Other comments and the lack of awareness of retrofitting recommendations or grants indicate that people may not be reading the whole EPC: *'Didn't see a*

certificate clearly sent to us. May have been in the contract of sale, but that was about 200 pages long!’ or may be only receiving part of it: ‘No recommended measures provided, only received page 1 of 6, work done recommended by own survey report.’, ‘Easy to get EPC summary graph (not very useful). Very hard to get EPC (full) before offer!’ This might have improved to some extent with the removal of HIPs in May 2010⁵ due to the reduced documentation requirements for house sales. Another area where EPCs might be lacking is private sales since sellers might think that they do not need to provide an EPC as shown by this comment: ‘Bought house in private sale - no need for energy certificate’. These comments highlight that the way EPCs are made available or advertised may need to be improved and fines perhaps better enforced.

3.1 Energy efficiency ratings of Southampton dwellings

Nearly all survey respondents who had seen an EPC answered the question on their property rating and the results principally followed the distribution given in the 2007 ‘English House Condition Survey’.¹² However, as can be seen in Figure 2, the peak was determined to be at D rated properties. Compared to the ‘English House Condition Survey’¹² this represents a shift up by one energy efficiency band. In addition, 17% of respondents indicated that their property achieved an A or B rating, which is much higher than the national percentage which is given as 0.2% B rated properties in 2007.¹² As this appeared unlikely, validation with online database information was required.¹¹ Figure 2 highlights a share of below 4% for B rated properties in the online sample which appears reasonable given the fact that Southampton has a large share of recently completed purpose built flats in its stock. The perception of the achieved ratings shows that despite general awareness, some homeowners may have forgotten their EPC rating and may be overestimating the rated performance of their home, which may ultimately lead to complacency regarding energy efficiency. This also means that more measures for raising awareness appear to be required.

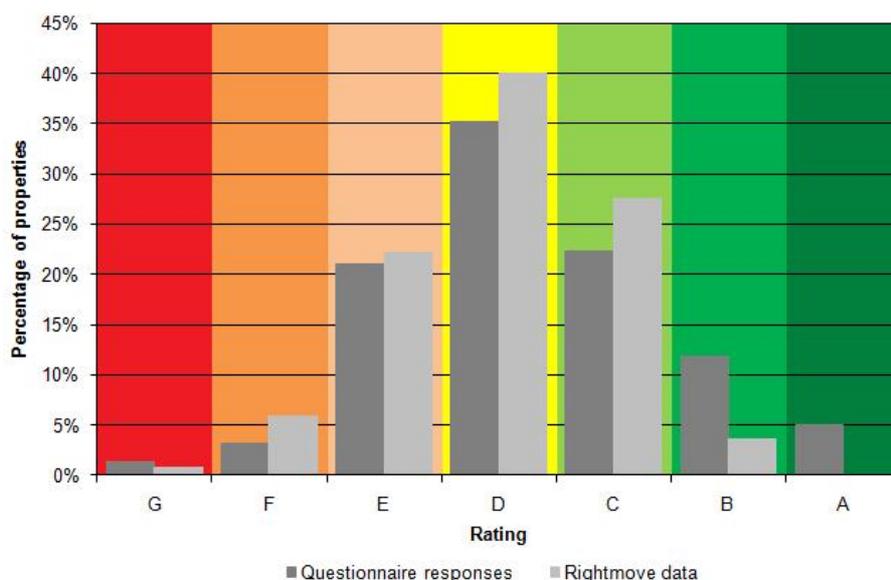


Figure 2 Energy efficiency ratings of the survey respondent’s properties compared to properties advertised on the property search engine Rightmove¹¹

3.2 Influence and impact of EPCs on the house buying process

The majority of homeowners indicated that the EPC had no impact on their decision to buy and no influence on sale price or price negotiation. This is shown in Figures 3 and 4 and further illustrated by the following two comments: *‘Our house was rated E with potential to be D, which I wasn’t too happy about, but it wasn’t enough for me to not buy the house.’* *‘We didn’t negotiate price of the house regarding that, as it didn’t occur to me that you could.’* Nevertheless, as shown in Figure 4, in almost 20% of sales EPCs appeared to have been used to some extent for price negotiation. The following comment highlights that such negotiation is probably undertaken in conjunction with other issues regarding the building’s condition: *‘EPC did not affect my intentions to buy house, EPC on its own is not sufficient to negotiate price reduction but added to other weaknesses it formed a basis for price reduction.’* This is a promising result. However, given the comments above and the fact that 60 to 70% of homes in Southampton were to be found to be rated D or below (Figure 2), the potentials of the scheme appear not to be exploited by homebuyers. This may also be due to the limited influence of EPCs on decision making highlighted in Figure 3 and again points to a requirement for raising awareness regarding energy efficiency.

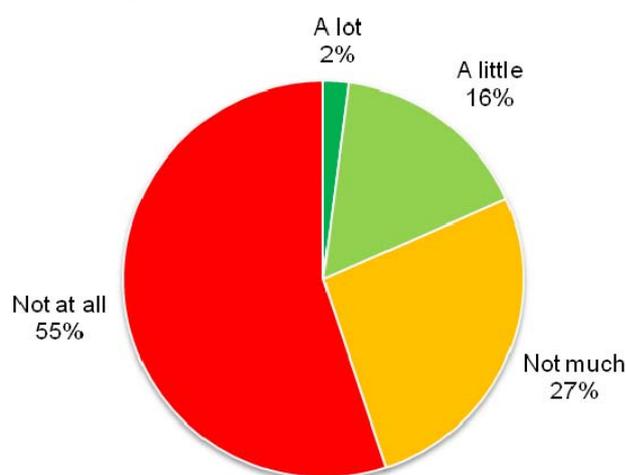


Figure 3 Influence of the Energy Performance Certificate on respondents’ decision to buy

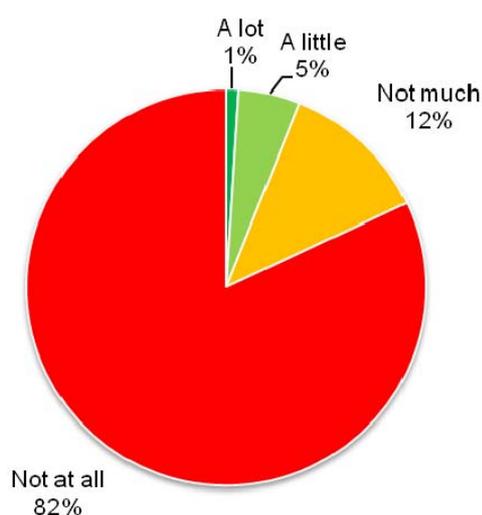


Figure 4 Effect of the EPC on sale price or price negotiation

62% of the survey respondents indicated that the EPC had been useful to some extent in explaining the energy efficiency of their property (18% a lot, 44% a little). However, some people believe that more information is required: *‘Information on this, especially for first-time buyers, would be very useful.’* Nevertheless, the survey findings appear to indicate a general change in attitude towards considering energy efficiency when choosing a property to live in. This conclusion is further supported by research commissioned by the Energy Saving Trust (EST) which suggests that 78% of buyers believe it is important to see the EPC rating before buying a property.¹³ However, whilst the EST research establishes that a third of people consider energy efficiency an important deciding factor, with many people being willing to pay more for an environmentally friendly house,¹³ the findings of this survey indicate that this may not be the case once people are confronted with the decision of buying a house. Furthermore, when asked to give the two main priorities for decision making, no

survey respondent selected energy efficiency. The greatest priorities to homebuyers were location and price, followed by size as highlighted by the following comment: *'As a developer, I buy and sell houses regularly. Energy performance is irrelevant. Factors which determine a property's value are size, location, price, condition (cost of bringing it up to standard) and resale/rental potential.'* Interestingly *'bringing the house up to standard'* is likely to entail energy efficiency improvements which highlights that the connection between energy performance and comfort is often not made.

Perhaps a significant impact and influence is unlikely for a newly introduced scheme, but with many negative comments from respondents, there appears to be considerable dissatisfaction amongst homeowners. This dissatisfaction was found to be either a resentment of the time and cost for producing an EPC or unhappiness with the assessor, method and outcome.

People who did not consider the EPC useful in explaining the energy efficiency of their property appear to have often resented the associated cost: *'EPCs seem to be an expensive commodity, with precious little benefit to purchaser or seller.'*, *'It may be a lack of understanding / knowledge, but they appear to be a waste of time / money.'*, *'The certificate seems to be a formality rather than something useful; didn't pay much attention to it.'*, *'In my experience most people buy a house because they like it. Not because it's energy efficient. If they then find it's cold and draughty, they correct it gradually over time as they can afford it. Most people seem to resent the government interference with the EPCs and the expense they entail.'* For the scheme to become an overall success such resentment needs to be overcome.

Some respondents highlighted more fundamental concerns regarding the scheme: *'I had an HIP done on previous home at Guildford - I was shocked at the untruthful facts of the HIP officers lack of building terminology and much of his knowledge was rubbish.'*, *'Our own enquiries about energy conservation measures had more influence and were more helpful than the EPC.'*, *'We also sold a house and saw basis on which energy rating is arrived at. This led us to the conclusion that the rating is based on a survey too superficial to have much value.'*, *'The energy assessment contains too many assumed values to be meaningful. Some recommendations contravene planning regulations.'*, *'I feel the info in it could have been supplied (and those bits I will act upon) by a competent surveyor.'* As shown by the following two comments, such fundamental concerns can easily lead to more severe dissatisfaction which may be difficult to address once established: *'Energy Performance Certificates are an utter nonsense; they are no indication of performance beyond that you could ascertain yourself at no cost at all. They should be scrapped immediately.'*, *'We felt the survey result was rather misleading! Certainly the survey was not worth the money we had to pay - all he seemed to do was draw a plan of the property, measure the thickness of walls and look at the light bulbs!'*

3.3 Success of EPCs for instigating retrofitting

A key aim of the EPC scheme is to instigate retrofitting of energy efficiency measures by giving recommendations which are complemented by annual energy cost savings for each suggested measure.¹⁴ Figure 5 shows the summary

information as given on the front page of an EPC for all of these measures together, in this case for the same case study house as used in Figure 1. Despite the availability of retrofit recommendations, the Southampton survey highlighted only limited uptake of EPC retrofitting recommendations. 38% of respondents indicated that they had undertaken retrofitting as suggested on the EPC, 13% planned to in the future, 44% had not and 5% did not know.

It was not clear from the survey results whether retrofitting was undertaken as a result of the EPC or whether it would have been done anyway. Many comments suggested that retrofitting changes were made regardless of the EPC, as part of refurbishing a newly purchased property: *‘Measures undertaken as needed, not as a result of EPC. Replaced boiler as not working properly. Replaced windows and doors as more cost effective to replace all, rather than just those needed. EPC had no influence.’*, *‘Energy changes detailed above would have been implemented regardless of EPC, as part of house refurb.’*, *‘Light bulbs and wall insulation, we have taken these measures but not as a result of the certificate.’*, *‘We have made many energy saving changes since we purchased our property but would have done so anyway as it was an old house that needed renovation.’*

Estimated energy use, carbon dioxide (CO₂) emissions and fuel costs of this home

| | Current | Potential |
|--------------------------|---------------------------------|---------------------------------|
| Energy use | 362 kWh/m ² per year | 250 kWh/m ² per year |
| Carbon dioxide emissions | 6.8 tonnes per year | 4.7 tonnes per year |
| Lighting | £89 per year | £57 per year |
| Heating | £1014 per year | £702 per year |
| Hot water | £110 per year | £110 per year |

Based on standardised assumptions about occupancy, heating patterns and geographical location, the above table provides an indication of how much it will cost to provide lighting, heating and hot water to this home. The fuel costs only take into account the cost of fuel and not any associated service, maintenance or safety inspection. This certificate has been provided for comparative purposes only and enables one home to be compared with another. Always check the date the certificate was issued, because fuel prices can increase over time and energy saving recommendations will evolve.

To see how this home can achieve its potential rating please see the recommended measures.

Figure 5 Estimated current and potential carbon emissions and energy costs given on the EPC for a 1915 semi-detached house in Southampton (see also Figure 1)

41% of all survey participants indicated that they had undertaken improvements, the most commonly implemented retrofit measure being energy efficient lighting (81% of the respondents answering this question). Loft insulation was the next most common measure (41%), followed by heating / boiler upgrades (33%), double glazing (30%) and wall insulation (28%). Given the fact that over 60% of the surveyed properties received a D rating or worse (Figure 2), retrofitting uptake needs to be more widespread and more measures implemented in order for emission reduction targets to be met. A potential problem might be that, whilst retrofitting suggestions are given, more specific advice may be required: *‘Cavity wall insulation suggested as an improvement, but think it can cause more problems than it solves.’*

There also appear to be cases where the EPC is devoid of recommendations: *'No [retrofitting] suggestions. The 'potential performance' was marked the same as the actual performance.'* Furthermore, there seems to be the perception that energy efficiency is not an issue for new properties as shown by the following three comments: *'The house was new when I brought it, so no improvements were required.'*, *'As I understand it, not a lot of changes to be made. This property is only around 10 years old.'*, *'The bungalow we moved into was brand new, so there was not anything really that required attention, for example, the boiler was brand new, central heating, loft insulation, double glazing, water meter, energy efficient light bulbs etc.'* Others questioned the general usefulness of the EPC recommendations: *'I think the certificate was of limited use - most changes are common sense.'*, *'Solid brick wall - internal/external cladding recommended. Can see no sense in this.'*

According to the survey results the greatest barrier preventing homeowners from making retrofitting changes was perceived to be cost: *'The changes for the improvement were rather costly and I have priorities with my money - like furniture.'*, *'I would love to install solar panels - price prohibitive.'*, *'Solar heating has been fitted - As a couple we are very environmentally aware. However, even with the available grants cost is too much.'* The next greatest barrier was retrofitting not being seen as a priority. This gives cause for concern as government plans to facilitate financial incentives to retrofitting such as the 'Green Deal' scheme¹⁵ will address the cost barrier, but not the lack of priority barrier. Comments suggested further barriers to retrofitting: *'Cost and conservation/preservation constraints for double glazing.'*, *'We have been advised that the property is not suitable for wall insulation.'*, *'Document recommends savings per year but makes no reference to possible costs of installing or environmental costs of scrapping e.g. windows and replacing.'*

Overall the survey results indicate an awareness of retrofitting measures with the availability of information not being perceived as a significant barrier to retrofitting (6% of respondents who answered the question regarding barriers). However this awareness is not translating into the retrofitting uptake required and, as detailed above, current retrofitting may well not be a result of the EPC.

Nevertheless, the survey established that benefits of retrofitting may not always be understood and knowledge on advice and support available limited. 49% of respondents did not know about grants they might be eligible for, 6% were not sure and nine respondents commented about not knowing about grants: *'I do believe that persons buying property - think they would not be entitled to grants - perhaps these details should also be part of the package when buying.'*, *'It would help if the available grants were included as part of the suggestions on the EPC.'* All of this information is included on a full EPC, which implies they are not being read or explained to home buyers. This highlights that the way EPCs are disseminated to potential buyers may require consideration. Otherwise they may be perceived as 'just another document' that is required for a house sale as exemplified by the following comment: *'My experience has shown EPC is a document that needs to be included in sales pack. No specific concerns are highlighted.'*

4. Discussion

Overall, the Southampton homeowner survey indicated a general awareness of the EPC scheme but follow up appears to be needed to instigate retrofitting. At present EPCs appear to be mainly considered as a document forming part of the house buying process with little practical benefit or value. The presented research furthermore highlights an apparent lack of priority for energy efficiency, limited impact of EPCs on decision making or influence on price negotiation and limited uptake of the retrofitting suggestions necessary for improvement of ratings. Given this, it appears highly unlikely that the government's carbon emissions targets can be realised in the domestic sector unless a step-change in public perception is achieved.

Future progress and initiatives have been laid out in the UK government's 'Low Carbon Transition Plan'¹⁶ and the 'Warm Homes, Greener Homes'¹⁷ strategy document. This includes the advertising of EPCs, targeting of advice and support, a database of grants, builders and trades people and the integration with financing options, such as 'pay as you save', 'feed-in tariffs' and 'time-of-use' tariffs.^{16 17 18} Legislation changes expected in the next few years should help to drive these ideas forward.

4.1 Future legislation

The UK government is introducing a new 'Energy Bill' to enable investment in energy efficiency and low carbon energy supplies, while enhancing energy security and fair competition in energy markets.¹⁹ This Energy Bill will make provision for 'The Green Deal', a framework for making energy efficiency improvements to properties at no upfront cost, instead funded by an additional charge in instalments on energy bills.¹⁵ Without interest on payments, this could be even more attractive to homeowners.¹⁸ In addition, the 'Energy Bill' aims to further the rolling-out of smart meters, remove restrictions on access to data in the 'Energy Performance of Buildings Regulations' and require energy companies to provide information on the cheapest tariffs.¹⁹

With regards the private rented sector, landlords will be expected to improve the least energy efficient properties and will not be able to refuse reasonable requests from tenants to make energy efficiency improvements, from as early as April 2015 onwards.¹⁹ In response to the 'Energy Bill', the Association of Residential Letting Agents (ARLA) has supported the suggestion that EPCs should be made publicly available, so that the least energy efficient properties can be identified.²⁰ This is rather significant as about 500 000 private residential properties are F or G rated. However, ARLA raised concerns that there needs to be further clarification on how energy improvements will be assessed, enforced and funded.²⁰

Further to the above, an update of the 'Approved Documents Part L' to the 'Building Regulations 2010' is scheduled for 2013.²¹ This will include further information on zero-carbon building, requirements for renovating elements of a building or the building as a whole and stating the energy performance of a building in all advertisements, when selling or leasing it. These changes will also reflect the amendments to the EPBD, published in Directive 2010/31/EU.²² All these measures are likely to strengthen the relevance of EPCs. However, as highlighted by the

survey findings presented here, care needs to be taken to connect with end-users in order to achieve the intended outcomes.

5. Conclusions

Besides legislation further incentives appear to be required to encourage homeowners to favour energy efficient properties and/or implement retrofitting measures. Such incentives are likely to impact on uptake, whether they involve 'pay as you save' style schemes, a greater availability of grants, lower council tax and stamp duty for high rating properties, a reduction in VAT on refurbishment materials, relating energy efficiency to house price, requiring a minimum energy efficiency improvement every time substantial work is done to a house or requiring a minimum rating before homeowners can sell or landlords rent out a property. However, some of these measures may be difficult to enforce.

What can be learned from the postal survey presented here is that public perception needs to be addressed. Homeowners and tenants will drive changes, indirectly through choice of property and directly by making alterations, but they need to be aware of what to do, willing and able to make changes. There remains a lack of awareness amongst homeowners, but the comments also highlighted significant levels of dissatisfaction with the EPC scheme at present. This affects the possible influence of EPCs on house buying and subsequent improvements. Some of this perception may be related to the impersonal and general nature of EPCs, many of which base on the rather basic RdSAP assessment method. Further reasons could be that homeowners see no benefits from having an EPC or committing to the time and money investments suggested. However, further study appears to be necessary to establish and address the exact reasons for dissatisfaction. Overall, perception needs to be improved, in addition to introducing financial incentives, since without a willingness to make changes, such incentives may not be utilised.

As highlighted in section 3 above, respondents commented that the survey was '*too superficial to have much value*', the assessment contained '*too many assumed values to be meaningful*' and the same information '*could have been supplied by a competent surveyor*' or arrived at by themselves. Others stated assessor incompetence or, based on their experience of living in the property, criticised the EPC rating as an inaccurate result. In addition recommendations were perceived as not being realistic or suitable for the property. This implies that the assessment is too generic and homeowners do not have faith in the process. This might be improved through better engagement of homebuyers or sellers in the assessment process, by the assessor and certification body. Awareness and understanding could for example be improved by ensuring that EPCs are made available in full at the earliest stage and better explained to buyers or tenants, with the benefits and implications highlighted. This means that the current way the actual EPC assessment is carried out without any direct interaction of the buyer and assessor may need to be reconsidered, yet respecting that the assessment process needs to remain standardised to make it applicable and allow comparison between properties.

Better marketing of high rating properties as cheaper to run might encourage buyers/tenants to consider energy efficiency as a priority or sellers/landlords to make

improvements. Conversely the lowest rating properties could be branded as ‘unfit’ and targeted by government advice and support initiatives. Finally, the use of data collected should be considered. Over 3.9 million EPCs have been produced so far for existing dwellings and recorded in a national database. This makes the scheme the first and largest ever assessment and collection of energy efficiency data for the existing housing stock in England and Wales. The data offers potential for use as baseline data, for allocation of resources and an indication of what has to be achieved to reach future targets. The combined EPC potential ratings are the potential of the current housing stock, if recommendations are undertaken. Therefore, the EPC database could be used to show the total energy efficiency currently achievable, how much this would cost and the further energy efficiency increase required to reach UK emission reduction targets.

Overall, this research indicates that in order to achieve more widespread success, the EPC scheme needs to be re-examined, developed and refined. A further investigation and consultation could be carried out of a wider sample of homeowners. Despite a general awareness, there seems to have been little progress in increasing the retrofitting necessary for improving the energy performance of the UK domestic building stock and meeting carbon emission reduction targets. The challenge for the government, certification bodies and others involved in the housing market is to better engage with buyers, sellers, landlords and tenants to initiate these changes.

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