Modelling progress in the energy efficient retrofit in the private rented sector

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Abstract: The private rented housing stock in the UK is the least energy efficient sector of the housing market. One of the tools that the government is using to attempt to address this is the Minimum Energy Efficiency Standard (MEES) which came into effect in April 2018. This requires properties to let to achieve a minimum Energy Performance Certificate efficiency rating of E – therefore dwellings that score F or G will no longer be allowed to be let out on new tenancies. The regulations are then being rolled out to existing tenancies in 2020. The government is also consulting on increasing the minimum standard to a C by 2030 or 2035.

This paper examines the housing stock in the West Midlands Combined Authority (WMCA) area and more specifically the Walsall local authority area to identify the extent to which dwellings are at risk of non-compliance with the minimum E standard. It finds that approximately 7.5% of WMCA private rented stock is currently rated band F or G and is therefore at risk of not being lettable or re-lettable by 2020. It further finds that approximately 1% of the stock is unlikely to be able to be cost effectively improved, but currently the government provides exemptions for such properties. The paper also demonstrates that most non-compliant dwellings have the potential to be improved for a cost of less than £2,500, which is the proposed cost ceiling for compliance. It shows that this level of expenditure can be very cost effective with pay back periods of less than 2 years. If the proposed minimum band C rule were to be implemented this would be very problematic for potentially as much as 40% of the rented housing stock.

Keywords: retrofit, private rented sector, energy efficiency

Introduction

The UK is committed to reducing CO_2 emissions by 80% by 2050 from a 1990 base. Approximately 29% of energy consumption is due to energy use in the home – primarily heating and hot water (BEIS, 2017a). The UK has an aging housing stock and therefore energy efficiency targets will only be achieved with extensive retrofitting of energy saving measures to the existing housing stock. It is particularly important that improvements are made to the existing housing stock as the older dwellings are more likely to be less efficient – 56% of the English stock was built before 1965 (60% in the private rented sector) – the year when the first national building regulations were introduced for new dwellings (MHCLG, 2018a).

Data show that dwellings in the private rented sector have traditionally been the least energy efficient part of the housing stock (MHCLG, 2018a). In April 2018 the Minimum Energy Efficiency Standard (MEES) was introduced. This standard states that a dwelling may not be let out if its energy efficiency rating is less than an E. This currently only covers new tenancies, but will also include existing tenancies from 2020. Going beyond this the government is also exploring the potential of a much more ambitious target of a minimum rating of C by 2030 or 2035(BEIS, 2017b)

This paper uses the private rented stock in the West Midlands Combined Authority area generally and the Walsall local authority area more specifically as a case study to examine the potential impact of the MEES minimum standard, estimate the number of affected dwellings and identify the most common range, and costings, of solutions that landlords will need to adopt in order to achieve compliance.

UK Housing Stock

The UK housing stock can be split into three types according to ownership: owner-occupied housing (63%) – the owner lives in their property; social rented (17%) – the property is owned by a registered social landlord and the tenant will often be paying under market rent; private rented sector (PRS) (20%) – the tenant is renting from a private individual or company (MHCLG, 2018a). Since 2008, when property in the UK is sold or let, it needs to have an energy performance certificate (EPC) that rates its energy efficiency in bands from A-G. From their introduction up to May 2018 over 18,000,000 EPCs have been produced for dwellings in England and Wales. As Table 1 shows, energy efficiency has generally been worst in the private rented sector.

Table 1. Energy Efficiency Rating Band by Tenure (EHS, 2018)

	Energy Efficiency Rating Band					
	A/B	C	D	E	F	G
						percentages
owner occupied						
2006	0.0	3.1	34.3	43.6	15.9	3.1
2016	1.1	23.7	52.2	17.8	4.0	1.3
private rented						
2006	0.3	6.0	28.0	40.3	18.4	6.9
2016	1.5	25.7	48.6	17.6	4.8	1.8
social rented						
2006	0.0	13.1	52.6	28.5	5.0	0.8
2016	2.0	48.7	42.0	6.4	0.6	0.4
all tenures						
2006	0.1	5.3	36.8	40.5	14.2	3.1
2016	1.3	28.4	49.7	15.8	3.6	1.2

As Table 1 shows, in 2016, 6.6% of the private rented stock was still in the worst two efficiency bands – F and G, as opposed to only 1% in the social rented sector. The typical UK private tenant will be renting their home on an Assured Shorthold Tenancy (AST) – this is generally for an initial period of six months, and will then roll on month by month with the landlord required to give two months' notice to reclaim the property. As such the AST tenant does not have rights to make changes to their home and instead is reliant on their landlord for making energy saving improvements. This leads to the lower energy efficiency in the private rented sector as the landlord will have to pay for improvements and the tenant will then benefit from lower energy bills. This is a well established phenomenon that occurs most obviously in the UK due to its short residential leases but is also observed in other European countries (Astmarsson et. al, 2013) (Hope & Boot, 2014). The UK government estimate that the average annual fuel bill for a band E property is £1,710; £2,180 for a band F property and £2,860 for a band G property. Therefore there are significant potential savings for tenants of over £1,000 per year, which clearly has the potential to affect quality of life, as these tenants are also most likely to be affected by fuel poverty (BEIS, 2018)

West Midlands Combined Authority

The West Midlands Combined Authority (WMCA) is the area covered by the seven local authorities that work with the Mayor of the West Midlands: Birmingham City Council, City of Wolverhampton Council, Coventry City Council, Dudley Metropolitan Borough Council, Sandwell Metropolitan Borough Council, Solihull Metropolitan Borough Council and Walsall Council. Table 2 shows the tenure breakdown for each local authority in the area and for England and Wales, as in the 2011 Census.

Table 2. Population by Tenure by Local Authority (Census, 2018)

Local Authority	All Households	Owner-occupier	Shared Ownership	Social Rented	Private Rented	Living Rent Free
Birmingham	410,736	226,616	3,940	99,592	73,405	7,183
Coventry	128,592	77,880	750	21,914	26,503	1,545
Dudley	129,867	89,304	707	25,719	12,004	2,133
Sandwell	121,498	69,135	701	33,439	15,674	2,549
Solihull	86,056	63,559	527	12,834	8,502	634
Walsall	107,822	67,265	601	25,967	12,569	1,420
Wolverhampton	102,177	57,812	419	28,648	13,455	1,843
Total	1,086,748	651,571	7,645	248,113	162,112	17,307
WMCA %	100	60.0	0.7	22.8	14.9	1.6
England and Wales	23,366,044	14,853,678	178,236	4,118,461	3,900,178	315,491
E&W %	100	63.6	0.8	17.6	16.7	1.4

As can be seen the WMCA area contained just over 1,000,000 households at the 2011 census and approximately 15% are in the private rented sector. It is these dwellings that will potentially be affected by the MEES requirement.

As previously mentioned over 18,000,000 EPCs have now been produced in England and Wales and these have now been made publicly available, therefore they can be used to investigate the state of the housing stock in more detail. When an EPC is carried out the purpose for it is also identified (ie: whether it is for sale, for rent or some other purpose). Therefore it is possible to filter the data to only select those where an EPC has been carried out as one has been needed for letting purposes. This will not be a perfect match with dwellings that are currently rented out as EPCs are valid for 10 years, so some that were originally rented out may have changed to an owner occupier status and some that were bought have been bought for the purpose of being let out. In addition, as the EPC is only currently required for a new tenancy there may be some dwellings that are rented out that do not have an EPC as they have had the same tenant since 2008 – it is not known how many such tenancies there may be, the English Housing Survey suggests that the average private tenancy is 4 years (MHCLG, 2018a). In addition there may be some dwellings where the landlord is in breach of the requirement to provide an EPC. For dwellings where there is no EPC due to the length of the tenancy, or the landlord is non-compliant, it may be reasonable to assume that these dwellings maybe less energy efficient than those where there is more awareness. Conversely, some of those with an EPC for purchase that have been bought for renting out may have had subsequent improvements that have not been captured by a new EPC as purchase is widely recognised as a trigger for improving a dwelling (EST, 2011). Despite

those caveats, as Table 3 shows approximately 58% of the PRS dwellings in the WMCA area have an EPC and that is a large enough sample to assume it is a good representation of the entire stock. Table 3 shows the headline information for each WMCA local authority for F and G ratings of PRS dwellings.

Table 3. % PRS Dwellings in EPC Bands F & G by Local Authority (EPC Register, 2018)

Local Authority	PRS Households	PRS EPCs	% Coverage	Current F&G	F&G %
Birmingham	73,405	42,437	57.8	3,129	7.4
Coventry	26,503	13,722	51.8	831	6.1
Dudley	12,004	7,252	60.4	578	8.0
Sandwell	15,674	10,072	64.3	711	7.1
Solihull	8,502	5,683	66.8	424	7.5
Walsall	12,569	6,543	52.1	550	8.4
Wolverhampton	13,455	8,628	64.1	820	9.5
Total	162,112	94,337	58.2	7,043	7.5

The English Housing Survey estimate is that 6.6% of the English PRS stock is rated F or G, Table 3 suggests that it is 7.5% on average across the WMCA local authorities. From the table it can also be estimated that there are approximately 12,000 dwellings in the WMCA area that are affected by the MEES minimum standard and these dwellings will need to be improved if they are to be let out on new leases now or on existing leases come 2020. The current social housing waiting list across the WMCA stands at 56,000 (MHCLG, 2018b), so if these 12,000 dwellings were to be withdrawn from the PRS sector that would add extra pressure to the social rented sector.

EPCs not only provide a current rating but also provide a set of recommended improvements that can be made to improve the energy efficiency and reduce the energy costs of a dwelling and also provide a theoretical new rating after the improvement measures have been carried out. It is possible that some dwellings will not be able to achieve an E efficiency rating even after carrying out all the recommended improvements and Table 4 identifies the extent of this problem:

Table 4. Percent PRS Dwellings trapped in EPC Bands F & G by Local Authority (EPC Register, 2018)

Local Authority	Current F&G	Potential F&G	% PRS Stock
Birmingham	3,129	730	1.0
Coventry	831	249	0.9
Dudley	578	114	0.9
Sandwell	711	163	1.0
Solihull	424	77	0.9
Walsall	550	124	1.0
Wolverhampton	820	167	1.2
Total	7,043	1,624	1.0

This shows that approximately 1% of the West Midlands stock will not practically be improvable to at least an E standard. Whilst there is an exemption in place for such dwellings

it can be anticipated that over the longer period these dwellings are likely to be lost to the private rented sector.

Energy Saving Measures

There are broadly three ways in which the energy efficiency of these dwellings can be improved: improve the thermal efficiency of the building envelope (insulation); improve the energy efficiency of the heating system (improved controls or new efficient systems); generating energy on site (eg: PV). When an EPC is produced it uses the standardised Reduced data Standard Assessment Procedure (RdSAP) (BRE, 2017). For RdSAP an assessor measures a dwelling to calculate gross internal area (GIA), floor heights and exposed perimeter, and records the relevant fabric details (roof, wall, floor construction and assumed insulation), heating system and controls; lighting. RdSAP software then calculates energy demand and related emissions based on standardised occupancy and heating patterns and has a standardised set of improvements, as detailed in Table 5, from which the software will chose according to a set of heuristics (eg: top up loft insulation to 270mm if currently less than 150mm depth).

Table 5. Summary of available EPC improvement measures (BRE, 2017)

Fabric	Energy use	Energy generation
Loft insulation	Cylinder thermostat	Solar water heating
Flat roof insulation	Low energy lights	Photovoltaics
Room in roof insulation	Heating controls	Wind turbine
Cavity wall insulation	Biomass boiler	
Solid wall insulation	Air/ground source heat pump	
Floor insulation	Micro-CHP	
Cylinder insulation	Upgrade boiler	
Draught proofing	Flue gas heat recovery	
Double glazed windows	Storage heaters	
Insulate doors	Waste water heat recovery	

This is an extensive set of measures designed to cover most situations of the varied housing stock of the UK. Potentially, having to install some of the more expensive measures on this list could easily see a landlord having to spend tens of thousands of pounds per dwelling on improvements. In 2017 the government consulted on the regulations and proposed a cost cap of £2,500 – the response to the consultation exercise is still awaited, but potentially this cap would provide an exemption to many landlords (BEIS, 2018). Under the proposed cap, if a landlord can demonstrate that the improvements required to achieve the standard would cost more than £2,500 then they could apply for an exemption from having to comply with the minimum standard. Where an EPC provides recommendations for improvements it also provides indicative costs of carrying out the improvement. Table 6 presents the improvement measures based on the mid-point of the EPC cost estimate:

Table 6. Summary of available EPC improvement measures (BRE, 2016)

Low cost (<£500)		Medium cost (£500-£2,500)		High cost (>£2,500)	
Light	£5 each	Flue gas	£650	Upgrade boiler	£2,600
Insulate cylinder	£22	Waste water	£655	Floor	£3,000

Draught proofing	£100	Cavity wall	£1,000	Glazing	£4,900
Loft insulation	£225	Flat roof	£1,175	Solar water	£5,000
Cylinder thermostat	£300	Room in roof	£2,100	Micro-CHP	£5,500
Heating controls	£400			Heat pump	£6,500
Insulate doors	£500 each			PV	£6,500
Storage heater	£500 each			Insulate solid wall	£9,000
				Biomass	£10,000
				Wind	£20,000

As can be seen, almost half of the recommended measures are too expensive to install if the proposed £2,500 cap is applied and all the dwellings requiring such a measure would therefore be exempt from the regulations in their current form. Before needing to analyse individual dwellings to identify whether they are likely to need to comply or not it is worthwhile comparing the common features of dwellings with different energy efficiency ratings.

Walsall Local Authority Housing Stock

In order to provide more detailed analysis, the Walsall local authority has been chosen from the constituent members of the WMCA as it has a good range of building densities. Walsall has 6,543 rental property EPCs available in the EPC data. Table 7 gives a breakdown of some of the main options for heating system, wall type and roof insulation in the different bands for the Walsall local authority in the WMCA:

Table 7. Percent per EPC band of PRS dwellings with a particular feature (EPC Register, 2018)

	B	C	D	E	F	G
Heating						
Mains gas	76.6	71.8	85.2	81.4	37.8	4.9
Community	6.7	2.4	0.3	0.2	0.7	0.0
Electric	16.5	25.8	14.3	18.0	60.9	94.4
Roof						
200mm+ insulation	20.6	35.0	26.4	13.0	6.9	4.2
Dwelling above	65.6	28.7	11.8	9.9	15.5	7.0
Wall						
Insulated cavity	80.5	75.6	37.4	15.2	10.8	6.3
Uninsulated cavity	0.5	4.3	23.6	28.7	33.7	29.4
Solid brick	0.3	4.4	32.4	52.6	51.1	55.9
Insulated solid brick	5.9	6.7	2.7	2.0	2.5	2.1
Built form						
Detached House	0.8	5.8	9.5	9.0	7.9	2.1
Semi-detached house	4.4	28.2	39.8	41.3	21.6	18.2
Terraced house	3.3	18.6	26.5	23.1	10.6	9.1
Houses/Bungalows	8.5	52.6	75.8	73.4	40.0	29.4
Detached flat	16.2	5.7	4.7	5.1	8.6	13.3
Semi-detached flat	36.0	20.0	10.7	11.3	28.7	33.6
Terraced flat	36.2	19.2	8.2	9.0	20.9	23.1
Flats	88.4	44.8	23.5	25.3	58.2	69.9

	(options may not add up to 100% due to less common alternatives and some missing data in the records)

There are some quite stark differences in moving from band B down to G (there were no A rated PRS dwellings in the Walsall sample). Nationally over 80% of dwellings are heated by mains gas, which is a reasonably efficient option. However, when it comes to bands F and G they are mostly heated by electricity – a mixture of individual room heaters and storage heaters. The EPC efficiency rating is price based and a kWh of electricity is currently estimated to cost 16.12p on the standard tariff or 18.97p peak and 7.06p off-peak for Economy 7, as opposed to 4.01p per kWh from gas (BRE, 2018). This therefore clearly explains why it is difficult for electrically heated dwellings to achieve high energy efficiency ratings.

Again there is a clear difference when it comes to insulating the roof. For the band B dwellings 66% are showing as having a dwelling above – from an energy efficiency perspective this is ideal as it is assumed that the dwelling above is being heated in the same way and therefore there is no heat loss to the dwelling above – this corresponds with the built form data which show that 88% of the band B dwellings are flats. Once the flats with a dwelling above are discounted 60% of the remaining band B dwellings have at least 200mm loft insulation vs 4.5% of dwellings with a roof in band G.

A similar pattern can be observed with the walls. The majority of domestic walls in the UK are either cavity walls or solid brick, there are also some timber frames and system builds, although these are generally amongst the newer stock that is more likely to have been built to achieve minimum energy standards in the building regulations. Cavity walls built in the last 20 years are expected to have been built with insulation built in to the cavity, older ones could have been retrofitted and the EPC inspector will look for signs of that when carrying out the inspection. The solid brick wall – as its name suggests – does not have a cavity but does have the option of internal or external insulation being retrofitted. Less than 1% of the band B stock has an unfilled cavity; whilst over 6% of the band B stock has a solid brick wall only a single dwelling showed in the Walsall data as having uninsulated solid brick walls. At the other end of the scale, only 18% of the band G dwellings have an insulated cavity, and 58% are solid brick walls, with only 4% of those insulated.

Finally, Table 7 provides built form data on the Walsall PRS dwellings. These have been separated out to show houses and bungalows and whether they are detached, semi-detached or terraced, and flats and maisonettes and whether they are detached, semi-detached or terraced. Here, there is a marked difference between the band B dwellings and the rest – 14.4% of flats achieve a band B rating but only 0.8% of the houses and bungalows. As discussed earlier – a lot of this is due to having another dwelling above, some will also benefit from having a dwelling below. In addition many will have a sheltered wall – eg: part of a flat will share a wall with communal space in a building – communal hallways, stairs etc – which will generally be warmer than if the walls of the flat are directly exposed to the outside of the building. A large proportion of band C's stock is still in the form of flats, whereas bands D and E are more similar to the national average of 21% of the dwelling stock being flats. Interestingly bands F and G are again mostly made up of flats as opposed to houses and bungalows. Therefore the band F and G flats have a theoretical potential to be improved to a similar standard to the band B dwellings as they will have some of the built form advantages of sharing some of their external envelope with another flat or with a sheltered communal space.

It can be seen from the analysis of the data that the band F and G dwellings are mostly electrically heated and mostly have low levels of loft insulation and predominantly have un-insulated walls. If the £2,500 cost cap is to be implemented then many of these properties will be able to apply for an exemption. Changing the heating system is too expensive an option, except for moving to electric storage heating. With the estimated cost of £500 per heater, this is only going to be an option for smaller dwellings without too many rooms, an analysis of the data suggests that this could be an appropriate measure for 35% of the band F and G PRS stock in the Walsall local authority area.

Individual dwelling analysis

From the bulk data it is not possible to determine the effectiveness of any individual set of measures, only of installing all the measures recommended for that particular dwelling. However, it is possible to estimate the impact individual measures will have by manually downloading complete EPCs for individual dwellings, below are two extracts from the EPC for one of the PRS dwellings in Walsall showing the list of recommended improvements and their impact on the energy efficiency rating.

Recommended measures	Indicative cost	Typical savings per year	Rating after improvement
Increase loft insulation to 270 mm	£100 - £350	£ 425	G14
Internal or external wall insulation	£4,000 - £14,000	£ 636	F32
Floor Insulation	£800 - £1,200	£ 122	F36
Draught proofing	£80 - £120	£ 65	F38
Fan assisted storage heaters and dual immersion cylinder	£1200 - £1600	£ 656	D68
Solar water heating	£4,000 - £6,000	£ 38	C69
Replace single glazed windows with low-E double glazed windows	£3,300 - £6,500	£ 124	C75
Solar photovoltaic panels, 2.5 kWp	£9,000 - £14,000	£ 253	B86

Figure 1. Recommendations section from a Walsall PRS dwelling's EPC (Stroma, 2014).

Summary of this home's energy performance related features

Element	Description	Energy Efficiency
Walls	Solid brick, as built, no insulation (assumed)	★☆☆☆☆
Roof	Pitched, no insulation	★☆☆☆☆
Floor	Suspended, no insulation (assumed)	—
Windows	Single glazed	★☆☆☆☆
Main heating	Room heaters, electric	★☆☆☆☆
Main heating controls	Appliance thermostats	★★★★☆
Secondary heating	None	—
Hot water	Electric immersion, standard tariff	★☆☆☆☆
Lighting	Low energy lighting in 75% of fixed outlets	★★★★★

Figure 2. Summary description section from a Walsall PRS dwelling's EPC (Stroma, 2014).

This dwelling has a current rating of G(4) and does not have mains gas available. The thresholds for the bandings are G: < 20; F: 21-38; E: 39-54; D: 55-68; C: 69-80; B: 81-91; A 92+. The numerical score is based on an energy cost per square metre, the relationship is linear at low costs (high EPC rating) and logarithmic at high costs (low EPC rating), and is designed so that the property that scores 100 should have no bills for heating, hot water and lighting (BRE, 2014). As the relationship is not exactly linear it is not possible to get a 100% accurate estimate of the improvement by simply changing the order in which improvements are carried out from those in Figure 1, although it can provide a reasonable approximation. It is also useful to identify the options that would be plausible within the proposed £2,500 limit and make a reasoned estimate as to the end result. It can be seen that the largest impact would be from installing storage heating and a dual immersion cylinder (30 points), taking the mid-price point this would be a cost of £1,400. This could be coupled with £225 on topping up the loft insulation (10 points). The two remaining measures within the price range are the floor insulation with an estimated cost of £1,000 and draught proofing at £100. In Figure 1 floor insulation improves the score by 4 points and draught proofing by 2. Given that this property started with a score of 4 and needs to reach 39 to reach the E band, it is likely that installing the fan assisted storage heater, dual immersion cylinder and loft insulation would achieve it with a spend of approximately £1,600 adding an extra £100 for the draught proofing and this property should expect to achieve a score in the mid-40s and therefore an E rating. Whilst the extra expense on the floor insulation would have a slightly larger impact it is not very cost effective as it costs ten times as much and only provides twice as much an improvement. Also floor insulation is a very disruptive technology to install as existing floors must be lifted and there is consequently significant disruption for a tenant, and the need to make good after installation, potentially leading to a need for replacement carpeting.

It is worth looking at this from a cost effectiveness perspective. For the three chosen measures the EPC estimates costs of at the worst £2,070 and estimated energy bill savings of £1,146 giving a theoretical rate of return of 55%, or a payback period 1 year 10 months. A Rightmove (2018) property search found a similar property in a neighbouring street being advertised for a rent of £595 per month – interestingly the advertised property has an F band and therefore should not be available for rent unless the landlord has applied for an exemption – an expenditure of around £50 would see this particular dwelling comply (low energy lighting and a hot water cylinder jacket). Nevertheless, a theoretical saving of over £1,000 per year on energy bills is potentially very significant for a tenant paying just over £7,000 per year rent. The saving has been described as theoretical for several reasons: firstly this exact figure would only be achieved for the theoretical household that operates its heating and occupancy patterns in the same way as the standard RdSAP assumption; secondly, there is the 'rebound effect' whereby the tenant is likely to use some of the savings to improve their quality of life – heat the house more, use more hot water etc. (Wrigley & Crawford, 2017); thirdly, evidence is beginning to exist that suggests some willingness to pay a higher rent for a more efficient property – ie: some of the saving would get passed on to the landlord rather than the tenant gaining all the benefit (Carroll, Aravena, Denny, 2016).

Conclusions

The results demonstrate that it is quite possible to improve many band F and G properties to a band E within the proposed £2,500 cost cap, therefore there is good potential for dwellings to be improved to achieve the current minimum E standard. It is also worth considering the proposed minimum C rating by 2030 or 2035. This is a much more ambitious target and 68%

of the PRS dwellings in the Walsall local authority would be affected by such a requirement. It would also affect 54% of the social housing in the area. If this many dwellings could no longer be let, it would be very disruptive for the markets and it is not at all clear how this could be managed. As the data in Table 7 show achieving band C is generally possible for cavity wall dwellings with mains gas – where the cavity is filled, a new gas boiler is installed and the loft insulation is increased to 300mm it is likely to achieve a band C. That therefore leaves the issue of the 'hard-to-treat' homes, which has been estimated as being as much as 40% of the UK housing stock (Rodrigues, et al., 2018). The hard-to-treat homes are generally those with solid walls and no access to mains gas, or are in large blocks of flats where the agreement of all leaseholders is needed for any changes to be made. Certainly, the evidence suggests that a blanket ban on the letting of band D and E properties would not currently be practical, but landlords should be aware that it is a potential future issue that may need to be addressed.

In conclusion it is possible for the majority of affected dwellings to be improved to a band E. This will have benefits primarily for tenants in the form of lower bills, but is also potentially starting to have an impact for landlords as evidence is starting to grow that tenants are becoming more prepared to pay a higher rent for a more efficient property with lower utility bills. This has the potential to become a virtuous circle that will encourage landlords to spend to improve their rented properties, although this is likely to need government support to be encouraged and promoted. The potential minimum band C rating is a much more challenging target that will require greater government intervention and will need successful engagement with landlords to determine appropriate solutions. As has been shown, EPCs provide a potentially long list of recommended improvements and some of these may not currently be practical, however prices of innovative technologies may fall as they become more widely adopted in the future (Lee, et al., 2014). Therefore there is the need to produce an effective decision making tool to aid landlords in selecting the most appropriate and cost-effective measures to improve the energy efficiency of their dwellings.

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