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Understanding the Characteristics of Low Income Households Most at Risk from Living in Cold Homes

Additional scenario modelling

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Understanding the Characteristics of Low Income Households Most at Risk from Living in Cold Homes: Additional scenario modelling (First Draft)

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1. Introduction

1.1 The Welsh Government is currently considering the future of a national demand-led energy efficiency and fuel poverty scheme that provides fully funded improvement measures to low income households. The key objective of this scheme will be to reach some of the most vulnerable types of people on low incomes who are living in and most affected by cold homes.

1.2 In 2015, the Welsh Government commissioned an independent piece of research to assist and inform decision making and the design of future energy efficiency schemes in Wales. In particular, the Study looked to:

- Identify which low income households are the most vulnerable from living in cold homes and in the greatest need of a home energy efficiency intervention.
- Propose ways of targeting these households, and for eligible households to demonstrate qualification, for a future national demand-led energy efficiency and fuel poverty scheme.
- Model a future targeted energy efficiency and fuel poverty scheme using the National Household Model (NHM).

1.3 Following this work, additional NHM scenario modelling has been commissioned to explore the impact of further changes to the eligibility criteria, specifically concerning the tenure and energy efficiency of dwellings. The findings of this additional modelling work are presented in this Report.

1.4 The particular focus of the additional work was to investigate the effects of adjusting the eligibility criteria for a future demand-led energy efficiency scheme for Wales. In particular, it has looked at the impact of excluding private rented dwellings from the scheme and of including properties in D rated dwellings (in addition to those in E, F and G). The combination of these options results in three additional eligibility scenarios as follows:

- Owner occupied dwellings in SAP bands E, F or G
- Owner occupied dwellings in SAP bands D, E, F or G
- Owner occupied or private rented dwellings in SAP bands D, E, F or G

1.5 Furthermore, the work has modelled the impact of two different potential annual scheme budgets (£10M and £25M). Thus, a total of six additional energy efficiency scheme scenarios have been modelled. However, to ensure that the most vulnerable households were tackled first within each budget scenario, the eligibility criteria for each scenario required some refining, for instance by introducing or amending age bands and/or expanding eligibility to include those with some of the diseases or conditions most vulnerable to cold homes.

1.6 This Report presents a summary of the approach taken to adjust the eligibility criteria, the impact of applying the additional eligibility criteria on the pool size of eligible households and presents results from the modelling of the six additional modelled scenarios.

2. Methodology

2.1 The methodology of this follow-on study follows that described in the publication "Understanding the Characteristics of Low Income Households Most at Risk from Living in Cold Homes" (Welsh Government, 2016)[1]. It is therefore not described here in full. However, there are some details that have been introduced for this additional work that are summarised below.

Refining the eligibility criteria

2.2 For most of the modelled scenarios, households can qualify for the scheme through two possible routes. They must live in owner occupied dwellings, or private rented dwellings for certain scenario options, and be households that either:

- Contain a member in receipt of one of the means tested benefits specified in the original study (see below); or
- Are living on a low income and contain a household member with a qualifying respiratory or circulatory disease.

2.3 The following list of benefits was considered the most appropriate set of existing means tested benefits to enable the identification of households with vulnerabilities highlighted in the original Study:

- Pension Credit.
- Child Tax Credit and under the relative income threshold.
- Income related Jobseekers Allowance and also in receipt of Child Benefit.
- Income related Employment Support Allowance (ESA).
- Incapacity Benefit.
- Income Support.
- Severe Disablement Allowance (SDA).
- Universal Credit.

2.4 This Report looks at applying a further set of eligibility criteria based on household tenures and the energy efficiency rating of the dwelling. These refinements to the eligibility criteria will inevitably change the number of

[1] http://gov.wales/statistics-and-research/understanding-characteristics-low-income-households-risk-living-cold-homes/?lang=en.

eligible households. In particular, including D rated dwellings will significantly increase the pool size of eligible households. However, a key consideration when determining the eligibility criteria for the original modelling exercise, as with any scheme, was that the number of eligible households should not be too large for the available funding levels, potentially resulting in over-subscription, waiting lists, or closure of the scheme in-year. The eligible group should also not be too small, resulting in an insufficient number of households registering for the scheme. The same consideration applies to this additional study.

2.5 Therefore, the initial stage of this work was to identify the impact of the changes to the eligibility criteria on the size of the pool of eligible households, and explore options to make further adjustments if required. Options for further adjustment included reducing the number of the eligible households in order to limit the chance of in-year scheme closure, or increasing the eligible pool size where funding levels allow. For each scenario option, the eligibility criteria were designed so that the households identified as being the most vulnerable were targeted as a priority. This was achieved through the introduction or amendment of age bands and / or extending eligibility to include those with some of the diseases or conditions most vulnerable to cold homes.

2.6 It is important at this point to clarify which households are being referred to when discussing 'target' households and what is meant by 'eligible' households.

Target households are those that we have identified as being at high risk of living in cold homes and most susceptible to the harmful effects from living in damp and draughty dwellings. These are the households that would be reached by the scheme in a perfect targeting situation.

Eligible households are those that meet the eligibility criteria recommended in the original research (and amended in this Study), and are thus eligible for measures. Some vulnerable target households will not be reached using these eligibility criteria and a proportion of eligible

households will not necessarily be ‘vulnerable’ or below the low income threshold.

2.7 The eligibility criteria in the original study was designed so that there was as close an overlap between the target households and eligible households as could be achieved while not incurring unreasonable administrative costs. The percentage of target households in the wider eligible group of households was referred to throughout the original study and in this additional study as the ‘targeting efficiency’ of the scheme. Further details on the characteristics of the target household group and the makeup of the eligible group of households can be found in the original study report.

2.8 Section 4 presents results from modelling these different eligibility criteria in additional scenario options for a future demand-led energy efficiency scheme in Wales.

Modelling energy improvement schemes targeted at qualifying households

2.9 Two annual budget scenarios of £10M and £25M were investigated, with the energy efficiency scheme running over a five year period and installing improvement measures in the dwellings of eligible households. Using the refined eligibility criteria, the model was used to run three different options for each annual budget and these were compared to original corresponding scenarios previously modelled in the original study. Thus, for each annual budget four options for a scheme were considered.

2.10 The NHM model selected dwellings for improvements using a random sampling approach from all households who were eligible according to the eligibility criteria for each option. From the pool of eligible households, each dwelling had the same probability of being selected by the NHM for improvement measures.

2.11 In addition, maximum spending caps were applied to dwellings of different energy efficiency ratings and using different main heating fuels. The maximum expenditure for different types of dwellings is shown in Table 2.1. The dwellings which were not connected to the mains gas grid were afforded the highest spending caps of £8,000 or £12,000 depending on their SAP

rating. Dwellings which used mains gas as a heating fuel had spending caps between £4,000 for properties in SAP bands D and E and £5,000 for properties in SAP bands F and G.

Table 2.1: Maximum spending caps for dwellings that received energy efficiency measures by energy efficiency band and main heating fuel

SAP band	Mains gas heating	Non mains gas heating
D	£4,000	£8,000
E	£4,000	£8,000
F,G	£5,000	£12,000

2.12 Reducing the cap for more efficient dwellings helped minimise the chances of these dwellings disproportionately using up the funding available, and also recognised the fact that the least efficient properties require higher levels of investment to bring them up to adequate levels of efficiency. In initial iterations of the modelling for options with an annual budget of £10M, the criteria were only expanded to include SAP D rated dwellings once all eligible dwellings in SAP bands E, F and G had received measures. However, as there were sufficient numbers of E, F and G rated dwellings for this level of funding, no point was reached whereby all these homes had received measures. The outcome was that no D rated dwellings received improvements over the lifetime of the programme; therefore this approach did not explore the impact of expanding the energy efficiency criteria as intended. To address this, in the final version of the modelling, D rated dwellings were instead considered eligible for measures from the first year of the programme.

2.13 The NHM has the capability to model a range of energy efficiency retrofit measures including insulation, heating systems and low carbon technologies. Following consultation with the Welsh Government, the following list of measures was agreed upon as being the most suitable for an energy efficiency scheme in Wales:

- Loft insulation
- External wall insulation

- Cavity wall insulation
- Draught proofing
- Low energy lighting
- Mains gas condensing combination boiler (where a property already has a mains gas connection and the efficiency of the existing heating systems is less than 85 per cent)
- Oil condensing combination boiler (where a property already has an oil system and the efficiency of the existing boiler is less than 85 per cent)
- LPG condensing combination boiler (where a property already has an LPG system and the efficiency of the existing boiler is less than 85 per cent)
- Modern slim line fan assisted electric storage heaters (where property currently has old large storage heaters)
- Air source heat pumps (ASHP)
- Solar photo voltaic (PV) panels
- Solar thermal panels

2.14 In the modelling scenarios in each given year, dwellings were improved with the combination of measures which resulted in the biggest energy bill savings, whilst having capital costs below the spending caps. The scenarios continued installing measures in dwellings each year until the total cost of the measures across all properties had reached the annual budget allowance for that year. The scenario then moved on to the next year and began the process again until five years had elapsed.

2.15 The model was designed so that eligible dwellings could only receive one set of improvement measures, with a combined cost no greater than the allocated maximum expenditure cap (see Table 2.1), over the five year programme.

2.16 Each modelling scenario generated a report on all dwellings in the modelled stock, documenting the changing circumstances of those households receiving measures. These outputs from the model form the basis of the results presented in Section 4.

3. Proposed eligibility criteria

3.1 The size of the pool of eligible households for each scenario was designed to ensure it was greater than the maximum number of households that could receive measures through the scheme for a given budget. It was assumed that not all eligible households would apply for the scheme, but the pool size was not expanded so as to be too large as to risk over-subscription to the scheme.

3.2 The theoretical maximum number of households that could receive dwelling improvement measures was calculated using an assumed spend of £4,000 per household. This was the approximate average spend per household for Warm Homes Nest and used as a guide in the original Study.

3.3 In this Report, in order to shorten the names of each option for each budget scenario, the following naming conventions have been adopted:

- **Original £10M** – The original scenario with an annual budget of £10M targeting **owner occupied** and **private rented dwellings** with SAP ratings of **E, F or G**.
- **£10M a)** – New option with an annual budget of £10M targeting only **owner occupied dwellings** with SAP ratings of **E, F or G**.
- **£10M b)** – A new option with an annual budget of £10M targeting **only owner occupied dwellings** with SAP ratings of **D, E, F or G**.
- **£10M c)** – A new option with an annual budget of £10M targeting **owner occupied** and **private rented dwellings** with SAP ratings of **D, E, F or G**.

- **Original £25M** – The original option with an annual budget of £25M targeting **owner occupied** and **private rented dwellings** with SAP ratings of **E, F or G**.
- **£25M a)** – New option with an annual budget of £25M targeting only **owner occupied dwellings** with SAP ratings of **E, F or G**.
- **£25M b)** – A new option with an annual budget of £25M targeting **only owner occupied dwellings** with SAP ratings of **D, E, F or G**.

- **£25M c)** – A new option with an annual budget of £25M targeting **owner occupied** and **private rented dwellings** with SAP ratings of **D, E, F or G**.

3.4 These are used to refer to each annual budget option in the remainder of the Report. However, a reminder of the details of each option is provided in Section 4 under each of the tables and figures.

3.5 The proposed eligibility criteria and the size of the resulting pool of eligible households are shown for the £10M annual budget below in Table 3.2. Where the initial criteria resulted in the creation of a pool that was much larger or smaller than the number of households who could receive measures within the scenario, additional criteria were applied. In order to ensure the scheme continued to target the most vulnerable people while simultaneously ensuring a suitable pool size of eligible households, age bands were altered and those with some of the diseases or conditions most vulnerable to cold homes were added to the eligibility criteria. The maximum pool size using the eligibility criteria for the original £10M budget scenario as modelled in the original study are shown for comparison.

3.6 In all four of the options for the £10m annual budget scenario, age thresholds were applied to ensure that only households containing the youngest children (aged under five years) or older adults received home energy improvement measures under the scheme. For three of the options, the older adult age threshold was set at 75 years to limit the size of the eligible group and in recognition of the fact that this group was more likely to contain the most vulnerable older adults. For the £10M option which excludes private rented properties but does not expand the energy efficiency criteria to SAP D rated properties, the age threshold was reduced to 65 years to ensure a sufficiently large pool of eligible households.

Table 3.2: Criteria and size of eligible groups £10M annual budget options

Annual budget	SAP band	Tenure	Household characteristics	Number of households
£10M Original	E,F, or G	Owner occupied or private rented	Households in receipt of any of the means tested benefits specified **AND** containing members who are aged either **over 75 years** or less than five years	23,457
£10M (a)	E,F or G	Owner Occupied	Households in receipt of any of the means tested benefits specified **AND** containing members who are aged either **over 65 years** or less than five years **OR** Low income households which include people with a respiratory or circulatory disease AND containing members who are either aged **over 65 years** or less than five years	28,384
£10M (b)	D, E, F or G	Owner Occupied	Households in receipt of any of the means tested benefits specified **AND** with members who are either aged over 75 years or less than five years **OR** Low income households which include people with a respiratory or circulatory disease **AND** containing members who are either aged over 75 years or less than five years	31,650
£10M (c)	D, E, F or G	Owner Occupied or Private Rented		43,788

3.7 Table 3.3, below, shows the proposed eligibility criteria and the size of the resulting pool of eligible households for the £25M annual budget scenario. For two of the options, £25M b) and £25M c) the older adult age threshold was set for all households at 65 years and 75 years, respectively. For option £25M a), which excludes private rented properties but does not expand the energy efficiency rating criterion to include SAP D rated properties, no age band restrictions were set as these would have reduced the pool size of eligible households too low and meant that it would be difficult to spend the available budget for that scenario.

3.8 The estimated number of eligible households for option £25M (b) was approximately 56,000. While this was higher than other options, it is still a feasible option because D rated properties comprise a significant proportion of this eligible group. As shown and explained in Section 4 below, having D rated dwellings in the group reduces the average cost of improvements per dwelling across the scheme. An average improvement cost of £4000 per dwelling was used to estimate the number of households likely to receive measures over the course of the scheme. However, for this option average costs were found to be lower than this, and the total scheme budget was spread over a larger number of dwellings than originally estimated. Therefore, it is unlikely that this pool size of households will risk over-subscription, waiting lists, or closure of the scheme in-year.

Table 3.3: Criteria and size of eligible groups £25M annual budget options

Annual budget	SAP bands	Tenure	Household characteristics	Number of households
£25M Original	E, F or G	Owner Occupied or Private Rented	Households in receipt of any of the means tested benefits specified AND containing members who are aged either **over 75 years** or less than five years **OR** Low income households which include people with a respiratory or circulatory disease	49,696
£25M (a)	E, F or G	Owner Occupied	Households in receipt of any of the means tested benefits specified **OR** Low income households which include people with a respiratory or circulatory disease	44,938
£25M (b)	D, E, F or G	Owner Occupied	Households in receipt of any of the means tested benefits specified AND Households with members who are either aged **over 65 years** or less than five years **OR** Low income households which include people with a respiratory or circulatory disease AND Households with members who are either aged **over 65 years** or less than five years	56,054
£25M (c)	D, E, F or G	Owner Occupied or Private Rented	Households in receipt of any of the means tested benefits specified AND Households with members who are either aged **over 75 years** or less than five years **OR** Low income households which include people with a respiratory or circulatory disease AND Households with members who are either **aged over 75 years** or less than five years	43,788

4. Summary of modelling results

4.1 Some headline results are presented here to better demonstrate the impact of two different energy efficiency programme budgets and of adjusting the eligibility criteria. For each annual budget scenario four different options are presented.

4.2 For each of the options the results are displayed by household eligibility (i.e. the route by which they were eligible for the scheme) so as to observe the differential impact on each of these groups. The results report the energy efficiency ratings of the dwellings before they had received measures, the number of dwellings which received measures, the number of measures that dwellings received on average, the proportion of each household type which received measures, the average expenditure per household and the average bill savings per household.

4.3 The full details of each option and the specific eligibility criteria used for each are presented above in Table 3.2 and Table 3.3 for the £10M and £25M annual budget scenarios, respectively. However, each of the tables of results and figures in this section have details of the eligibility criteria summarised below in the table or figure notes.

Starting SAP rating of those dwellings that received measures by annual budget, option and household type

4.4 The energy efficiency profile and average SAP rating for private rented and owner occupied dwellings in Wales are shown in Table 4.4. The table shows the energy efficiency profile of all private rented and owner occupied dwellings in Wales, and also for just those who are inhabited by eligible households. Overall, the dwellings across both types of tenure had similar proportions of dwellings in each SAP band and similar average energy efficiency (SAP) ratings. For all homes in Wales, private rented dwellings were found to have a slightly lower average SAP rating of 50, compared with the average SAP rating of 52 for owner occupied dwellings. When only the dwellings of eligible households were selected, the results showed that the energy efficiency profile of eligible households in private rented homes were similar to the wider national profile. The dwellings of only eligible owner occupied households were slightly more efficient than all owner occupied households across Wales (54 versus 50), and on average 4 SAP points more efficient than their private rented counterparts (50).

Table 4.4: Modelled SAP profile of all owner occupied and private rented dwellings in the Welsh Housing stock

SAP band	All owner occupied dwellings in Wales	Eligible owner occupied dwellings only	All private rented dwellings in Wales	Eligible private rented dwellings only
A/B	0%	0%	0%	0%
C	3%	4%	2%	0%
D	37%	44%	33%	37%
E	35%	33%	35%	42%
F	17%	11%	20%	19%
G	8%	8%	9%	3%
Average SAP rating	52	54	50	50

(Source: Modelled housing stock for Wales and NHM modelled energy efficiency ratings)

£10M annual budget options

4.5 Table 4.5 summarises the starting SAP rating of those dwellings that received measures for an annual spend of £10M. It compares the SAP ratings from the original modelled scenario with the three new options described in Table 3.2 and shows differences in the SAP rating of the dwellings of the various household types that received measures.

4.6 In each of the options, some household types were not eligible for measures (for example, due to the use of age bands) or, for particular small groups, were simply not selected for measures by the random selection function of the NHM. (This is discussed more in the following sub-sections.) In these cases, where no households in a household type have received measures, no data is included in the tables.

Table 4.5: Average pre-installation SAP rating of dwellings that received measures – annual scheme budget: £10M annual budget options

Type of household		Average starting SAP rating of dwellings that received measures			
		Original*	£10M a)†	£10M b)‡	£10M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	38	31	48	48
	Not in receipt of MTB	-	-	48	-
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	-	-	-
	Above income threshold, vulnerable, on MTBs	39	48	50	51
	Above income threshold, not vulnerable, on MTBs	-	-	-	-
Total		38	32	48	48

*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.7 For those options where D rated properties were not eligible (original £10M and £10M a)), the average initial SAP ratings were, as expected, lower than the initial SAP ratings for the options where D rated properties were eligible (£10m b and £10m c).

£25M annual budget options

4.8 Table 4.6, below, summarises the average starting SAP ratings of those dwellings that received measures for an annual spend of £25M. It compares the SAP ratings from the original modelled scenario with the three new options described in Table 3.2 and shows differences in the SAP rating of the dwellings of the various household types that received measures.

Table 4.6: Average pre-installation SAP rating for dwellings that received measures: £25M annual budget options

Type of household	Average starting SAP rating of dwellings that

		received measures			
		Original*	£25M a)†	£25M b)‡	£25M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	38	36	46	48
	Not in receipt of MTB	35	42	48	48
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	51	-	-
	Above income threshold, vulnerable, on MTBs	48	48	55	50
	Above income threshold, not vulnerable, on MTBs	-	54	-	-
Total		40	39	47	48

*** Original £25M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E, F, G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

The number of dwellings that received measures by annual budget, option and household type

£10M annual budget options

4.9 Table 4.7 summarises the number of dwellings that received measures for options with an annual budget of £10M. It compares the numbers of households that received measures in the four options modelled for this annual budget – the original £10M scenario plus the three new options described in Table 3.2.

4.10 For several options, the target group of households not in receipt of means tested benefits did not receive any measures under the modelling (e.g. £10M a) and £10M c)) despite these households being eligible. Households including members with respiratory or circulatory diseases can be in receipt of eligible means tested benefits and therefore many of these were included in the 'Target Group: In receipt of MTB'. So although low numbers of the 'Target Group: Not in receipt of MTB' received measures, households including people with respiratory or circulatory conditions did receive measures as they will have been included in the 'Target Group: In receipt of

MTB' through also being in receipt of qualifying means tested benefits. In addition, the pool size of the 'Target Group: Not in receipt of MTB' was significantly smaller than the 'Target Group: In receipt of MTB' and overall fewer households were selected for measures from the former group, particularly with lower budgets.

Table 4.7: The number of dwellings that received measures by household type: £10M annual budget options

Type of household		Number of dwellings receiving measures			
		Original*	£10M a)†	£10M b)‡	£10M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	19,596	18,161	23,546	24,586
	Not in receipt of MTB	0	0	261	0
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	0	0	0	0
	Above income threshold, vulnerable, on MTBs	1,811	995	1,714	2,624
	Above income threshold, not vulnerable, on MTBs	0	0	0	0
Total		**21,407**	**19,156**	**25,521**	**27,210**

*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.11 For each of the four options with a £10m annual budget the household types which did not include any vulnerable people did not receive measures. This is because the definition of vulnerable applied here includes adults over 65 years and children. In all four options the criteria for eligibility include children under 5 years and adults over 65 years or 75 years. This means it was not possible to qualify for a measure and have no vulnerability characteristics.

£25M annual budget options

4.12 Table 4.8 summarises the number of households that received measures for a scheme with an annual budget of £25M. It compares the number of households that received measures in the original option, with the three additional options outlined in Table 3.3.

4.13 Option £25M b) installed the greatest number of improvement measures both in Welsh households overall and in the target group. The majority of households whose dwellings received measures were in the target group; the remainder were on incomes above the relative low income threshold but nevertheless contained people with additional vulnerabilities.

4.14 Option £25M a) was the only option where age thresholds were not included in the eligibility criteria. As Table 4.8 shows, this was the only option where households classed as 'not vulnerable' (i.e. not including children, older adults or those with disabilities or long term health conditions) received measures - these households qualified through being in receipt of qualifying means tested benefits. For the other options with a £25M annual budget, all eligible households were classified as vulnerable because they contained either young children (aged under 5 years) or older adults (aged over 65 or 75 years depending on the option).

Table 4.8: The number of dwellings that received measures by household type: £25M annual budget options

Type of household		Number of dwellings receiving measures			
		Original*	£25M a)†	£25M b)‡	£25M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	25,307	30,074	40,492	38,892
	Not in receipt of MTB	2,681	1,424	261#	261#
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	0	2,320	0	0
	Above income threshold, vulnerable, on MTBs	8,737	6,647	4,979	3,832
	Above income threshold, not vulnerable, on MTBs	0	198	0	0
Total		**36,725**	**40,662**	**45,732**	**42,985**

*** Original £25M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E, F, G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
# **Note:** the small number of households in this group is from one case in the modelled housing stock with a household weight of '261'. It was the same house case selected for the original £25M b) and £25M c) options.

The proportions of households receiving measures by annual budget, option and household type

£10M annual budget options

4.15 Table 4.9 shows the proportion of different eligible household types whose dwellings received improvement measures for options with a £10M annual budget.

Table 4.9: The proportion of each household type that received measures: £10M annual budget options

Type of household		Proportion of dwellings that receive measures found in each group			
		Original*	£10M a)†	£10M b)‡	£10M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	92%	95%	92%	91%
	Not in receipt of MTB	0%	0%	1%#	0%
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	0%	0%	0%	0%
	Above income threshold, vulnerable, on MTBs	8%	5%	7%	10%
	Above income threshold, not vulnerable, on MTBs	0%	0%	0%	0%
Total		**100%**	**100%**	**100%**	**100%**

*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

Note: The low proportion of households in the 'Target Group: Not in receipt of MTB' was represented by one house case with a household weight of '261' (see Table 4.7). Please refer to the note accompanying Table 4.7 for further explanation of the distribution of households receiving measures across the groups.

4.16 In each of these options the target groups' dwellings received the majority of the measures installed. The remainder of the measures were received by the group that, despite falling outside the target group, were still eligible for the scheme due to the receipt of qualifying means tested benefits.

£25M annual budget options

4.17 Table 4.9 shows the proportion of different eligible groups who received improvement measures for options for a scheme with a £25M annual budget.

Table 4.10: The proportion of each household type that received measures: £25M annual budget options

Type of household		Proportion of dwellings that receive measures found in each group			
		Original*	£25M a)†	£25M b)‡	£25M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	69%	74%	89%	90%
	Not in receipt of MTB	7%	4%	1%	1%
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	0%	6%	0%	0%
	Above income threshold, vulnerable, on MTBs	24%	16%	11%	9%
	Above income threshold, not vulnerable, on MTBs	0%	0%	0%	0%
Total		**100%**	**100%**	**101%[2]**	**100%**

*** Original £25M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E, F, G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.18 In every option the majority of the measures were installed in the target groups' dwellings. However, for this higher annual spend the proportion of measures installed in the target group was lower than for the £10M scenario options. In other words, the narrowed criteria used for the £10M scenario options resulted in a higher targeting efficiency than for the £25M annual budget scenario options.

[2] Figures may not sum to 100% due to rounding.

Average number of measures installed by annual budget, option and household type

Table 4.11: The average number of measures installed in the dwellings that received measures: £10M annual budget options

Type of household		Average number of measures installed in each dwelling			
		Original*	£10M a)†	£10M b)‡	£10M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	2.4	2.4	2.4	2.3
	Not in receipt of MTB	-	-	3.0	-
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	-	-	-
	Above income threshold, vulnerable, on MTBs	2.2	2.6	1.6	2.2
	Above income threshold, not vulnerable, on MTBs	-	-	-	-
Total		2.3	2.5	2.3	2.3

*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.19 Table 4.11 and Table 4.12 show the average number of energy efficiency improvement measures that were installed in each dwelling for schemes with a £10M annual budget and those with a £25M annual budget, respectively. Generally, the average number of measures installed varied between 2 and 3 measures per dwelling.

Table 4.12: The average number of measures installed in the dwellings that received measures: £25M annual budget options

Type of household		Average number of measures installed in each dwelling			
		Original*	£25M a)†	£25M b)‡	£25M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	2.7	2.7	2.4	2.5
	Not in receipt of MTB	2.8	2.0	3.0	3.0
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	3.6	-	-
	Above income threshold, vulnerable, on MTBs	2.9	2.4	2.0	2.1
	Above income threshold, not vulnerable, on MTBs	--	3.0	-	-
Total		2.8	2.7	2.4	2.5

*** Original £25M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E, F, G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.20 The number of measures installed in each dwelling was influenced by the maximum spending cap applied. Although multiple measures may have been suitable to install in a dwelling, the model selected the most cost-effective measures to reduce energy bills in each case, while maintaining total spending below the cap. Although the cost of measures and the caps varied between types of improvements and types of dwellings, the results suggest that on average the caps limited the number of measures installed to between 2 and 3 measures per dwelling.

Average costs of energy efficiency improvements by annual budget, option and household type

£10M annual budget options

4.21 For the £10M annual budget options, Table 4.13 shows the average cost of the measures that were installed, illustrating that the average cost of installation of improvements varied between approximately £1,800 and £2,600 for all household types.

4.22 The average cost of measures for the 'Target Group: Not in receipt of MTB' for the £10M b) option was based on one house case in the modelled stock representing 261 dwellings in Wales (Table 4.7).

Table 4.13: The average cost of measures for different households types: £10M annual budget options

Type of household		Average cost of measures			
		Original*	£10M a)†	£10M b)‡	£10M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	£2,396	£2,698	£2,017	£1,865
	Not in receipt of MTB	-	-	£2,920	-
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	-	-	-
	Above income threshold, vulnerable, on MTBs	£1,662	£994	£1,014	£1,571
	Above income threshold, not vulnerable, on MTBs	-	-	-	-
Overall average cost of measures		**£2,335**	**£2,610**	**£1,959**	**£1,837**

*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.23 On average, for the £10M annual budget options, the target group received more expensive packages of measures than those households outside the target group. As previously shown in Table 4.5 and Table 4.6, the initial average SAP ratings of the target group who were also in receipt of means tested benefits was generally lower than the average SAP ratings of those outside the target group. It is likely that these dwellings may not already have had the more cost effective measures installed, such as cavity wall and loft insulation that dwellings with higher SAP ratings may have been built with, or already had retrofitted. As a result, these dwellings have a greater potential for improvement. Table 4.11 and Table 4.12 show that the 'Target Group: in receipt of MTB' tended to install slightly more measures on average than those not in the target group, and thus the average cost of measures was higher than for other household types.

£25M annual budget options

4.24 For the £25M annual budget options (Table 4.14) the average costs of improvement measures were higher than for the equivalent £10M annual budget options; average installation costs for the £25M annual budget options varied between £2,300 and £3,400 across all household types. As with the £10M annual budget options, on average the target group received more investment than those households outside the target group.

4.25 The numbers of dwellings receiving measures in the original £25M option in the 'Target Group: Not in receipt of MTB' was represented by 9 house cases in the modelled housing stock. Four of these were off gas properties rated in SAP bands F and G, who received measures costing approximately £11,000 (approaching the maximum spending cap of £12,000 for these dwellings, see Table 2.1). These households have therefore skewed the average cost of measures for this group of households under this option.

Table 4.14: The average cost of measures for different households types: £25M annual budget options

Type of household		Average cost of measures			
		Original*	£25M a)†	£25M b)‡	£25M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	£3,342	£3,453	£2,878	£2,383
	Not in receipt of MTB	£6,073	£1,615	£2,920	£2,920
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	£2,997	-	-
	Above income threshold, vulnerable, on MTBs	£2,760	£1,766	£1,550	£1,404
	Above income threshold, not vulnerable, on MTBs	-	£857	-	-
Overall average cost of measures		**£3,403**	**£3,074**	**£2,733**	**£2,299**

*** Original £25M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E, F, G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

Average annual bill savings by annual budget, option and household type

£10M annual budget options

4.26 For the £10M annual budget options, Table 4.15 shows the average bill saving experienced by households who received energy efficiency measures. Option £10M a) achieved the greatest average bill savings for all eligible households, but specifically for the target group.

4.27 The average bill savings were also higher for those in the target group in receipt of means tested benefits, in contrast to those households not in the target group but still receiving measures due to being on means tested benefits. It is important to remember here that the number of households in the target group who are not in receipt of means tested benefits but receiving measures due to being on a relative low income with a qualifying chronic health condition, under the £10M options was

small (see Table 4.7). As a result, bill savings reported here for the 'target group: Not in receipt of MTB' should be treated with caution.

Table 4.15: The average annual bill savings from installation of measures for each household type: £10M annual budget options

Type of household		Average annual bill saving			
		Original*	£10M a)†	£10M b)‡	£10M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	£328	£392	£292	£275
	Not in receipt of MTB	-	-	£97	-
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	-	-	-
	Above income threshold, vulnerable, on MTBs	£224	£195	£98	£169
	Above income threshold, not vulnerable, on MTBs	-	-	-	-
Overall average bill saving		**£319**	**£381**	**£277**	**£266**

*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

£25M annual budget options

4.28 Table 4.16 shows the average bill saving for households who had measures installed in their dwellings under the £25M annual budget options. The results shows that measures installed under option £25M a) resulted in the most significant average annual bill saving. However, comparable bill savings were also experienced by households in the original £25M option.

4.29 For each option, the highest savings were experienced by the target group of households on means tested benefits – a reflection of the higher cost of measures installed in their dwellings (see Table 4.14). For options £25M b) and £25M c) the

savings for the target group of households not in receipt of means tested benefits (i.e. those low income households containing someone with respiratory or circulatory diseases) were lower than other households. However, as Table 4.11 shows, these results are from one house case in the modelled stock representing 261 households in Wales and therefore should be treated with caution.

Table 4.16: The average annual bill savings from installation of measures for each household type: £25M annual budget options

Type of household		Average bill saving			
		Original*	£25M a)†	£25M b)‡	£25M c)§
Target Group (relative low income and vulnerable)	**In receipt of MTB**	£399	£419	£301	£327
	Not in receipt of MTB	£313	£198	£97	£97
Outside of target group but eligible	**Below income threshold, not vulnerable, on MTBs**	-	£358	-	-
	Above income threshold, vulnerable, on MTBs	£236	£183	£155	£155
	Above income threshold, not vulnerable, on MTBs	-	£189	-	-
Overall average bill saving		**£354**	**£368**	**£284**	**£310**

*** Original £25M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E, F, G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

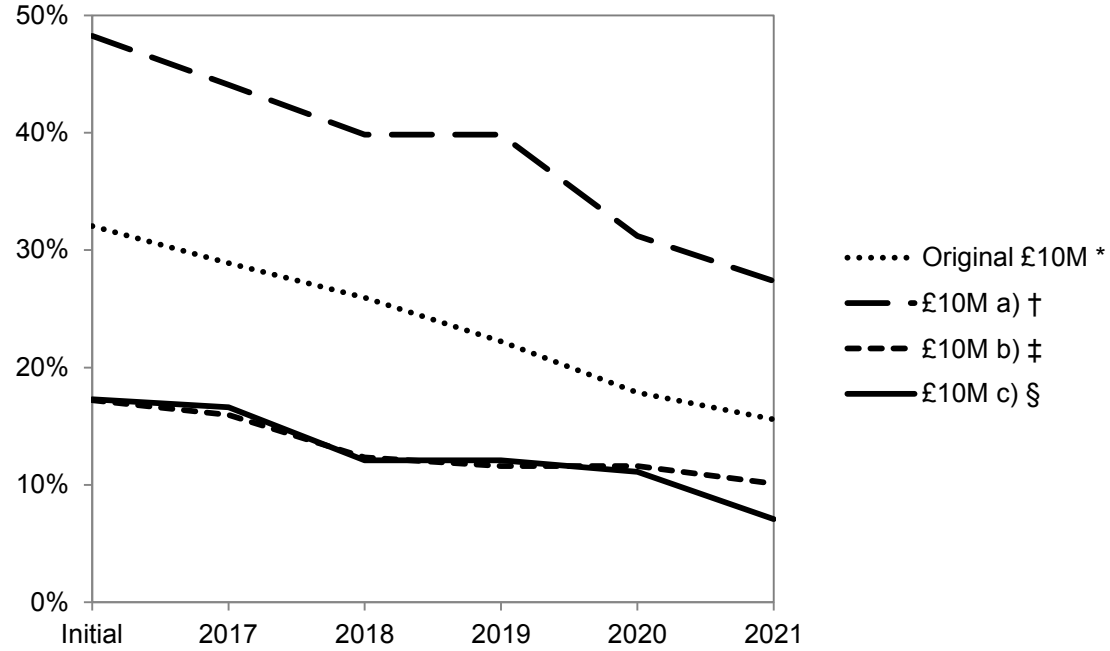
Average improvement in energy efficiency by annual budget, option and household type

£10M annual budget options

4.30 Figure 4.3 shows the proportion of all dwellings receiving measures that were in SAP bands F or G initially and for each year over a five year scheme with an annual budget of £10M. The graph shows the results from all four options modelled.

4.31 The number of dwellings improved ranged between 19,000 for option £10M a) and 25,500 for option £10M b) (see Table 4.7).

Figure 4.1: The proportion of dwellings in SAP bands F and G over the five year lifetime of scenarios: £10M annual budget options

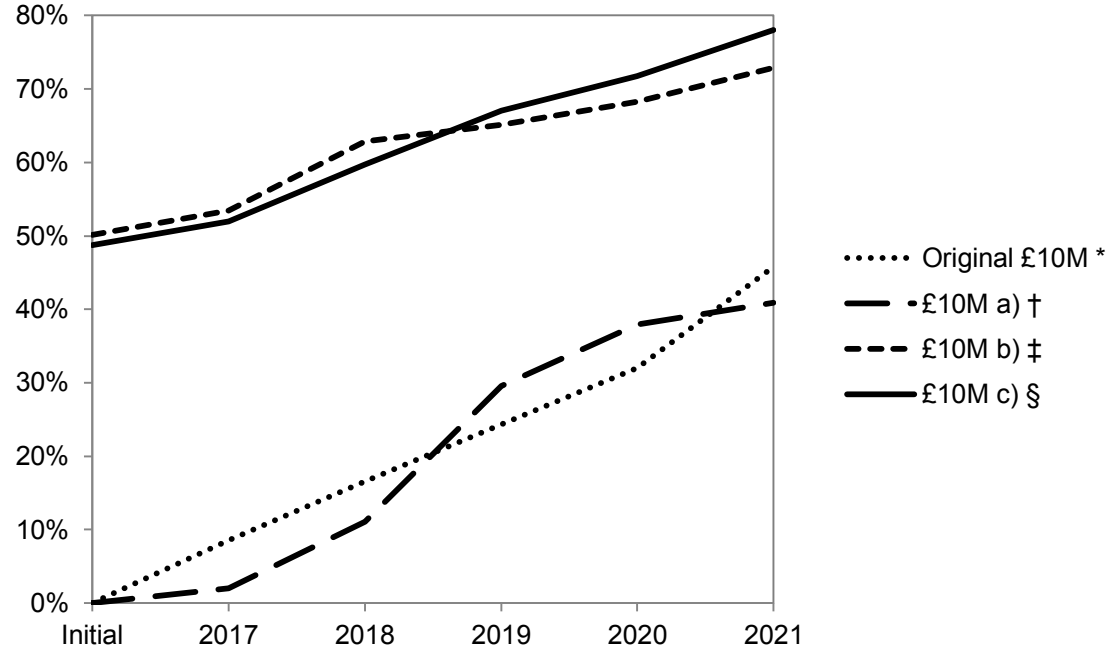


*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years.
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.32 The initial proportion of dwellings rated in SAP band F or G varied between the four options. For both the original £10M option and option £10M a), only dwellings in SAP bands E, F and G were eligible. As a result, the percentage of dwellings in bands F and G initially comprised a higher proportion than options in which D rated dwellings were eligible.

4.33 All of the options for a £10M annual budget showed a gradual decrease in the proportion of dwellings in bands F and G over time. On completion of the scheme, option £10M b) had the lowest proportion of dwellings rated F or G. However, over the lifetime of the scheme, option £10M a) experienced the biggest overall reduction in dwellings rated F or G.

Figure 4.2: The proportion of dwellings in SAP bands C or D over the five year lifetime of scenarios: £10M annual budget options



*** Original £10M** – Owner occupied and private rented; SAP bands E, F, G; MTB and over 75 years or under 5 years.
† **£10M a)** – Owner occupied only; SAP bands E, F, G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
‡ **£10M b)** – Owner occupied only; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.
§ **£10M c)** – Owner occupied and private rented; SAP bands D, E, F, G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.34 Figure 4.2, above, shows the impact of the different options for a scheme with an annual budget of £10M on the proportion of those dwellings that received measures which were in SAP bands C and D, over the lifetime of the scheme.

4.35 For the £10M original option and option £10M a), only dwellings in SAP bands E, F and G were eligible, so the proportion of dwellings in bands C and D at the start of these options was zero. For options £10M b) and £10M c) – in which dwellings in band D were eligible – approximately 50% of the initial eligible dwellings were D rated.

4.36 For all four options with a £10M budget there was a gradual increase in the proportion of dwellings in band C or D. After five years, the proportion of dwellings in bands C and D for options £10M b) and 10M c) was 20-30% higher than for the original £10M option and option £10M a) – a result of options £10M b) and 10M c) including D rated properties in the original eligibility criteria. However, the original £10M option and option £10M a), which only targeted dwellings in E, F or G SAP bands, experienced a larger overall increase in the number of dwellings rated C or

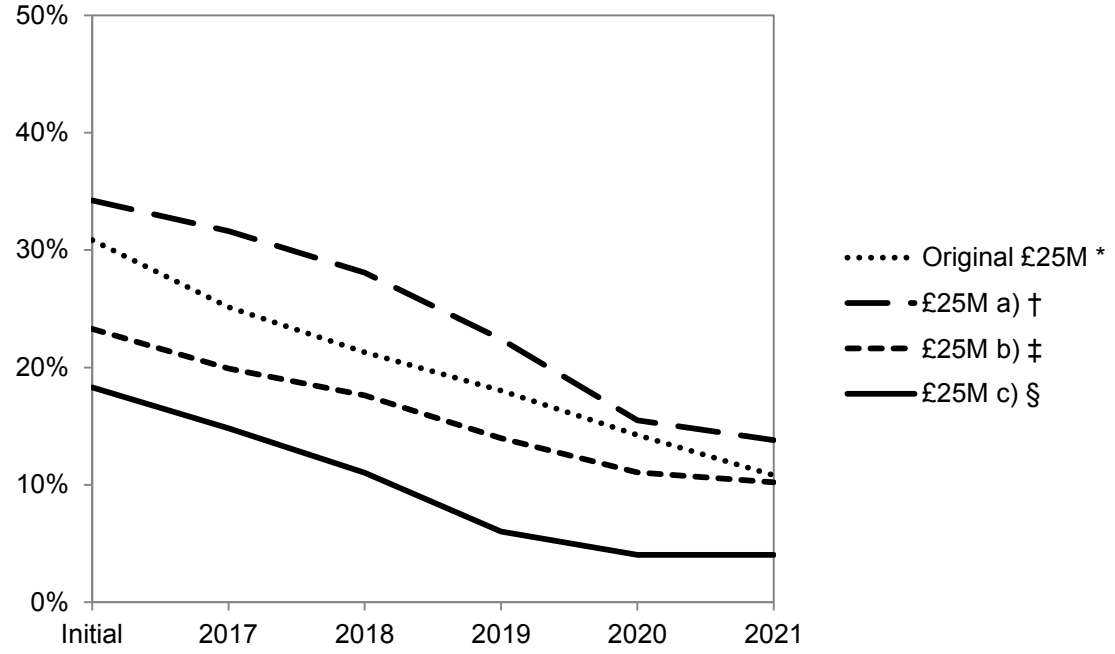
D. For example, option £10M b) resulted in approximately 5,800 dwellings improved from SAP bands E, F or G to SAP band D or C, but option £10M a) resulted in approximately 7,850 dwellings improved from SAP bands E, F or G to SAP band D or C.

£25M annual budget options

4.37 Figure 4.3 shows the proportion of all dwellings receiving measures that were in SAP bands F or G initially and for each year over a five year scheme with an annual budget of £25M. The graph shows the results from all four options modelled.

4.38 It is worth noting that the number of dwellings that received measures varies between the options for a £25M annual budget. The largest number of dwellings (46,000) was improved by Option £25M b), and the smallest number (37,000) was improved by the original £25M option, as shown in Table 4.8.

Figure 4.3: The proportion of dwellings in SAP bands F and G over the five year lifetime of scenarios: £25M annual budget options



*** Original £25M** – Owner occupied and private rented; SAP bands E,F,G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E,F,G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D,E,F,G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D,E,F,G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

4.39 Initially, the number of dwellings with energy efficiency ratings in the bottom two SAP bands (SAP F & G) varied between the four options for a £25M annual budget. For both the original £25M option and for option £25M a), only dwellings in SAP bands E, F and G were eligible. As a result, the percentage of dwellings in bands F and G was higher from the beginning.

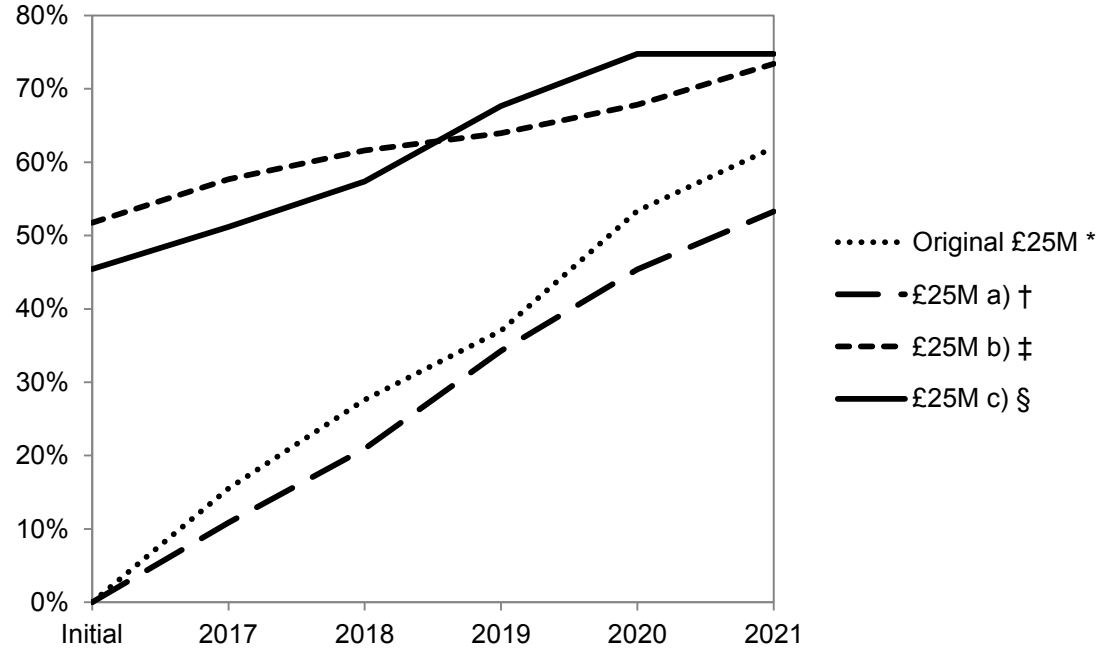
4.40 All of the options showed a steady decrease in the proportion of dwellings in bands F and G over time. Overall, as well as improving more dwellings, this higher budget had a more significant impact on reducing the proportion of dwellings rated F or G than the options with a £10M annual budget. For the original £10M option and options £10M a), £10M b) and £10M c), the numbers of F and G rated dwellings reduced by 51%, 43%, 41% and 59%, respectively. This compared to reductions of 65%, 60%, 56% and 78% for the corresponding options for the £25M annual budget.

4.41 Finally, Figure 4.4 shows the impact of the different options for a scheme with an annual budget of £10M on the proportion of those dwellings that received measures which were in SAP bands C and D over the lifetime of the scheme.

4.42 For the original £25M option and option £25M a), only dwellings in SAP bands E, F and G were eligible, so the proportion of dwellings in bands C and D at the start of these scenarios was zero. For options £25M b) and £25M c), where dwellings in band D were also eligible, approximately half of all dwellings receiving measures were initially in SAP band D.

4.43 For all options, there was a steady increase in the proportion of dwellings in band C and D over the five years of the scheme. For the original option and option £25M a) this rate of increase was more substantial than other options. By the end of the five year model run, the proportion of dwellings in SAP bands C and D for the original £25M option increased from 0% (as only dwellings in bands E, F and G were eligible) to 63%, and from 0% to 53% for option £25M a). For options £25M b) and £25M c), for which D rated dwellings were included in the eligible group, the increase was from approximately half of all dwellings to 73% and 75% of dwellings, respectively.

Figure 4.4: The proportion of dwellings in SAP bands C or D over the five year lifetime of scenarios: £25M annual budget options



*** Original £25M** – Owner occupied and private rented; SAP bands E,F,G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions.
† **£25M a)** – Owner occupied only; SAP bands E,F,G; MTB OR respiratory or circulatory conditions (no age bands).
‡ **£25M b)** – Owner occupied only; SAP bands D,E,F,G; MTB and over 65 years or under 5 years OR respiratory or circulatory conditions and over 65 years or under 5 years.
§ **£25M c)** – Owner occupied and private rented; SAP bands D,E,F,G; MTB and over 75 years or under 5 years OR respiratory or circulatory conditions and over 75 years or under 5 years.

5. Conclusions

5.1 Altering the eligibility criteria for dwellings (SAP rating and tenure) and for households (age group) had some noteworthy impacts on the modelling results. The most significant of these are summarised below.

Impact of changing energy efficiency eligibility

5.2 In the scenario options in which the eligibility criteria were widened to include SAP D rated dwellings, the average cost of improvements was lower and more dwellings received improvements when compared with the scenario options that only included E, F or G rated dwellings. This is partially a result of D rated dwellings having a smaller capacity for energy efficiency improvements, since they will tend to either be newer properties that were built with more efficient walls and/or full loft insulation, or older dwellings with measures such as loft or cavity wall insulation already installed. This trend occurred for options with both annual budgets but was more pronounced for the £25M annual budget options.

5.3 In the £25M annual budget options that excluded D rated dwellings (£25M Original and £25M (a)), the average number of measures installed was 2.7 and 2.8 per dwelling respectively, whereas in the £25M annual budget options that included D rated dwellings (£25M (b) and £25M (c)), the average number of measures installed per home reduced to 2.4 and 2.5 respectively.

5.4 However, another impact of including D rated properties was that for a fixed budget fewer of the least efficient properties (SAP bands F and G) were included in the eligible group and fewer received measures (Figure 4.1 and Figure 4.3). F and G rated dwellings were granted a higher spending cap per dwelling (£5,000 for on-gas dwellings, £12,000 for off-gas dwellings) than those rated in SAP bands D or E (£4,000 for on-gas dwellings, £8,000 for off-gas dwellings). In options £25M (b) and £25M (c), a lower proportion of SAP band F and G dwellings received improvements. This also contributed to the budget being distributed over a large number of dwellings, and reduced the average spend per dwelling for these options.

Impact of different eligibility criteria on targeting efficiency

5.5 The four £10M annual budget options had better targeting efficiency than the £25M options. For the £10M annual budget options, the targeting efficiency ranged

between 91% and 95%[3]. Whereas for the £25M annual budget the efficiency varied from 76% to 91%.

5.6 The results suggest that the £10M budget option with the best targeting efficiency had the following eligibility criteria:

- Only the least efficient (rated E, F and G) owner occupied dwellings were eligible.
- Households had to contain an adult aged over 65 years and/or a child aged under 5 years.
- At least one member of a household was in receipt of qualifying means tested benefits or had a respiratory or circulatory disease.

5.7 The use of age bands had a more significant impact on targeting efficiency than the removal of private rented dwellings. For example, for option £25M a) the target group in receipt of means tested benefits represented 74% of all households receiving measures and had no age bands included in the eligibility criteria. For option £25M b), which applied age criteria of under 5 years or over 75 years old, the targeting efficiency for this group was 89% (Table 4.10). Neither option included any households in private rented dwellings. The targeting efficiency of option £25M c) which did include households in private rented was 90% - a very similar targeting efficiency to option £25 b) (89%).

5.8 As expected, although the targeting efficiency was lower for the £25M budget options, greater numbers of households in the target group benefited from energy efficiency improvements to their dwellings. Furthermore, on average the £25M annual budget options installed more measures per dwelling and had a larger average spend per dwelling, which resulted in higher bill reductions for the majority of household types receiving measures.

5.9 The modelling proceeded by randomly selecting dwellings for improvements from the eligible pool of households, and as such was unable to predict households' behaviour and engagement with a future scheme. However, the results suggest that a £25M annual scheme budget would be more effective than a £10M annual scheme budget at providing a high number of measures to low income households containing individuals with respiratory or circulatory conditions.

Impact of including or excluding private rented dwellings

[3] Combined efficiency of both target groups of households, i.e. both those on MTB and those not on MTB.

5.10 Removing private rented dwellings from the model had the obvious outcome that households in these homes no longer received measures, and more owner occupied households benefitted from energy efficiency improvements.

5.11 In general, the average SAP ratings of owner occupied and private rented dwellings were very similar. The estimated average SAP rating of eligible private rented dwellings using the modelled housing stock for Wales was 50, compared with 54 for eligible owner occupied dwellings (see Table 4.4). Despite this, in some cases removing private rented dwellings from the eligibility criteria influenced the original energy efficiency profile of the pool of dwellings. However, this did not follow a predictable pattern.

5.12 For the £10M annual budget there were two options which targeted dwellings in SAP bands D, E, F and G. Option £10M b) only included owner occupied dwellings, whereas options £10M c) also include private rented dwellings. The initial average SAP rating for dwellings receiving measures in both cases was 48. However, the original £10M option and option £10 a) both allowed only dwellings in SAP bands E, F or G to be included. The latter option excluded private rented households but the baseline SAP rating of these dwellings was 6 points lower than the original £10M option which included private rented households.

5.13 From other results, such as the targeting efficiency (as mentioned above), the overall impact of removing private rented dwellings from the eligibility criteria does not appear to have a consistent impact and it is hard to isolate the effect of this change alongside alterations in other aspects of the eligibility criteria. Nevertheless there are some factors to contemplate when considering whether to include or exclude private rented dwellings from the eligibility criteria – these are discussed below in the recommendations section.

Impact on changing other eligibility criteria based on additional vulnerabilities

5.14 The original Report identified the kinds of vulnerability that can be experienced by older adults and children living in low income households. In many of the options investigated for this additional modelling, age bands were therefore used to ensure that only households with young children aged under 5 Years or with older adults aged over 65 years qualified for the scheme. Using age band thresholds to confer eligibility also helped to adjust the size of the pool of eligible households so that an appropriate number of households were eligible for assistance.

5.15 For the £25M annual budget the option targeting only owner occupied dwellings in SAP bands E, F and G had no age threshold as this would have reduced the pool of eligible households too far. This option had one of the lowest targeting efficiencies. It also had a higher proportion of households receiving measures who were neither vulnerable nor on low incomes (but who qualified through being in receipt of qualifying means tested benefits).

5.16 The use of age restrictions in the eligibility should therefore be considered to help focus the scheme at some of the more vulnerable households.

6. Recommendations

Private rented dwellings

6.1 The Welsh Government are currently considering alternative options for the private rented sector and different approaches to support the energy efficiency improvements in housing of this tenure. This could involve a move from grant funding to repayable low cost loans to private landlords, and be based on a similar design to other various Welsh Government initiatives. For example, the 15 year, £10m National Home Improvement Loan Scheme, currently delivered through local authorities in Wales. The final recommendations for each annual budget (£10M and £25M) below therefore consider two scenarios, one whereby the private rented sector is supported by an alternative system, and one where there is no such support.

6.2 However, it is important to consider that although the income of households of different tenures was not examined as part of this work, it is well reported elsewhere. For example, JRF[4] note the significant rise of those in private rented dwellings living in poverty between 2003/4 and 2013/14, with the largest rise occurring in working households. The median net income of those in private rented housing in Wales was approximately £22,500 in 2013/14, £7,000 lower than the median net income for owner occupied households (approximately £27,700) according to the Households Above Average Income (HBAI) survey[5]. Therefore, we would not recommend excluding private rented households from being eligible for a future scheme specifically hoping to target low income vulnerable households unless other suitable, effective and well considered policy mechanisms or funding streams were to be available to assist these households.

Energy Efficiency

6.3 It is recommended that a future scheme ensures that as many low income vulnerable households living in dwellings rated F and G benefit from the scheme as possible. The results suggest that opening up the criteria to include dwellings rated D from the offset for a scheme with a limited budget (i.e. £10M per annum) does not necessarily help with this aim. However, for larger budgets, including annual budgets of £25M, this could be a feasible option.

[4] https://www.jrf.org.uk/mpse-2015/poverty-and-tenure
[5] Department for Work and Pensions. (2016). *Households Below Average Income, 1994/95-2014/15.* [data collection]. *9th Edition.* UK Data Service. SN: 5828, http://dx.doi.org/10.5255/UKDA-SN-5828-7

The use of age bands

6.4 The results support the use of age restrictions for both budgets (£10M or £25M) to ensure only households with older adults or younger children (two key vulnerable groups previously identified in the original Study) are targeted. This also increases targeting efficiency and aids better use of resources.

6.5 Although not a significant additional burden, it is worth noting that this could represent an additional requirement in some instances to demonstrate responsibility for a young child or that someone in the household is over a certain age. This would require production of a further piece of evidence from official documentation such as a birth certificate, driving license or passport most of which are used as standard evidence for proving identity or age for a range of other activities or official processes.

Recommendation for £10M annual budget

6.6 If sufficient alternative options are available for private rented dwellings, as mentioned above, then it is recommended, based on the results presented in this report, that a future energy efficiency scheme with an annual budget of £10M focuses on owner occupied dwellings rated in SAP bands E, F and G (i.e. option £10M a)). People on the specified list of means tested benefits or households who are on low incomes and include a member suffering from a respiratory or circulatory disease should be added to the eligibility criteria. However, age bands should remain but be broadened to ensure that, with limited resources, those in some of the potentially most vulnerable situations (children under 5 years or older adults over 65 years) are still prioritised.

6.7 Several results from this Study support this recommendation. This option resulted in the highest targeting efficiency and resulted in the highest number of measures being installed in each dwelling, with the result that those who received measures received the highest reductions in their energy bills (£381). This group also had the highest initial proportion of F and G rated properties. Low income households living in these least efficient properties should continue to be a key focus of future energy efficiency schemes in Wales, particular schemes with limited resource.

6.8 However, without sufficient policies in place to simultaneously support the private rented sector, and based on the targeting efficiency of low income vulnerable households in the coldest homes, we recommend use of the eligibility criteria

specified and modelled for the original £10M option. That is, to include households on one or more of the proposed means tested benefits with household members who are either children under 5 years or adults over 75 years. This option most effectively targets vulnerable low income households living in the least efficient homes including those privately renting.

Recommendation for £25M annual budget

6.9 A stand out recommendation from the results of modelling a £25M annual budget is less clear. Options £25 b) and £25 c) both reach more households and have significantly higher targeting efficiency than the original £25M option and option £25M a), meaning that these scenarios benefit a higher proportion of vulnerable households. However, the inclusion of D rated dwellings results for these options reduces their impacts on individual homes; a smaller average number of measures were installed on average compared with other £25M options, and on average smaller bill reductions for these households were experienced as a result. However, households in the target group on means tested benefits still experience estimated average bill savings of over £300.

6.10 If sufficient alternative policies are in place to support the private rented sector in parallel, the results suggest only allowing those in owner occupied homes to qualify is the optimum option in terms of the targeting efficiency and the number of vulnerable homes that would be improved with this budget (i.e. option £25 b)). In this instance, age bands should be applied (on top of the other existing eligibility criteria) to focus resources on households which include a child under 5 years or an older adult over 65 years.

6.11 However, if no such policy exists for the private rented sector, then there are arguments that could support two different options. If focusing on targeting resources at the most inefficient homes is the priority, then the results support the recommendation to maintain focus only on dwellings rated E, F and G and the eligibility criteria proposed in the original Study for an annual budget of £25M. This option is also more likely to encourage a whole-house approach; the least efficient dwellings are more likely to be eligible for a wider variety of measures and under the proposed design will also be eligible for a large spending cap. This is supported by the modelling results which show higher average spending, higher average number of measures installed and resulting larger average bill savings per house under the original £25M scenario, compared to the other three £25M options.

6.12 However, the original £25M option had the lowest targeting efficiency of the four £25M annual budget options modelled. Therefore, if the priority is to ensure as high a proportion of the annual budget is spent on some of the most vulnerable households, then the results suggest that option £25M c) is preferable. This expanded the eligibility criteria to include D rated dwellings but simultaneous applied age bands so that only households with people over 75 years or with children under 5 years were eligible. The changes increase the targeting efficiency from approximately 76 per cent to 91 per cent.