Explanatory Memorandum to the Home Energy Efficiency Schemes (Wales) (Amendment) Regulations 2018

This Explanatory Memorandum has been prepared by the Decarbonisation and Energy Division and is laid before the National Assembly for Wales in conjunction with the above subordinate legislation and in accordance with Standing Order 27.1.

Minister's Declaration

In my view, this Explanatory Memorandum gives a fair and reasonable view of the expected impact of the Home Energy Efficiency Schemes (Wales) (Amendment) Regulations 2018. I am satisfied that the benefits justify the likely costs.

Lesley Griffiths AM
Cabinet Secretary for Energy, Planning and Rural Affairs

9 March 2018

DOC 2

1. Description

The existing Welsh Government Warm Homes Nest scheme ends on 31 March 2018 and will be replaced by a new Warm Homes Nest scheme which commences on 1 April 2018. Welsh Government consulted on the design of the new scheme which has resulted in a number of changes. This Statutory Instrument makes provision to:

- make changes to enable the maximum amount of grant (spending cap) per household in on-gas and off-gas properties to be based on the starting Energy Performance Certificate (EPC) rating of the property;
- include low energy light bulbs as a measure for which a grant may be approved;
- remove the provision of partial grants;
- exclude from grant eligibility those properties that have previously received assistance under the scheme.

2. Matters of special interest to the Constitutional and Legislative Affairs Committee

None.

3. Legislative background

Section 15 (1) of the 1990 Social Security Act (as amended by section 142 of the Housing Grants, Construction and Regeneration Act 1996) provides that the Secretary of State may make, or arrange for the making of, grants towards the cost of work or advice to improve thermal insulation or otherwise to reduce or prevent energy wastage in dwellings. The Secretary of State's functions under this provision were made exercisable, in relation to Wales, by the Assembly concurrently with the Secretary of State by article 2 of, and Schedule 1 to, the National Assembly for Wales (Transfer of Functions) Order 1999. They are now exercisable in relation to Wales by the Welsh Ministers concurrently with the Secretary of State, by virtue of section 162 of, and paragraph 30 of Schedule 11 to, the Government of Wales Act 2006.

The instrument is subject to the negative resolution procedure.

4. Purpose & intended effect of the legislation

The purpose of the amended Regulations is to implement changes to the scheme following the Welsh Government consultation on the design of the new Nest scheme. These include actions to better target support at those most in need and living in the most energy inefficient properties. The changes:

- enable the maximum amount of grant (spending cap) per household in on-gas and off-gas properties to be based on the starting Energy Performance Certificate (EPC) rating of the property,
- provide for low energy light bulbs to be a measure for which a grant may be approved
- provide for the removal of partial grant applications; and
- ensure that customers who have previously benefitted from a package of free energy efficiency measures under the Welsh Government Warm Homes Programme will not be eligible to receive any further measures and/or funding for the same property.

5. Consultation

Details of the consultation undertaken are included in the Regulatory Impact Assessment below.

PART 2 – REGULATORY IMPACT ASSESSMENT

1. What is the Problem under Consideration?

The Welsh Government has a statutory obligation under the *Warm Homes and Energy Conservation Act 2000* to eradicate fuel poverty, as far as is reasonably practicable, in all domestic private households in Wales by 2018.

There are three main factors that influence whether a household will be in fuel poverty. These are household income, energy prices and the energy efficiency of the home.

Welsh Government has limited powers to tackle low income and energy prices, making the eradication of fuel poverty a real challenge. However, where we can make a significant difference is in improving the energy efficiency of homes in Wales. This is the most sustainable way to reduce energy bills.

The *Fuel Poverty Strategy 2010* outlines the actions we will take to reduce the number of households in Wales living in fuel poverty. A key action in the Strategy is to provide a demand-led all-Wales fuel poverty scheme targeted at those householders most in need and living in the most energy inefficient homes, complemented by area-based investment. Demand-led support to improve the energy efficiency of low income homes across Wales is delivered through the *Welsh Government Warm Homes - Nest* scheme.

The current contract for *Nest* is managed by British Gas. It began in April 2011 and will end on 31 March 2018. The scheme provides households in Wales with access to a range of advice and support to reduce their energy bills and maximise their income. For households most in need, the scheme includes a referral system for a package of free home energy improvements, subject to eligibility criteria.

The Welsh Government has committed to continuing with a demand-led energy efficiency and fuel poverty scheme with support targeted at those households most in need and living in the most energy inefficient homes.

Consultation

On 27 July 2016, the Welsh Government published a 12-week consultation on a future demand-led fuel poverty scheme to succeed Welsh Government Warm Homes – Nest from September 2017. As the existing scheme has since been extended, the new scheme will now commence from April 2018.

The consultation closed on 19 October 2016 and the consultation document is available at:

https://consultations.gov.wales/consultations/future-demand-led-fuel-poverty-scheme-succeed-welsh-government-warm-homes-nest

A total of 9 questions were asked, seeking stakeholder views on a range of issues relating to the proposed design and delivery of the new scheme.

As part of the consultation, the Welsh Government ran a stakeholder engagement workshop on 5 October 2016 bringing together a range of key stakeholders from different sectors to discuss key aspects of the consultation. The event was well attended with 29 representatives from a range of sectors including voluntary/third sector organisations, energy suppliers, local authorities and advice providers.

A Summary of Response to the consultation was published in December 2016, outlining refined proposals for the new scheme.

Overall respondents welcomed and agreed with Welsh Government proposals to extend eligibility to low income households with respiratory or circulatory health conditions which are the conditions identified by Centre for Sustainable Energy (CSE) as being most vulnerable to the impacts of living in a cold home. During the period 1 October until 31 January 2018 a health conditions pilot was trialled by the Nest scheme manager. However the interim findings of this 3 month pilot showed that the expected referral volumes had not been realised and the pilot had not been able to fully test the referral routes or their effectiveness.

On 16 February 2018 the Welsh Government agreed the Nest health conditions pilot should be extended until 31 March 2019 to allow further testing of the referral process with health professionals for citizens who have chronic respiratory and circulatory conditions. The findings from the extended pilot will be reviewed and may lead to changes being made to the Home Energy Efficiency Scheme (Wales) Regulations.

Impact Assessment

This Impact Assessment looks at the options for the creation of a new demand-led energy efficiency and fuel poverty scheme to succeed *Nest,* based on the proposals from the consultation. The options are similar to the existing *Nest* scheme, however,

some options involve extending eligibility to low income households with health conditions alongside variations on spending caps per household to ensure support is better targeted at the most energy inefficient homes. Options are compared to a baseline of cessation of *Nest* with no replacement scheme.

The overall objective of the programme is to remove as many households as economically practical from fuel poverty, or as a minimum to mitigate the risk of fuel poverty in line with the Welsh Government policy objectives through the procurement of an economic and sustainable contract. There are also economic objectives, in terms of creating green jobs and business opportunities for the people of Wales and environmental objectives in terms of reducing the greenhouse gas emissions in the domestic sector.

The challenges of affordable energy (fuel poverty) and climate change are being addressed together. As a result of addressing these two challenges, it is also hoped the options will help to make the most of economic opportunities in the new 'green economy'.

The policy options in the assessment are geared to achieve a range of goals encompassed in the Wellbeing of Future Generations (Wales) Act 2015:

- A prosperous Wales
- A resilient Wales
- A healthier Wales
- A more equal Wales
- A Wales of cohesive communities
- A Wales of vibrant culture and thriving Welsh Language
- A globally responsible Wales

By far the largest potential impact for the policies discussed in this analysis relate to the fuel poor and energy efficiency benefits, with consequential impacts on the health and wellbeing of recipient households.

Fuel Poverty

In Wales, fuel poverty is defined as having to spend more than 10% of net income (including housing benefit) on all household fuel use to maintain a satisfactory heating regime[1]. Where expenditure on all household fuel exceeds 20% of income, households are defined as being in severe fuel poverty.

The most recent Welsh Government statistics on fuel poverty in Wales are modelled estimates for 2012 to 2016 produced by the Building Research Establishment (BRE). BRE's report, *The Production of Estimated Levels of Fuel Poverty in Wales: 2012-*

[1] The definition of 'satisfactory heating regime' recommended by the World Health Organisation is 23°C in the living room and 18°C in other rooms, to be achieved for 16 hours in every 24 for households with older people or people with disabilities or chronic illness and 21°C in the living room and 18°C in other rooms for a period of 9 hours in every 24 (or 16 in 24 over the weekend) for other households.

2016[2], was published on 11 July 2016. The report provides estimates of fuel poverty and severe fuel poverty in all households, fuel poverty in vulnerable households and fuel poverty in social housing from 2012 to 2016. The research also estimates the impact of energy efficiency improvements on levels of fuel poverty.

The 2008 Living in Wales[3] dataset was used as the base dataset and estimates of the fuel poverty levels were derived by modelling the installation of reported numbers of energy efficiency improvement measures, along with changes to fuel prices and household incomes and recalculating the fuel poverty indicator for each household in the dataset.

BRE estimates for 2016 show:

- 291,000 (23%) households living in fuel poverty
- 43,000 (3%) households living in severe fuel poverty

Error! Reference source not found. shows the estimated numbers and proportions of all households in fuel poverty in Wales between 2012 and 2016.

Table 1: Projected number and percentages of households in fuel poverty, 2012 to 2016

	Number of households in fuel poverty (000s)	Percentage of households in fuel poverty (%)
2012	364	29
2013	351	28
2014	376	30
2015	305	24
2016	291	23

Source: BRE

Whilst fuel poverty levels between 2012 and 2014 are relatively stable, the estimates show declining numbers and proportions of households in fuel poverty since 2014. This is based on a number of factors:

- Moderately increasing household incomes
- Energy efficiency improvements contributing to a reduction in household energy consumption
- Decreasing gas and oil prices

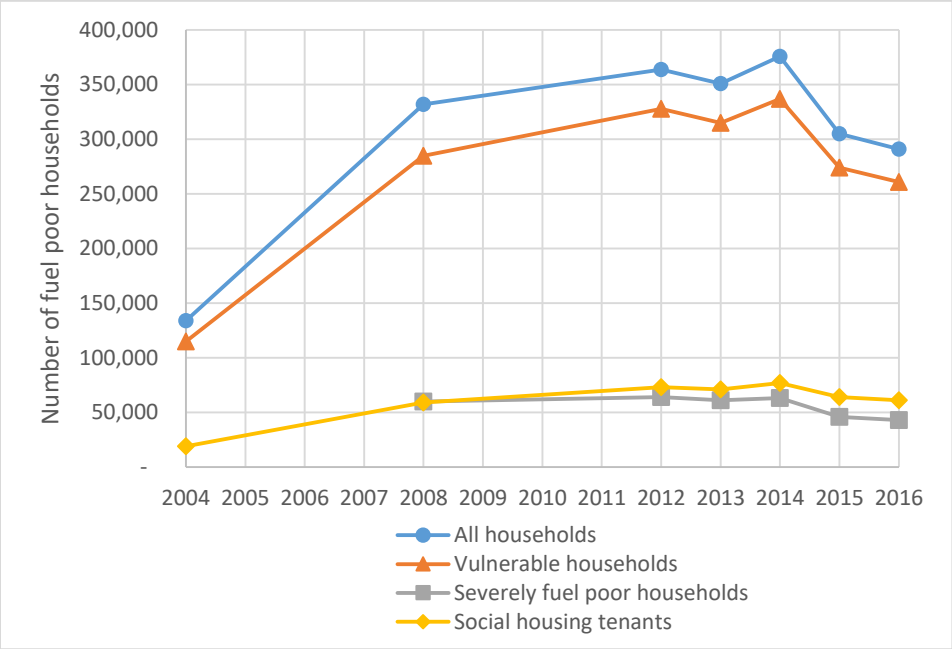
The BRE report also estimates that the impact of energy efficiency measures has been to reduce projected levels of fuel poverty in all households by approximately

[2] http://gov.wales/statistics-and-research/production-estimated-levels-fuel-poverty/?skip=1&lang=en
[3] http://gov.wales/statistics-and-research/living-in-wales-survey/?lang=en

80,000 households (6 percentage points) and to reduce the projected levels of fuel poverty in vulnerable households by approximately 73,000 households (7 percentage points).

Error! Reference source not found. shows the time series of the number of household in Wales in fuel poverty, including data on vulnerable households, severe fuel poor households and social housing tenants since 2004 in Wales. The data from 2012 are modelled in the BRE report.

Figure 1: Fuel poor households, Wales, 2004-2016



Source: BRE

Whilst the research estimates the number of households in fuel poverty has fallen since 2014, around 23% of all households in Wales are projected to be in fuel poverty in 2016. This supports the case for continued action on fuel poverty, with support prioritised to low income, energy inefficient households who are most at risk from living in cold homes.

The options outlined as part of this assessment have the potential to bring some of these households out of fuel poverty, improve the health and wellbeing of recipients, create job and training opportunities and tackle climate change.

Proportions of households living in fuel poverty tend to increase with the age of the property. In 2008, 32% of dwellings built between 1919 and 1900 were in fuel poverty. Almost half of households living in dwellings built before 1850 were fuel poor. The proportion falls to 11% of households built after 1990, highlighting the need to target the existing older housing stock.

The high prevalence of fuel poverty amongst households using fuels other than mains gas means that it is essential to offer appropriate solutions for hard to treat, rural properties under the fuel poverty scheme.

Climate change

In addition to tackling fuel poverty, this scheme will assist in tackling climate change. Climate change results from the negative externalities caused by Greenhouse Gas (GHG) emissions. The residential sector represents 23% of all UK CO2e in emissions and 16% of Welsh CO2e emissions[4]. As the Welsh housing stock is made

[4] 2015 figures from GHG inventories, measured on end-user basis. By source, the percentages are 13% in the UK and 8% in Wales.

up predominantly of housing over 50 years old, it is key any policy is aimed at improving the energy efficiency and reducing GHG emissions covers the existing housing stock.

Why does the Government need to intervene?

Policy design is based on market failure and in this case we are referring particularly to the market failures associated with public goods, externalities and inequality. In simple terms, the market may not always allocate scarce resources efficiently in a way that achieves the highest total social welfare.

Market failure can be caused by the existence of inequality throughout the economy. Wide differences in income and wealth between different groups within our economy lead to a gap in living standards between those living comfortably and those experiencing poverty, and particularly relevant to this assessment, fuel poverty.

Many cost effective energy efficiency measures exist in the household sector, but they may require government intervention to overcome barriers to uptake including:

- Lack of information – householders do not have a full understanding of all the energy efficiency measures that could be used to decrease their bills and save carbon.
- Limited time horizons – households are generally unwilling to accept long loan periods for energy efficiency because of the likelihood that they will move before they can recoup the costs of their loan.
- Access to credit – credit availability does not reflect the risk associated with recouping the costs of energy efficiency measures, but the wealth of the householder. As a result some groups in society cannot access credit at the appropriate level of risk thus restricting their installation of energy efficiency measures.
- High effective discount rates – households may have higher discount rates than market participants or Government.
- Consumer inertia may prevent consumers taking up worthwhile investment opportunities. Some consumers are highly averse to the risk of loss on an investment and do not appear to value the likelihood of possible benefits in the same way.
- Incentive incompatibility in the rented sector – the owner does not pay the energy bill and occupier has no interest in investing in energy efficiency measures because he or she have moved out before any payback period.

Size of Market

The importance of the domestic sector for UK energy demand is apparent from Table 2, showing energy consumption by sector and end use. The majority (84%) of domestic energy consumption was for heating related end uses.

Table 2: Energy consumption by sector and end use 2015, UK, thousand tonnes of oil equivalent

End Use	Domestic	Services	Industrial	Transport	Total	Total excluding Transport
Space Heating	27,579	8,276	1,725	-	37,580	37,580
Water Heating	4,905	1,158	-	-	6,063	6,063
Process Use	-	-	8,957	-	8,957	8,957
Drying/ Separation	-	-	1,786	-	1,786	1,786
Cooking/ Catering	866	1,753	-	-	2,619	2,619
Heat Total	33,350	11,187	12,467	-	57,005	57,005
Other	6,273	7,114	5,616	54,810	73,812	19,002
Total	39,623	18,301	18,083	54,810	130,817	76,007
% of total attributed to heat	84%	61%	69%	-	44%	75%

Source: BEIS

Error! Reference source not found. illustrates domestic energy use by fuel. Gas-fired space heating is the single most important fuel and purpose. The data show the prominence of space heating in the domestic sector in terms of energy consumption across the fuel types.

Table 3: Domestic energy consumption by fuel and end use 2015, UK, thousand tonnes of oil equivalent

End Use	Gas	Oil	Solid Fuel	Electricity	Heat sold	Bioenergy and Waste	Total
Space heating	21,051	2,238	502	2,180	52	1,556	27,579
Water heating	3,651	218	82	423	-	532	4,905
Cooking/ catering	441	-	-	424	-	-	866
Heat total	25,143	2,455	584	3,027	52	2,088	33,350
Lighting and	-	-	-	6,273	-	-	6,273
Overall total	25,143	2,455	584	9,300	52	2,088	39,623

Source: BEIS

Options

This section outlines the options considered in this Impact Assessment:

Option 1 – **'Do nothing'** – Nest to expire in March 2018 with no replacement demand-led energy efficiency and fuel poverty scheme.

Option 2 – Continue with the current Nest scheme design with no changes. Current spending caps are maintained at £8,000 for on-gas properties and £12,000 for off-gas properties.

Option 3 – Amend scheme design in accordance with outcome of the consultation. Extend eligibility for home energy improvement measures to low income households where a member suffers with a circulatory or respiratory condition. Extend available support to include the provision of in-home advice to eligible households. Remove partial grants. Current spending caps are maintained at £8,000 for on-gas properties and £12,000 for off-gas properties.

Option 4 – Do not amend the Regulations to extend the eligibility of the scheme. Remove partial grants. Revise spending caps to either:

a Remove caps – spend as much as necessary to bring property to SAP rating of 69 (equivalent to EPC C).

b £5,000 for on-gas properties and £8,000 for off-gas properties

c £5,000 for on-gas properties and £15,000 for off-gas properties

d A cap on properties relative to the starting EPC rating:

- EPC Rating E - £5,000 for on-gas properties and £8,000 for off-gas properties.

- EPC Ratings F & G - £8,000 for on-gas properties and £12,000 for off-gas properties.

Option 4d is the preferred option. As proposed as part of the consultation, this option introduces separate spending caps based on the starting energy efficiency rating of the property, with comparably higher caps for the least energy efficient properties. This is in line with Welsh Government's policy of ensuring support is targeted at the most energy inefficient homes.

Whilst the cap for E rated on- and off-gas properties is lower than the existing Nest scheme, reflecting the higher starting energy efficiency rating of these properties, the cap for F & G properties is maintained. This will continue to enable the most energy inefficient and hardest to treat properties to receive appropriate measures, whilst enabling the scheme to help more households with the available resources.

The following sections outline the estimated costs and benefits across all the options.

Costs & benefits

Each option has been considered relative to a 'baseline' level in order to evaluate the impacts of each option relative to 'doing nothing' i.e. the cessation of Nest on 31 March 2018.

The cost and benefit information is discounted according to HM Treasury guidance and combined to give Net Present Values (NPVs) for each option. The assessment uses 2018 as the base year for the present value calculations.

In March 2018, the current Nest contract would finish under the 'do nothing' option, which the other options are compared to. We have therefore excluded costs/benefits prior to March 2018 (under the existing scheme) from the assessment and assumed all costs and benefits to initiate after this point.

The costs of the scheme are estimated at £20 million per annum for a period of 5 years, based on average annual costs from the current *Nest* scheme. These are assumed to occur after March 2018 and each of the following years to 2022. The costs refer to providing 'front-end' advice and the installation of home energy improvement measures to eligible households. We have estimated £2m per annum for 'front-end' advice and support costs with the remaining £18m per annum for installation of the measures. The costs are estimated to be identical for each year and the duration of the scheme is assumed to be 5 years, giving a total cost of £100m (undiscounted). However, the actual spend in each year may vary, as has been experienced with the existing scheme. These costs are assumed to be the same across options 2–4d, effectively modelling a ceiling on the total expenditure on advice and measures.

Benefits are estimated to begin in 2019, which allows time for installation of measures. The average lifetime of a typical energy efficiency package has been estimated at 14 years per household. This has been calculated by weighting the lifetimes of the different measures of the existing scheme. More detail on this is available in the Annex.

The total time horizon for the valuation of costs and benefits is therefore from 2018 to 2036, include the initial construction phase and the assumed average lifetime of the measures.

The estimated benefits in this assessment include:

- Energy bill savings
- Direct rebound effect
- CO2 emissions savings
- Air quality
- Jobs protected/supported

The energy saving benefits has been estimated using information from British Gas (as scheme manager for the current Nest scheme) on over 20,000 installations through Nest. Whilst a large number of properties have received energy efficiency upgrades under the current scheme, estimates show that there are still a large number of properties in fuel poverty. In 2016, BRE estimated that there were 291,000 households in fuel poverty (see **Error! Reference source not found.** and **Error! Reference source not found.**). Therefore, it is unlikely that continuing with a demand-led energy efficiency and fuel poverty scheme will result in diminishing returns because of a lack of eligible households.

The widening of the eligibility criteria, as outlined for options 3would better target households in need from the benefits of the measures, further reducing the likelihood of diminishing returns. This option will be further explored with an extended pilot scheme. The Centre for Sustainable Energy has produced a report containing estimates of eligible households by qualifying benefit or condition (table 3.7)[5].

We have used Department for Business, Energy and Industrial Strategy (BEIS) published data linked to the Treasury Green Book to monetise emissions of CO2 which have also been supplied by the scheme manager for Nest.

There are also other benefits associated with energy efficiency measures that are not quantified here:

- Energy security/delivery
- Energy prices
- Macroeconomic impacts
- Productivity
- Poverty alleviation
- Health and Wellbeing[6]
- Resource management
- Educational attainments
- Public budgets
- Disposable income
- Asset values
- Reduction in the use of the NHS

Emissions have been monetised by disaggregating into traded sector and non-traded sector emissions. Emissions in the two sectors are essentially different commodities and are therefore valued differently. Emissions in the traded sector are valued at the Traded Price of Carbon, whereas changes in emissions in the non-traded sector are valued at the Non-Traded Price of Carbon. These traded and non-traded prices are currently different, but it is assumed that they will converge and become equal in 2030 and subsequently follow the same trajectory. This is based on the assumption that there will be a functioning global carbon market by 2030.

Error! Reference source not found. shows how we have mapped the different fuel types into the traded and non-traded sectors.

Table 4: Attribution of emissions to the traded and non-traded sectors

[5]http://gov.wales/docs/caecd/research/2016/160711-understanding-characteristics-low-income-housholds-en.pdf

[6] Some health impacts are considered in the air quality impacts.

Emissions from	Sector
Electricity	Traded
Gas	Non-traded (traded is used by large power generators)
Fuel/heating oil	Non-traded
Coal	Non-traded (traded is used by large power generators)

Option 1 (do nothing)

There are no associated costs or benefits identified with option 1, given that no funding is required and there would be no further benefits derived from advice, support or additional energy efficiency measures.

Options 2–4d

Costs

As discussed above, the costs are identical across these options as the annual spending would effectively be capped. The two costs associated with the options are:

- £18m annual investment in measures
- £2m annual 'front-end' advice and support costs

In cash terms (i.e. undiscounted) the total cost of the scheme over 5 years is estimated at £100m. The present value of the total cost is £93.5m.

Error! Reference source not found. shows some of the typical measures installed through the current Nest scheme, their average costs[7] in 2015/16 and estimated lifetimes.

Table 5: Average costs of measures and lifetimes

Measure	Average cost (£s)	Lifetime (years)
Heating (boiler)	3,615	12
External wall insulation	8,035	36
Cavity wall insulation	353	42
Loft insulation	277	42
Draft proofing	177	10

Source: Nest and Ofgem

Benefits

The benefits that are estimated and presented in this impact assessment are:

[7] Excludes fees, VAT and margin.

- Energy bill savings
- Direct rebound effect
- C02 emissions
- Air quality
- Jobs protected/supported

Nest have supplied estimates of the numbers of households and average fuel bill savings for each option under average deployment levels for an £18m investment in energy efficiency measures. They have also provided information on low and high deployment scenarios, based on data from the current Nest scheme. The estimates are based on higher numbers of oil-fuelled properties and higher gas-fuel properties in the low and high deployment scenarios, respectively.

Summary of the preferred option

Error! Reference source not found. shows a summary of the NPVs, present value of benefits (PVB), present value of costs (PVC) and CO2 savings from each option under the average deployment scenario[8]. It highlights that the costs are the same for each of the options. Hence, all the NPV's presented in this analysis are driven by the PVB. The PVB and hence NPV is made up of four distinct benefits:

1. Net change in energy bills
2. Direct rebound effect
3. Net change in CO2 emissions
4. Net change in air quality

Table 6: Summary of NPV and CO2 savings relative to baseline (average deployment)

Option	NPV (£s)	PVB (£s)	PVC(£s)	Carbon savings (tonnes)
Option 2	62,664,333	156,125,917	93,461,584	849,420
Option 3	62,664,333	156,125,917	93,461,584	849,420
Option 4a	51,023,335	144,484,919	93,461,584	780,714

[8] Nest has provided different deployment level scenarios (low, average and high). More detail is provided in the annex.

Option 4b	61,299,096	154,760,680	93,461,584	871,992
Option 4c	60,880,409	154,341,993	93,461,584	833,976
Option 4d	62,346,646	155,808,230	93,461,584	851,598

The preferred option is option 4d. It has an NPV of £62.3m. This option has a benefit cost ratio of 1.67. The preferred option yields the second highest NPV of the options.

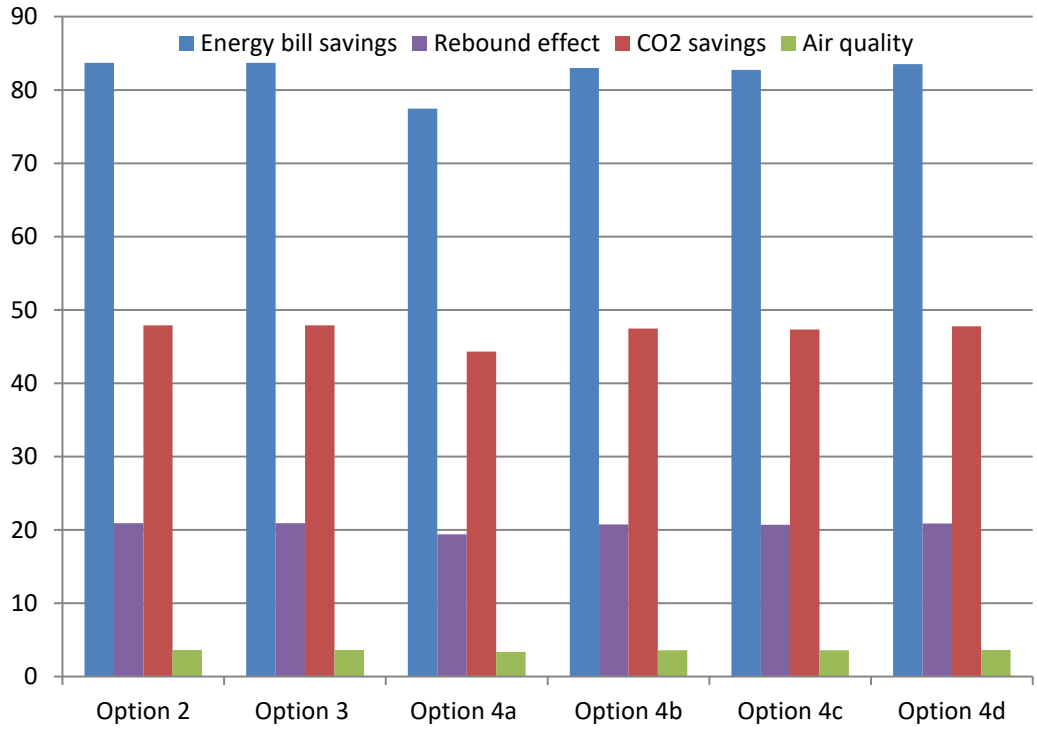
The joint highest NPVs are estimated to occur under options 2 and 3 (the benefits from both of these options are assumed to be identical given that the caps are the same). However, under these options, the same spending cap is applied to the relatively more energy efficient E rated properties as that applied to F&G rated homes. Under the preferred option, the cap on E rated properties is reduced, which is more equitable given that they should not need the same level of expenditure compared to the less energy efficient F&G rated properties.

Although options 2 and 3 have the highest NPV, the difference between this the NPV of the preferred option is marginal.

The option with the lowest NPV is option 4a. This is because investment in measures for these properties is uncapped. Therefore, fewer households are able to receive improvement measures within the £18m annual investment allocation. The average cost savings per household are estimated to be similar to the other options, which consequently mean lower benefits for this option in terms of fuel bill savings. The **Energy savings** section below provides more detail on the estimated numbers of households receiving measures and estimated average fuel bill savings.

Error! Reference source not found. demonstrates the scale benefits from each option are largely similar. **Error! Reference source not found. Error! Reference source not found.** also highlights, for all policy options considered, the majority of the monetary benefits come from energy bill savings.

Figure 2: Present Value of Benefits (£s)



This report now examines each of the contributors to PVB in turn.

Energy savings

The majority of benefits resulting from the scheme and all related options are made up of energy savings to households.

The estimates of fuel cost savings are supplied by Nest, along with the estimates of households upgraded for each option. The fuel cost estimates are derived from their rdSAP9.92 programme (run by e-tech, approved by Ofgem and BEIS/DECC), which contains information on over 20,000 customers. The programme calculates an indicative cost saving per customer. This is done by estimating energy expenditure (based on average usage) before the measures are installed. The programme uses data on the type of boiler already in place (if any), number of rooms, floor space, age of property, property type, amount of external walls, insulation etc. It then re-calculates the estimated spend, using new data (replacement boiler/improved insulation). The cost saving is the difference between the two bill estimates. Further details on the assumptions and estimated bill savings are outlined in the annex.

The estimates provided by this modelling do not take into account comfort taking i.e. the 'rebound effect'. However, we have applied a rate for direct rebound effects (more details below). **Error! Reference source not found.** shows the present value of energy bill savings of each option under the average deployment scenario over

the lifetime of the energy efficiency measures[9]. It should be noted that an assumed 20% rate of rebound effect has been applied to these figures.

Table 7: Present values of energy bill savings (£s)

Option	£s
Option 2	83,706,744
Option 3	83,706,744
Option 4a	77,465,435
Option 4b	82,974,773
Option 4c	82,750,295
Option 4d	83,536,416

The present value of bill savings with option 4a is the lowest of all the options, reflecting the relatively low number of households that would receive energy efficiency improvements under 'unrestricted investment' per household. Options 2 and 3 have the highest present value of bill savings, although there is little difference in these values compared to options 4b, 4c and 4d (the preferred option).

Rebound effect

The 'rebound effect', in relation to energy efficiency, is driven by the reduction in energy bills for consumers. It can be decomposed into direct and indirect effects.

The direct rebound effect will increase the consumption of energy due to increased affordability of energy. This may be particularly relevant to the *Nest* scheme, as measures are targeted toward those in fuel poverty who may not be heating their homes to a sufficient level prior to the installation of energy efficiency measures. Such homes could increase consumption, thereby increasing welfare through 'comfort taking'. This would have the effect of reducing energy bill savings. However, this is offset by measures that make the home more energy efficient. Reductions in bill savings could also be offset by the uptake of energy saving advice (outlined above).

Increased comfort taking also reduces the scale of benefits from reduced carbon emissions and air quality improvements.

Whilst comfort taking reduces energy bill savings for consumers, they benefit from heating homes to a sufficient level. The analysis values this benefit at the retail price of energy.

[9] Results for high and low deployment scenarios are shown in the sensitivity analyses section.

The standard assumption for the direct rebound effect is a 15% increase in energy consumption[10]. However, this assessment assumes a higher rate of 20%, given that the target group would probably disproportionately increase energy consumption as many households receiving measures are unlikely to be heating their homes sufficiently.

Error! Reference source not found. shows the present value of direct rebound effects associated with each option.

Table 8: Present value of direct rebound effect (£s)

Option	£s
Option 2	20,926,686
Option 3	20,926,686
Option 4a	19,366,359
Option 4b	20,743,693
Option 4c	20,687,574
Option 4d	20,884,104

Indirect rebound effects relate to changes in energy consumption of other goods and services which would become more affordable. The change in disposable income and potential increased expenditure are additional benefits to households and firms. We have not quantified indirect rebound effects in the assessment

Net change in CO2

Nest has provided average CO2 savings estimates from the e-tech programme, which are monetised using BEIS traded and non-traded carbon prices. The benefits from CO2 savings, accounting for direct rebound effects, are shown in **Error! Reference source not found.** and **Error! Reference source not found.**.

Electricity savings are estimated to occur from just 4% of energy efficiency improvements in previous Nest operations, on average. Therefore, a small percentage of the CO2 savings have been priced at the traded price of carbon, with the remaining portion priced at the non-traded price.

Table 9: Present value of CO2 benefits (£s)

[10] This rate is used in the impact assessment of the Green Deal and Energy company Obligation: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/42984/5533-final-stage-impact-assessment-for-the-green-deal-a.pdf

Option	£s
Option 2	47,873,130
Option 3	47,873,130
Option 4a	44,303,633
Option 4b	47,454,505
Option 4c	47,326,122
Option 4d	47,775,717

Table 10: CO2 benefits (tonnes)

Option	Tonnes
Option 2	824,569
Option 3	824,569
Option 4a	763,088
Option 4b	817,359
Option 4c	815,148
Option 4d	822,892

Further details on how the carbon benefits have been derived and monetised are available in the annex.

Air quality impacts

Air quality impacts are calculated using Defra air quality damage costs, which are applied to household data supplied by *Nest* (more details are available in the annex). Damage costs include a range of health impacts, including mortality and morbidity effects and non-health impacts, such as damage to buildings and effects on crop yields. **Error! Reference source not found.** shows the monetised benefits from the impact on air quality for each option (accounting for direct rebound effects).

Table 11: Present Value of Air Quality Impacts (£s)

Option	£s
Option 2	3,619,358
Option 3	3,619,358

Option 4a	3,349,493
Option 4b	3,587,709
Option 4c	3,578,002
Option 4d	3,611,993

Employment

Employment is a key benefit associated with energy efficiency instalment. The 2016/17 Nest Annual Report identified that the scheme directly supported 43 jobs and apprenticeships. Furthermore, 100% of installations were completed by Wales-based installers. However, this does not cover the full extent of employment attributable to *Nest* in Wales.

Employment from installation of energy efficiency measures, measured as jobs lasting for 1 year, can be modelled according to BEIS methodology as set out in the annex. We estimate over 900 annual jobs to be created/protected through installation of energy efficiency measures from an £18m investment in each year over a 5 year period. This equates to an average of 180 jobs per year. This equates to an average of around 10-11 jobs per £1m investment.[11] There are also jobs associated with the front-end services. There have been 25-30 Full-Time Equivalents (FTEs) employed in this part of *Nest*, depending on seasonal demand.

We have assumed employment to be identical across options 2–4d because the overall budgets for each are identical. Further details on the assumptions of employment modelling are in the annex.

Front-end service - additional benefits

The 'front-end' telephone advice and support service provided by the Nest scheme has assisted households in taking up benefits they are eligible for, such as a Warm Homes Discount rebate and/or a Benefit Entitlement Check. However, we have not included these benefits in calculations as entitlements may change in the future, which creates uncertainty in future valuations.

Error! Reference source not found. shows the additional benefits which have resulted from contact with the front-end service between 2011/12 and 2015/16. The Benefit Entitlement Checks have yielded a total of £2.3 million in additional benefits and over £140,000 in Warm Home Discount rebates claimed from energy suppliers for those contacting the *Nest* service.

Table 12: Additional benefits and Warm Home Discounts (WHD)

	2011/12	2012/13	2013/14	2014/15	2015/16

[11] 'Annual' jobs refer to jobs that last 12 months, i.e. they are not permanent. In each of the 5 years of construction, there are 180 jobs that are supported through the scheme. This gives a total of 900 jobs supported through the scheme over 5 years. Jobs per £m of investment

BEC - households claiming new/additional benefits	105	271	354	115	348
BEC - average value of new/additional benefits	£2,059	£1,809	£2,084	£2,088	£1,912
Social Tariff – volume of households receiving WHD	-	174	242	274	338
Social Tariff – value of WHD	-	£22,620	£32,670	£38,360	£47,320

Source: Nest

Tailored advice and support is provided on a range of issues including energy and water efficiency, heating controls, appliance guidance and income maximisation. Callers are also referred to a number of third party services including Care and Repair services, debt advice, money management advice, energy tariff advice, fire service etc.

In addition to providing advice and referrals to third party services, the front-end telephone service is vital to determining eligibility for home energy improvement measures and enabling the initiation of works to eligible properties.

Whilst this service is important, we have not quantified the associated benefits in the NPV calculations.

Error! Reference source not found. shows the potential energy bill savings that are possible if advice on energy conservation is followed.

Table 13: Potential annual energy bill savings from energy efficiency advice (£s)

Energy tip	Description	Saving (£s)
Clothes drying tips	Line dry clothes instead of using tumble dryer	18
Hot water tips	Spend one minute less in shower	10
Kettle tips	Only fill kettle with as much water as you need	7
Laundry settings	Only use your washing machine on a full load	5
Laundry temperature	Wash clothes at 30 degrees rather than higher temperature	6
Turning down heating	Turn your thermostat down one degree	80-85
Turning off lights	Turn off your lights when you do not need them	13

Total		**139-144**

Source: Energy Saving Trust

It should be noted that the potential saving per property could be substantial if these energy saving tips are observed. In the preferred option, the average energy saving per household is £434 per household. This saving has the potential to increase by a further £139-£144 if all tips are followed.

The Evaluation of the Nest Energy Efficiency Scheme[12] suggests there is evidence of some level of behaviour change amongst around half of advice beneficiaries in terms of using heating and appliances more efficiently. However, it should be recognised that this is based on self-reported information, which can be unreliable. We have therefore not included any valuation of energy savings as a result of behaviour changes from advice in this assessment. However, we have still included the cost of the front-end service as this is still an essential element of the process of uptake of energy efficiency upgrades.

Sensitivity analyses

Deployment scenarios

The results exhibited so far have included scenarios of average, low and high deployment scenarios. *Nest* has supplied estimates of numbers of households and average spends per household for each option and deployment scenario.

The NPVs under the average, low and high deployment scenarios are shown in **Error! Reference source not found.**.

Table 14: NPVs under average, low and high deployment scenarios (£s)

Option	NPV (£s, average deployment)	NPV (£s, low deployment)	NPV (£s, high deployment)
Option 2	62,664,333	51,713,403	73,508,398
Option 3	62,664,333	51,789,063	73,508,398
Option 4a	51,023,335	34,475,516	71,139,935
Option 4b	61,299,096	49,631,798	81,668,804
Option 4c	60,880,409	49,415,379	81,059,236
Option 4d	62,346,646	51,510,541	74,375,353

The central NPV estimate under the preferred option (4d) is **£62.3m**, with a range of **£51.5m–£74.4m** between the low and high deployment scenarios.

[12] http://gov.wales/statistics-and-research/evaluation-nest-energy-efficiency-scheme/?lang=en

The following sensitivity tests assume the average deployment scenario throughout.

Energy prices

We have tested the impact of changes in energy prices on the NPVs of each option. We have used BEIS retail energy price forecasts to uprate the central estimates of bill saving to correspond with a high price scenario and to deflate bill savings to correspond with a low price scenario. The results are shown in **Error! Reference source not found.**.

Table 15: NPVs under central, low and high energy price scenarios (£s)

Option	**NPV (£s, central energy price)**	**NPV (£s, low energy price)**	**NPV (£s, high energy price)**
Option 2	62,664,333	44,665,328	80,243,022
Option 3	62,664,333	44,665,328	80,243,022
Option 4a	51,023,335	34,366,364	67,291,329
Option 4b	61,299,096	43,457,482	78,724,068
Option 4c	60,880,409	43,087,064	78,258,240
Option 4d	62,346,646	44,384,265	79,889,565

The NPVs for the preferred option range between **£44.4m and £79.9m** under the low and high energy price scenarios respectively (central estimate of **£62.3m**).

Carbon prices

Error! Reference source not found. highlights the impact of changing the central scenario for the carbon price to the BEIS high and low prices compared to the 'do nothing' baseline.

Table 16: NPVs under central, low and high carbon price scenarios (£s)

Option	**NPV (£s, central carbon price)**	**NPV (£s, low carbon price)**	**NPV (£s, high carbon price)**

Option 2	62,664,333	38,706,275	86,621,381
Option 3	62,664,333	38,706,275	86,621,381
Option 4a	51,023,335	28,851,628	73,194,106
Option 4b	61,299,096	37,550,537	85,046,651
Option 4c	60,880,409	37,196,100	84,563,719
Option 4d	62,346,646	38,437,337	86,254,945

The range of the preferred option NPVs between the high and low options is **£38.4m-£86.3m** with a central estimate of **£62.3m.**

Combing energy and carbon prices

This section combines both energy and carbon prices to produce best and worst case price scenarios under average deployment. It compares the NPVs under central energy/carbon prices with low energy and low carbon price ('low, low') with high prices for each ('high, high'). The results are shown in **Error! Reference source not found.**.

Table 17: NPVs under central, low and high carbon price scenarios (£s)

Option	**NPV (£s, central, central)**	**NPV (£s, low, low)**	**NPV (£s, high, high)**
Option 2	62,664,333	20,707,269	104,200,069
Option 3	62,664,333	20,707,269	104,200,069
Option 4a	51,023,335	12,194,657	89,462,100
Option 4b	61,299,096	19,708,923	102,471,623
Option 4c	60,880,409		

		19,402,754	101,941,550
Option 4d	62,346,646	20,474,957	103,797,864

Error! Reference source not found. shows a worst case price scenario NPV for the preferred option of **£20.5m**, ranging to **£103.8m** for the best case scenario (with a central estimate of **£62.3m**). This indicates a positive NPV despite potential falls in prices (both for carbon and energy).

Rebound effect

This section evaluates the impact of varying the rebound effect around the 20% assumed rate. The sensitivity analysis uses rates of 15%-25%, with the results shown in **Error! Reference source not found.**.

Table 18: NPVs under central, low and high rebound effect scenarios (£s)

Option	NPV (£s, 20% rebound effect)	NPV (£s, 15% rebound effect)	NPV (£s, 25% rebound effect)
Option 2	62,664,333	65,882,614	59,446,053
Option 3	62,664,333	65,882,614	59,446,053
Option 4a	51,023,335	54,001,655	48,045,015
Option 4b	61,299,096	64,489,234	58,108,957
Option 4c	60,880,409	64,061,917	57,698,901
Option 4d	62,346,646	65,558,378	59,134,914

Assuming a 15% rebound effect returns an estimated NPV of **£65.6m** and **£59.1m** for a 25% rate. This compares to the central estimate of **£62.3m** with an assumed 20% rebound effect.

Specific Impact Assessments

Equality Impact Assessment

1. Distributional Impacts

Measures to save energy and reduce CO2 are usually paid for by all consumers when the policy is funded by energy companies. The costs and benefits of these measures can therefore fall unequally on different income groups because not everyone will incur the same increase in their energy bills, proportional to income.

The majority of funding for the new fuel poverty scheme will come directly from Welsh Government funds. Hence it will ensure that fuel poor households are targeted and we therefore do not expect this policy to have a negative distributional impact on bills.

Some funding for measures will come from the Energy Company Obligation. This is a policy set by the UK Government. By utilising Energy Company funding, the Welsh Government will help to ensure that Wales gets its 'fair share' of activity under the energy company obligations and therefore that Welsh consumers gain as much as they contribute to such schemes.

2. Fuel Poverty

Fuel poverty occurs when a household needs to spend more than 10% of its income on energy costs. A household is in severe fuel poverty if they have to spend 20% or more of their income on energy costs. Whether a household is in fuel poverty or not is determined by an interaction of a number of factors, but three specifically stand out. These are:

- the energy efficiency status of the property;
- the cost of energy;
- household income.

Each of the policy options presented in this economic assessment is aimed at removing households from fuel poverty. Fuel poverty cuts across a number of equality group areas including disability, race and age.

In 2008, over 90% of the fuel poor in Wales were in the lower three income deciles and around 30% were living in F & G rated homes[13]. The preferred option will target the most energy inefficient properties, occupied by those who are most in need.

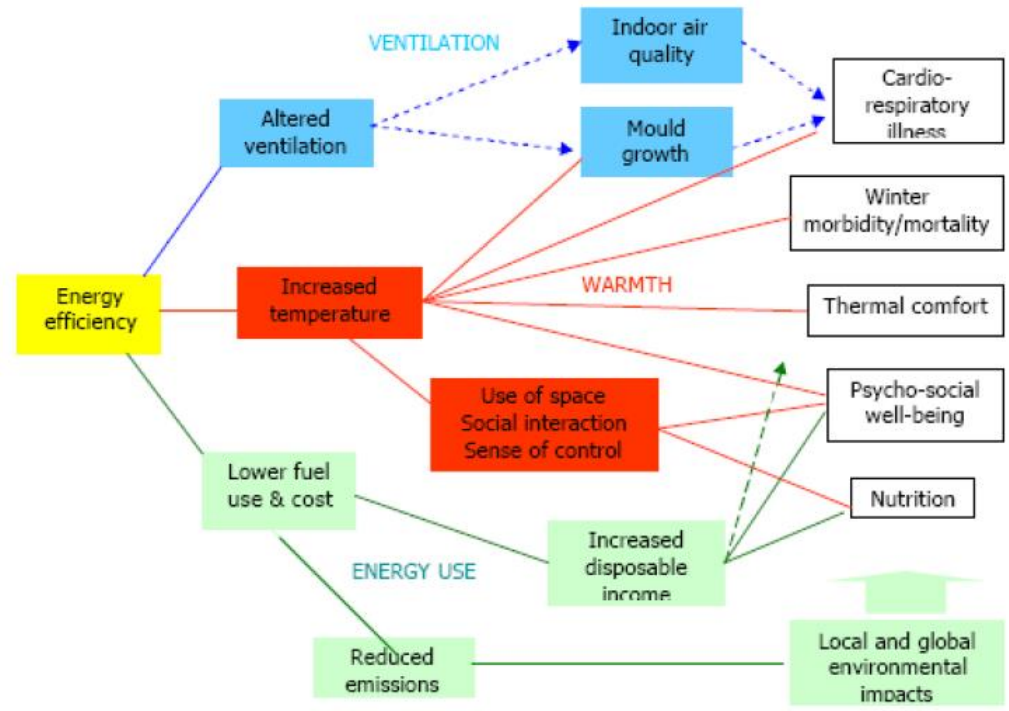
3. Health

Error! Reference source not found.[14] highlights the complex nature of linking energy efficiency policies with health benefits.

Figure 3: Links between energy efficiency and health benefits

[13] http://gov.wales/docs/caecd/research/110321fuel.pdf

[14] Health Impact Evaluation of England's Home Energy Efficiency Scheme (warm front): Summary of Papers, Dec 2005.



The relationship between fuel poverty and health is complex. In terms of health benefits, measures delivered by the proposed policy options are expected to be accrued to more vulnerable households, namely the fuel poor, as referred to in the previous section. Focusing on the fuel poor should reinforce the equitable distribution of benefits under the scheme.

More broadly, the fuel poor are more likely to suffer as a result of living in poorly heated homes. Many studies have found that poorly heated homes can increase the chances and the frequency of both the young and elderly from suffering from ailments such as Asthma, Bronchitis, Pneumonia and Influenza. As a result of these illnesses, such vulnerable householders could require additional emergency assistance/and or hospitalisation. Illness in the young can affect their development and lead to days off school and work for their parents. There is a cost to the economy as a result of the health impacts of cold, damp housing, although it is difficult to quantify this link.

A report by Public Health Wales titled *Making a Difference: Investing in Sustainable Health and Well-being for the People of Wales*[15] states poor quality housing, including issues such as mould, poor warmth and energy efficiency, is linked to physical and mental ill health. It impacts the individual, as well as costs to the individual, society and the NHS in terms of associated higher crime, unemployment and treatment costs. Investing in housing improvements provides a cost-effective way of preventing ill-health and reducing health inequalities. It could lead to less time

[15]http://www.wales.nhs.uk/sitesplus/documents/888/PHW%20Making%20a%20difference%20ES%28Web_2%29.pdf

off school or work, increased use of the home for study and leisure and improved relationships between household members.

The Fuel Poverty Data Linking Project

Welsh Government have jointly commissioned research looking at using linked administrative data to evaluate the impacts of Welsh Government's energy efficiency and fuel poverty schemes on health outcomes. The project uses the SAIL (Secure Anonymised Information Linkage) Databank, which securely brings together the widest possible array of anonymised routinely-collected data for research and evaluation purposes.

An Emerging Findings Report[16] was published on 3 October 2016, examining the impact of measures installed under the Nest Scheme on the health of recipients e.g. levels of hospital admissions. The latest report was published on 4 April 2017[17].

Levels of health service use were compared for 36,467 recipients of home energy efficiency measures and a control group of 36,070 individuals who were eligible but who had not yet received measures.

From a Rapid Evidence Assessment of the literature, the following key health risks associated with living in fuel poverty were identified:

- *General health:* A range of health impacts have been demonstrated to be associated with inadequate heating, e.g. gastric and duodenal ulcers, colds and sore throats, frequent headaches and eczema.
- *Cardiovascular health:* The research literature identifies an association between coronary events and cold weather; those living in cold homes also have an increased risk of high blood pressure.
- *Respiratory health:* Studies show a 30-50% increase in a variety of respiratory symptoms and an increase in hospitalisations due to respiratory causes for people living in damp and/or cold homes.

Latest findings include:

- A significant positive effect on respiratory health with a 3.9% decrease in the average number of respiratory GP Events for those receiving *Nest* measures, compared with a 9.8% increase in the average number of events for the control group for the same period.

- A similar pattern was found for asthma GP events, with a 6.5% decrease in those receiving measures, compared with a 12.5% increase in the control group.

[16]http://gov.wales/docs/caecd/research/2016/161003-fuel-poverty-data-linking-project-emerging-findings-en.pdf
[17]http://gov.wales/docs/caecd/research/2017/170404-fuel-poverty-data-linking-project-findings-report-1-en.pdf

- The data suggests a 'protective effect' on rates of prescribing for infection, with a smaller increase in the average number of prescriptions for infection for those receiving measures.

- The data also suggests a positive impact on emergency hospital admissions for both cardiovascular and respiratory conditions.

These findings demonstrate the clear positive impact the Nest scheme is having on the health of recipients with a knock-on reduction in the use of the NHS.

These beneficial impacts will be further increased by extending eligibility for free home energy improvement measures to low income homes where an occupant suffers from a respiratory or circulatory health condition. This is included within options 3 and 4a-d.

4. Rural Proofing

The high prevalence of rural and 'hard to treat' homes has been one of the main factors for the relatively higher levels of fuel poverty in Wales.

The characteristics of rural housing are different to those found in urban areas. This, coupled with the generally lower density of properties in rural areas compared to urban, present a different set of challenges to any delivery approach.

The cost of providing telephone advice is expected to be the same as for households in urban areas, but the cost of providing in-house advice and energy improvement measures for homes may be higher in rural areas. Many homes in rural areas will be off the gas grid and/or have solid walls that will require expensive measures to improve the energy performance of the property and help reduce the fuel bills of the household. The hard to treat nature of rural properties is recognised in the higher per property spending cap proposed for off-gas properties (options 2, 3 and 4a-d).

A full Rural Proofing Impact Assessment has been undertaken, which has not identified any negative impacts.

5. Age Impact

In 2015, the Welsh Government commissioned independent research to help inform the targeting of any future demand-led energy efficiency and fuel poverty scheme. The Centre for Sustainable Energy (CSE) have produced a report titled *'Understanding the Characteristics of Low Income Households Most at Risk from Living in Cold Homes'* [18].

CSE's recommendations on which vulnerable groups the new Nest scheme should target included low income households containing: older adults and/or dependent children.

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

Older People

There are various reasons why older people have an above average risk of living in a cold home. One explanation is that elderly people are more likely to live alone, often in a large family home, and thus have high running costs that they must pay for from a single income (Goodman et al 2011, in Centre for Ageing Research and Development in Ireland, 2014). Older people who are no longer working are more likely to spend more of their time in the home, so may need to spend more of their income on heating to keep the house at a comfortable temperature. Amongst older generations, below-average rates of computer literacy and internet access and a lack of confidence in engaging with energy-related online services, such as online switching and tariff comparison sites, may partially explain why older people are also less likely to be on lower tariffs (Tod et al, 2012, Stockton, 2014).

As well as being more likely to live in cold homes, older people are more likely to be vulnerable to the harmful effects of living in cold homes. The vast majority of studies included in the NICE guidance evidence review identified greater winter- and cold-related mortality at older ages (NICE 2015). This is very clear in the numbers of excess winter deaths amongst older people in England and Wales. As reported in the NICE guideline, in 2013/14, 51 per cent of cold related deaths were among people aged 85 years and older and 27 per cent were among those aged between 75 and 84 years (NICE, 2015).

Living in a cold home can also worsen social isolation amongst older people. Costly fuel bills make it harder to afford money to go out, and increase reluctance to risk getting cold going out and then having to go back to a cold home. It can also deter older people from inviting friends around (Marmot Review Team, 2011).

Children

There are an estimated 1.6 million children in the UK who are living in fuel poverty (ACE, 2013). Children living in certain household types are particularly at risk of living in cold homes, namely single parent households, low income households, households in rural areas, households headed by a black or minority ethnic parent and households headed by a parent with a long term health condition (National Children's Bureau, 2012). Members of households with children, particularly children aged less than five years, spend an above-average amount of time at home, increasing their exposure to the harmful health effects of living in cold homes.

Physiological factors which contribute to children's greater susceptibility to the harmful effects of cold homes include a lesser ability to deal with thermal stress as compared with adults, making children living in cold homes more prone to respiratory health problems, such as asthma and bronchitis (Marmot Review Team, 2011) (Climate Just, 2014). Weight gain in babies and toddlers can also be impeded by the increased calorie requirements to keep warm in a cold home. This can be particularly acute in materially deprived households with below-average calorie-intake (Liddell, 2008).

For school-aged children, there can be harmful consequences for educational attainment if school is missed due to cold home related illness (Liddell, 2008). A lack

of a warm place to do homework may also cause children to fall behind in their studies (Marmot Review Team, 2011). Amongst adolescents, links have been drawn between mental health problems and time spent living in cold homes (Shelter, 2006); the reasons for this are not certain.

Households containing older people and children will continue to form target groups for the new Nest scheme.

We have also undertaken an Equality Impact Assessment and a Children's Rights Impact Assessment.

6. Impact on the disabled and sick

Analysis of the Living in Wales survey 2008 has been used to estimate the proportion of low income households who also have a vulnerability. This analysis shows that a significant proportion of low income households have dual markers of vulnerability to the harmful effects of cold homes, including:

- Older people who have a long term illness or disability; and
- Households with children, which also include a household member with a long term illness, health condition or disability.

Households including both an older household member and at least one person with a long term illness or disability account for an estimated 21 per cent (49,654) of all low income households in Wales.

Approximately one third of all low income households with children are also estimated to include at least one household member with a long term illness or disability.

CSE's recommendations for which groups the new Nest scheme should target include low income households containing at least one person with a disability or long term health condition.

The 2012 Hills Review of Fuel Poverty in England' estimated that 34 per cent of fuel poor households include somebody with a disability or long term health condition (CASE, 2012). Amongst disabled people, many struggle with paying their bills and keeping their homes warm enough (Gore and Parckar, 2009). Below-average employment rates amongst disabled people and associated below-average incomes mean that disabled people have a greater than average risk of living in a cold home (Disability Action, 2011).

Furthermore, high rates of unemployment amongst disabled people increase the likelihood of spending more time at home, and potentially in a cold home. Condition-related or impairment-related needs, such as muscular dystrophy, also explain why some disabled people or people with long term conditions spend greater than average time at home (Snell, Bevan and Thomson, 2013). Relatedly, disabled people with reduced mobility may suffer from reduced blood circulation, so that a higher-than-average temperature is needed to achieve a comfortable level of warmth in the home. It is well established that disabled people encounter increased costs to

enable participation in everyday activities, whilst low incomes (associated with unemployment or low-paid employment) reduce the ability of households to afford energy bills (Disability Action, 2011; Gore and Parckar, 2009; George, Graham and Lennard, 2013).

For people living with certain long term conditions, living in a cold home may aggravate their condition and/or hinder their recovery (Bevan Foundation, 2010). The literature identifies respiratory diseases, chronic obstructive pulmonary disease (COPD) and circulatory diseases as being the most likely to be aggravated by living in a cold home (WHO, 2011; Lacroix and Chaton, 2015; Webb et al., 2013; Canterbury District Health Board, NZ, 2012; Lacroix and Chaton, 2015; Public Health England, 2014).

A Health Impact Assessment and Equality Impact Assessment have also been completed.

7. Gender and race equality

It is not anticipated that there will be any disproportionate impacts regarding gender or race as a result of this policy.

The current Nest scheme has been working with community based groups in rural areas and other groups including BAME (black, Asian and minority ethnic) communities. Nest information is available in a number of languages which is promoted to specific relevant partners throughout the year. The new scheme will build on these successes.

We have also undertaken an Equality Impact Assessment which has not identified any negative or disproportionate impacts on gender and race equality.

8. Welsh Language

As the delivery of the new scheme will be contract managed by a third party, we will ensure that they comply with the Welsh Language Standards. As with the existing scheme, the new scheme will have bilingual customer service representatives and all material will be provided bilingually.

The scheme will have a positive impact on Welsh speakers in fuel poverty.

The scheme could also have a positive impact on the Welsh language through the improvement of homes in rural areas, where Welsh language is more frequently used. Spending caps on measures per household have been set higher for rural homes in recognition of the harder to treat nature of these properties.

In 2015-16 around 33% of all homes improved through the existing Nest scheme were in rural areas. By making these homes more affordable to heat, this has the potential to enable Welsh speakers to remain within their Welsh language communities.

Many of the homes improved through the Nest scheme are in traditional strongholds of the Welsh language (where there are some 40% or more Welsh speakers). This includes areas such as Carmarthenshire, Anglesey, Gwynedd and Anglesey.

The scheme is also designed to create local jobs, which could increase economic prospects for Welsh speakers and communities.

There is evidence that the Nest scheme has a positive impact on health or recipient, with a reduction in the use of local health services. The new scheme will extend eligibility for free energy efficiency measures to low income homes where members suffer from respirator or circulatory conditions. This will have a beneficial impact on low income welsh speakers with health conditions in addition to local services.
In addition, improving the energy efficiency of homes through the scheme can free up money to spend in the local economy and address social exclusion by enabling recipients to invite neighbours into a warm home.

We have undertaken a Welsh Language Impact Assessment which has not identified any negative impacts.

9. Competition Assessment

We do not foresee any impacts on the competitiveness of markets as a result of the policy. The continuation of a demand-led energy efficiency scheme would most likely benefit Welsh firms as has happened so far in Nest's history. The 2015/16 Nest Annual Report showed that 100% of installations were conducted by Welsh installers and it is reasonable to expect this to continue. This is due to the labour intensive and localised nature of most energy efficiency work.

However, Wales' competitive position relative to other countries may improve from the support of the energy efficiency sector more generally. The successful growth of the sector in Wales should lead to a skilled and highly specialised workforce in several sectors of our economy. This could have a positive, more indirect effect on our competitiveness in the manufacturing and services sectors as well as in research and development.

Annex

Modelling assumptions

NPV calculations and discounting

Net Present Value (NPV) is calculated from a societal viewpoint (i.e. costs and benefits to society as a whole). The NPV calculations include the following cost and benefit categories:

Table 19: Summary of monetised costs and benefits

Costs	Benefits
Investment in energy efficiency measures	Energy bill savings
Front end support cost	Direct rebound effect
	Monetised carbon avoided
	Air quality benefits

NPV is calculated from 2018 to 2036. Cost and benefit streams are discounted using a 3.5% discount rate.

Energy efficiency lifetimes

Energy efficiency measures can last for a variety of lifetimes. Boilers and heating controls are estimated to last for around 12 years, whilst loft insulation and external wall insulation last for 42 and 36 years respectively. For the purposes of assessing benefits, we have estimated a lifetime of an 'average energy efficiency package' by weighting the lifetime of each measure by the proportion of households receiving that measure and summed to give an overall lifetime. The heating measures (boilers), which have shorter lifetimes, are weighted more heavily than the insulation measures, producing a package lifetime of 14 years. This uses *Nest* 2015/16 data on households to calculate weights which are then applied to energy efficiency measure lifetimes from Ofgem[19] data.

Annual energy savings

Error! Reference source not found. shows the estimated average fuel savings per household, number of households and measures from an annual investment of £18m in home energy improvement for each of the options, supplied by modelling from Nest.

Table 20: Estimated numbers of households, measures and average annual cost savings under different levels of investment scenarios

[19] https://www.ofgem.gov.uk/sites/default/files/docs/2015/10/eco2_measures_table_-_oct_2015-_v2_3_-_final.pdf

Option	Average deployment (current fuel mix)	Low volumes (higher % of Oil properties)	High volumes (higher % gas properties)
Option 2	Households: 4,290 Measures: 4,642 Average annual cost saving per household: £436	Households: 3,833 Measures: 4,147 Average annual cost saving per household: £443	Households: 4,638 Measures: 5,019 Average annual cost saving per household: £428
Option 3	Households: 4,290 Measures: 4,642 Average annual cost saving per household: £436	Households: 3,833 Measures: 4,147 Average annual cost saving per household: £443	Households: 4,638 Measures: 5,019 Average annual cost saving per household: £428
Option 4a	Households: 3,943 Measures: 4,326 Average annual cost saving per household: £439	Households: 3,331 Measures: 3,754 Average annual cost saving per household: £449	Households: 4,565 Measures: 4,967 Average annual cost saving per household: £429
Option 4b	Households: 4,404 Measures: 4,765 Average annual cost saving per household: £421	Households: 3,936 Measures: 4,258 Average annual cost saving per household: £425	Households: 4,993 Measures: 5,401 Average annual cost saving per household: £417
Option 4c	Households: 4,212 Measures: 4,557 Average annual cost saving per household: £439	Households: 3,745 Measures: 4,052 Average annual cost saving per household: £446	Households: 4,814 Measures: 5,208 Average annual cost saving per household: £431
Option 4d	Households: 4,301 Measures: 4,654 Average annual cost saving per household: £434	Households: 3,843 Measures: 4,158 Average annual cost saving per household: £441	Households: 4,673 Measures: 5,057 Average annual cost saving per household: £427

Source: Nest

Note: This assumes Welsh Government budget only, and does not take account of any additional funding levered into the scheme (i.e. ECO).

Error! Reference source not found. contains the assumptions behind energy savings and household numbers in **Error! Reference source not found.**.

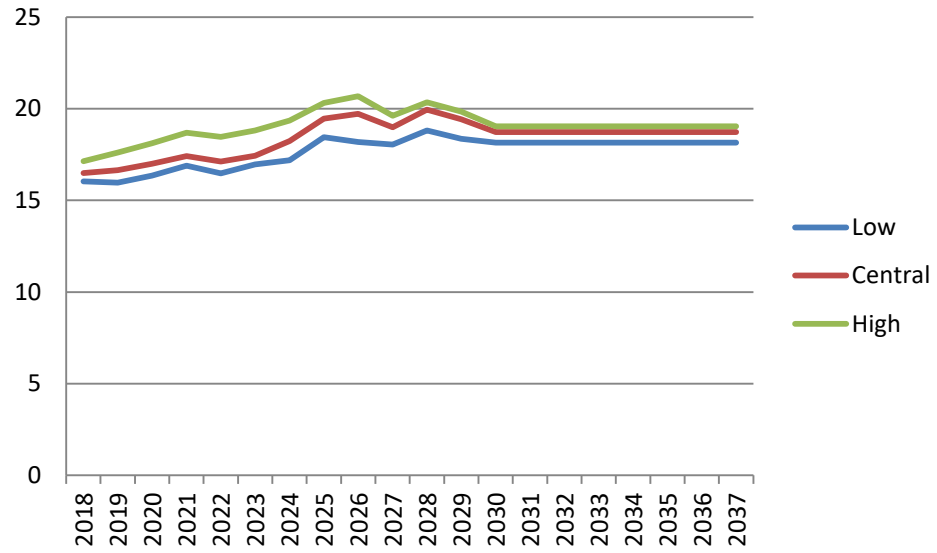
Table 21: Assumptions for household numbers and bill savings

Option	Commentary/Assumptions
Option 2	8% insulation, 0.2% External Wall Insulation, remaining boiler installation Average Grant Cost £3,500 + fee + key performance indicator (low:£3,000, high:£4,000)
Option 3	8% insulation, 0.2% External Wall Insulation, remaining boiler installation Average Grant Cost £3,500 + fee + key performance indicator (low:£3,000, high:£4,000)
Option 4a	Fuel mix stays the same, but additional 27, 60 or 150 External Wall Insulation over a year for low, medium and high deployment scenarios
Option 4b	16% of on-grid, 68% of off-grid would be over the threshold, Average Grant Cost assumed to fall by £100 per 10% reduction in higher value jobs
Option 4c	16% of on-grid, 5% of off-grid would be over the thresholds, Average Grant Cost assumed to fall by £100 per 10% reduction in higher value jobs
Option 4d	In 2016/17, around 10% of properties treated are E rated, 90% are F/G

To calculate energy savings for each option, the average energy bill saving is multiplied by the estimated number of households treated. We assumed that the bill savings change in line with BEIS estimated fuel prices to account for the real terms future price variation.

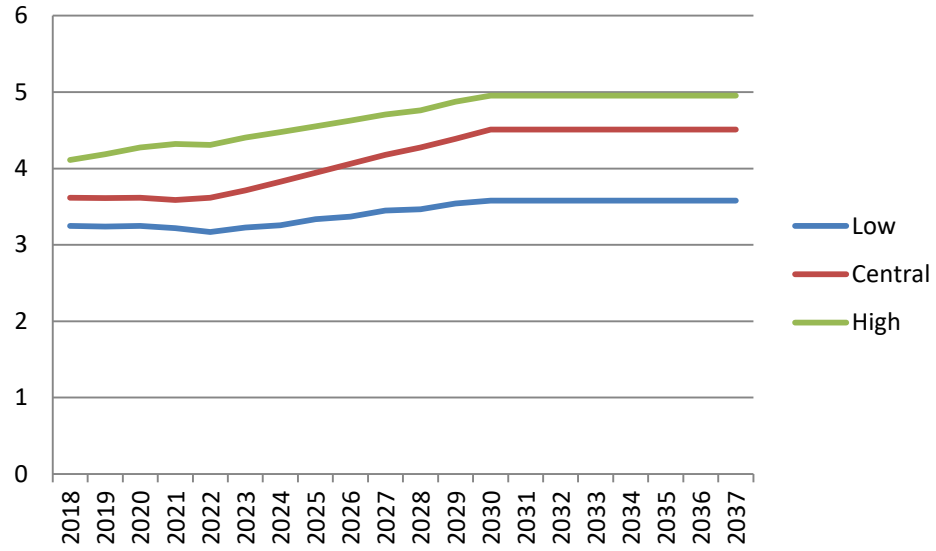
Figures 4, 5, 6 and 7 show the energy prices that are used to adjust energy bill savings in the analysis.

Figure 4: Electricity prices used in sensitivity testing, p/KWh



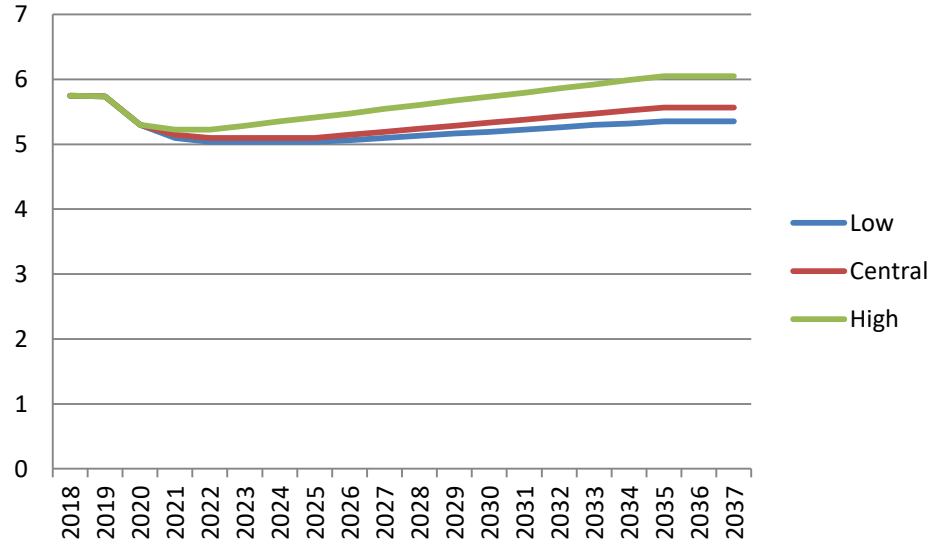
Source: BEIS

Figure 5: Gas prices used in sensitivity testing, p/KWh



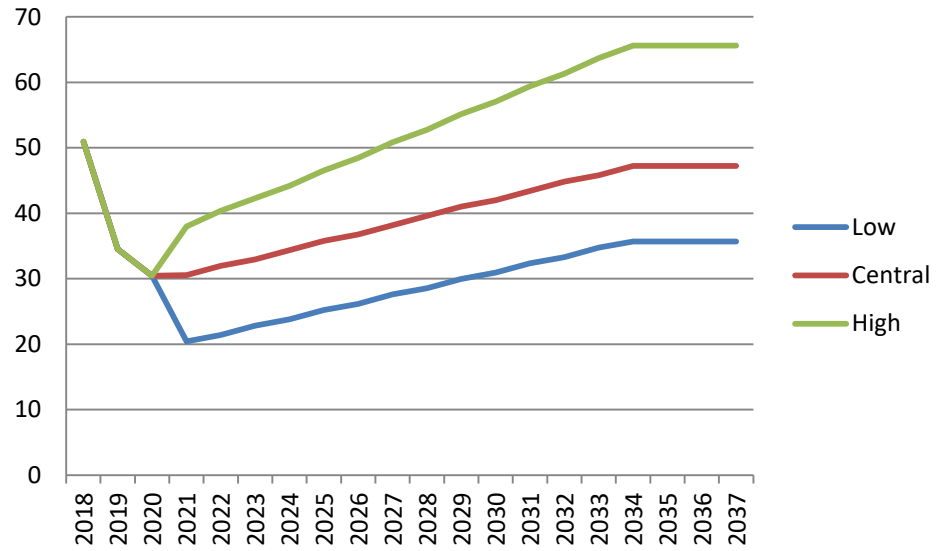
Source: BEIS

Figure 6: Coal prices used in sensitivity testing, p/KWh



Source: BEIS

Figure 7: Oil prices used in sensitivity testing, p/litre



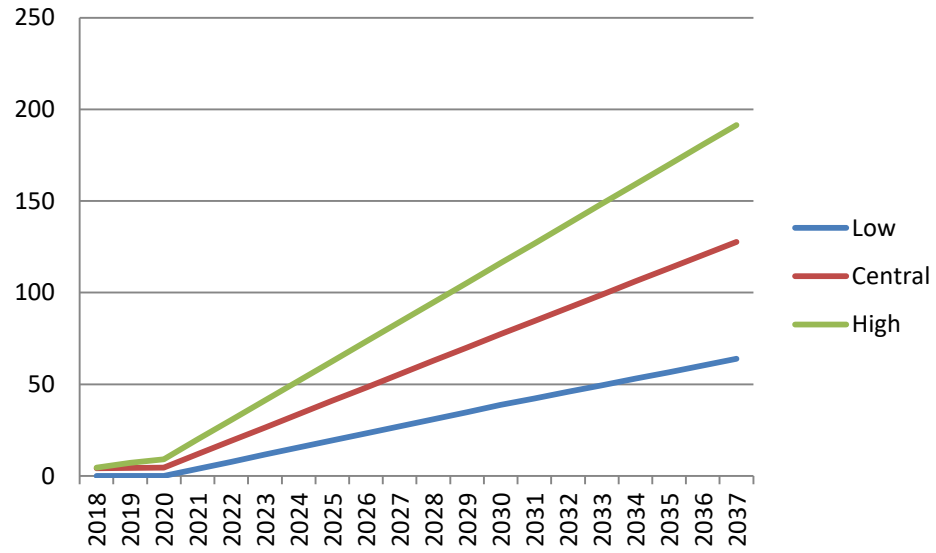
Source: BEIS

Carbon savings

Nest has supplied average CO2 savings per property on the basis of estimations from over 20,000 upgraded properties. The CO2 savings have been monetised using published BEIS data on carbon prices. They are shown below in figures 8 and 9. We have used the high and low estimates to perform the sensitivity tests.

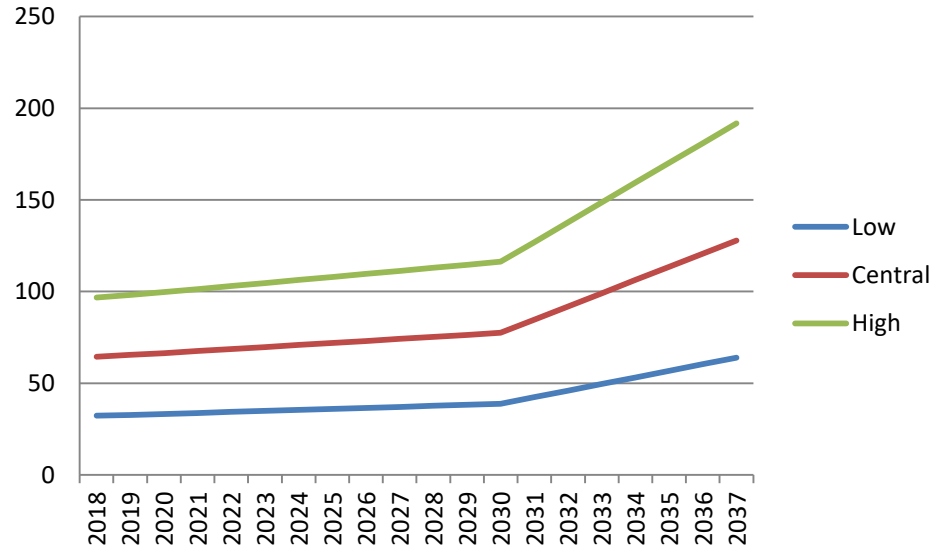
To make the CO2 savings more specific to each option, the average saving has been adjusted in proportion to the energy bill savings and traded/non-traded prices applied in proportion to the fuel splits of past energy efficiency upgrades in the Nest scheme. These are predominantly in the non-traded sector, as gas saving installations makes up the vast majority of savings in the scheme so far.

Figure 8: Traded CO2e prices used in sensitivity testing, £/tCO2e



Source: BEIS

Figure 9: Non-traded CO2e prices used in sensitivity testing, £/tCO2e



Source: BEIS

Air quality impacts

Air damage costs have been used in this impact assessment used for valuing the benefits in terms of improved air quality. We have used the damage cost approach as the impacts are relatively small (below £50m). The national average values were assigned against energy fuel types and applied to household numbers for each

option. The energy bills savings for each option, as a proportion of average bill savings per household, were used to scale air quality impacts.

Employment

In order to estimate the number of jobs supported/created, we have used 'job intensity factors' or 'multipliers' from the Office of National Statistics' Annual Business Survey. These estimate the number of jobs supported in different areas by £1m of turnover/investment. The 'job multipliers' are summarised in **Error! Reference source not found.**. We also assume that capital spend is broken down as detailed in **Error! Reference source not found.**.

Using these figures we estimate annual job impacts for each investment period using the formula below. These jobs are then applied to each year of construction to estimate total jobs supported over a number of years.

$$Jobs\ supported\ by\ capital\ spend\ (per\ annum) = Assumed\ Disaggregation(\%) \times \left(\frac{Annual\ Investment\ in\ Technology}{Years\ of\ construction}\right) \times Job\ Intensity\ Factor$$

Table 22: Job Intensity Factors

Area	Multiplier
Construction	10.7
Project Management	9.3

Table 23: Assumed Disaggregation of Capital Costs

Construction	90%
Project Management	10%