



Wales Centre for Public Policy
Canolfan Polisi Cyhoeddus Cymru

What Works in Tackling Rural Poverty:

An Evidence Review of Interventions to Address Fuel Poverty

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Summary

- This report explores interventions to tackle fuel poverty in a range of OECD countries about which some reliable evidence about effectiveness exists.
- The majority of interventions are large-scale government subsidised activities focused on improving the energy efficiency of the housing stock and/or household appliances (in particular hot water and heating boilers). Investment costs of these schemes are high, but they can have significant long-term benefits, and help meet CO₂ emissions targets as well as alleviating fuel poverty.
- There is widespread recognition that energy efficiency measures that reduce damp and cold in the housing stock also result in health improvements. Although, for the most part, these benefits have not been quantified, recent evidence suggests significant savings in healthcare and medical costs. Energy efficiency improvements also enable more people to pay their utility bills and keep their warmer thus improving their quality of life.
- Locally delivered projects targeted at localised needs can reach significant numbers of households in fuel poverty, and through partnership work can leverage additional funding and benefits. Such schemes can raise awareness about energy efficiency measures, and have some effect on reducing energy consumption through relatively quick and cheap measures that improve quality of life.
- Alleviating fuel poverty in the UK will require long-term measures that focus on improvements in the housing stock. Wales is at the forefront of addressing fuel poverty through targeted schemes such as Nest and Arbed. The renewal of the Nest contract in 2018 creates an opportunity for developing a more targeted household energy improvement programme, based on improved evidence of health benefits.
- New technology offers scope for small-scale community benefits through the use of community generated energy and savings through more effective energy purchasing. It also provides scope for extending the activities of fuel purchasing clubs, as well as opportunities for developing new forms of community energy management organisation. Linking the use of food banks with targeted support for those in fuel poverty may provide opportunities to alleviate some of the negative effects of fuel poverty for individual households.

Introduction

The Welsh Government has supported a wide range of programmes to address rural poverty and yet recent estimates suggest that almost a quarter of the rural population of Wales is living in poverty. The causes of rural poverty are complex and multi-faceted, but fuel poverty is recognised as an important contributory factor to the ‘rural poverty premium’ (Williams and Doyle, 2016). Assessments of the extent of fuel poverty in Wales vary from 32% of households (Grey et al., 2015) to 23% of households (Welsh Government, 2016) or 25% of the population (National Energy Action, 2017), and there are concerns that rising energy prices pose a particular problem for households on fixed incomes.

Rural fuel poverty is driven by rising fuel prices, an ageing housing stock that is not thermally efficient, the lack of access to natural gas supplies, and the increased costs of delivering fuel to sparsely populated areas. Fuel poverty is known to have adverse effects on health (associated with living in cold, damp homes) and improvements in the thermal efficiency of homes can reduce medical and health care costs. The Public Health Outcomes Framework (Department of Health, 2012) identifies fuel poverty as a key determinant of health outcomes and the strong links to health have enhanced the priority of tackling fuel poverty among vulnerable sectors of the population, particularly older people and children.

The UK has probably been more pro-active than most other European countries in seeking to identify and reduce fuel poverty. This may be associated with the poor energy efficiency of much of the UK’s housing stock (National Audit Office, 2016; Guertler, et al., 2015). Policies that can reduce fuel poverty are mostly devolved, and Scotland, Wales, and Northern Ireland have all developed fuel poverty strategies and targets. In England, a new fuel poverty strategy was adopted in 2015 (Department of Energy and Climate Change, 2015) based on a recommendation by the Hills Review (Hills, 2012). It aims to ‘ensure that as many fuel poor homes as is reasonably practicable achieve a minimum energy efficiency rating of Band C, by 2030’.

Continuing pressure on the Welsh Government’s budget combined with the potential loss of EU funding for rural programmes means that it is imperative that its resources are targeted on the most cost-effective approaches to tackling fuel poverty. This report provides an overview of interventions that have attempted to reduce rural fuel poverty in a range of OECD countries. The evidence is drawn from a wide-ranging search of the academic literature, government documents, annual reports, and organisational websites. It focuses on studies published from 2000 onwards that provide some form of evaluation or impact assessment of relevant interventions.

Review questions

The study identified a total of twelve interventions (see Appendix 1) from five countries where sufficient evaluation information could be found to enable the research team to draw conclusions regarding the effectiveness of the interventions. In some countries rural fuel poverty is not recognised, while in other countries it has only recently been identified as an issue requiring action (e.g. France). The major focus of activity in relation to rural fuel poverty has been in the UK and Ireland.

Until March 2013 the major element of the UK government strategy dealing with fuel poverty was the Warm Front Scheme, which provided heating and insulation measures to eligible households, whether urban or rural. The Warm Front Scheme was replaced with the Green Deal and additional subsidy could be achieved potentially through the Energy Company Obligation (ECO), whereby energy suppliers have a responsibility to address fuel poverty needs. A 2013 report (Centre for Regional Economic and Social Research, 2013) suggested that neither the ECO nor the Green Deal were working well and were unlikely to alleviate fuel poverty.

The Green Deal aimed to improve energy efficiency in households by making loans of up to £10,000 available to improve energy efficiency. The cost of the improvements would be paid back through payments taken out of energy bills (which would not exceed the annual savings delivered through the efficiency improvements). Under the scheme, the repayments became the responsibility of the person in charge of the energy bills, even when the property changed hands. Due to poor take-up (partly due to high interest rates charged on the loans) the government stopped funding the Green Deal scheme in 2015 (Syal, 2016; National Audit Office, 2016). It is worth noting that the problems were not related to the fact it was addressing urban as well as rural households, but to programme design.

The major focus of government initiatives (in the UK and other countries such as France and New Zealand) has been on improving the energy efficiency of the housing stock. Programmes such as *Warmer Homes in Eire*, *Habiter Mieux* (France), the Central Heating Programme in Scotland, and the New Zealand Heat Smart Programme, have all explored the potential for reducing fuel poverty through government interventions to support home improvements. *Habiter Mieux* was the only one of these schemes targeted specifically at rural areas and had a focus on older people within rural areas. However, the programme suffered from implementation issues and lack of training for delivery personnel.

For the most part the identified schemes all tend to focus on the same broad approaches, incorporating improved insulation and replacing old inefficient heating systems with new technology (Department of Social and Family Affairs, 2009; Dubois, 2012; Grimes et al., 2011). In general the evaluations indicate relatively minor reductions in home energy bills for residents, although there is evidence to suggest those benefitting from such programmes

find it easier to pay their utility bills. Health improvements, especially among older people, are also cited as evidence of benefits, although most of the changes are self-reported and anecdotal.

Schemes such as the 'Warm Homes Healthy People Fund', which operated across the winter of 2012-13, illustrate just how much can be achieved with relatively modest amounts of funding through partnership approaches (Brown, 2012). The strength of the scheme was in allowing local authorities to bid for a flexible funding pot, which enabled them to target perceived local needs. The programme enabled local authorities to target both rural and urban areas; the main weakness was not targeting but the short time frame, both for making an application and spending the funding.

Outside of government-sponsored programmes there is relatively little activity to tackle fuel poverty. The Npower Fuel Bank pilot project is one example that is proving successful, and the scheme is being expanded in conjunction with the Trussell Trust food banks to support those in crisis, illustrating how new partnerships can be effective in delivering benefits to the 'hard-to-reach' sectors of society. Again, the focus is not specifically rural but can be applied in any area where there are food banks.

Another interesting development are 'energy local clubs', which plan to use new technology (e.g. smart metering) to reduce energy purchasing costs for larger groups of people. This potentially offers low cost approaches for small community groups to tackle fuel poverty. A number of approaches, in both rural and urban settings, are currently in the pilot phase so it is too early to tell whether such approaches will be successful. In terms of potential application in rural areas the 'energy local club' approach may be limited by the need to have sufficient households to achieve the required purchasing power, and may not be suited to remote households in sparsely populated areas. On the other hand it could be ideal for small rural communities with reasonable levels of social capital capable of organising themselves into 'energy buying organisations'. Another approach, in South Lanarkshire (Energy Saving Trust, 2015), has resulted in installation of a biomass district heating unit, which has resulted in significant energy savings to tenants living in high rise buildings. This urban-based scheme is not covered in detail here, but it points the way towards alternative options for alleviating fuel poverty in rural areas through integrating new technology into community-based schemes.

Table 1. Summary of Fuel Poverty Interventions

Subject: Fuel Poverty

Intervention	Location	Characteristics	Description of intervention	Evaluation
The Warm Homes Initiative	Northern Ireland	Addressing fuel poverty amongst vulnerable owner occupiers and private rented households. Started July 2001	Strategic objective of eliminating fuel poverty. A total of £109 million was spent on the scheme by 31 March 2008: of which £11 million from Northern Ireland Electricity Energy Ltd, funded by the energy efficiency levy. Eligibility limited to vulnerable households: those on specific benefits or over 60 years old, or with children.	Initiative has provided energy efficiency measures to 60,000 homes since 2001. Contributed to a range of government priorities (improved health, fewer winter deaths, improved air quality, reduced carbon dioxide emissions). Concluded that Scheme unlikely to achieve its objective without massive increase in expenditure.
Transforming Lives: Lessons Learned and Shared 'Home is Where the Heat is'	Armagh and Dungannon Health Action Zone	Rural fuel poverty and health issues Operated 2002	Developed a community self-selection process to determine the commitment or 'buy-in' within fuel poor wards. Prioritised resources to provide fuel poor households with maximum assistance through total solutions' packages, i.e. heating, energy efficiency measures and appliances.	Significant reduction in the number of houses reporting condensation, mould and damp after the intervention. Fuel expenditure costs reduced for all groups. The project also claimed that it assisted in identifying unmet need as almost 40% of heating system recipients were not eligible for the Warm Homes Scheme.
Warmer Homes Scheme	Eire	Installation of energy efficiency measures in low income households Operated: 2006 - 09	Targeted low income households for energy efficiency improvements.	Evaluation of 600 households in cork and Donegal area over the period 2006-09. Reduction in average heating bills winter and summer; larger proportion of households could pay utility bills on time; reductions in self-reported health problems.
Habiter Mieux	France	Focus on older people living in rural areas. Launched 2010	Programme aims at improving thermal efficiency of homes of fuel poor households by minimum of 25%. Delivered through Departments - each identifies number of households affected and defines targets for renovation.	Programme requires capacity building among implementation personnel. No evaluation information.
Warm Up New Zealand: Heat Smart Programme	New Zealand	Renovation of homes with poor insulation to reduce energy consumption and improve health	Subsidies are provided towards the costs of retrofitting insulation and/or installing clean heating for pre-2000 houses.	Evaluation suggests programme as a whole has net benefits though health benefits dominate and not all benefits measured. Central estimate of benefit-cost ratio is 4.8:1. Gross benefits \$1.28 billion with resource costs of \$0.33 billion.

Subject: Fuel Poverty

Intervention	Location	Characteristics	Description of intervention	Evaluation
Npower Fuel Bank (pilot phase)	Co Durham, Gloucester, Kingston, the Wirral, England	Supporting households in energy crisis; particularly those at immediate risk of self-disconnection and/or rationing of energy.	Targeted at food bank service-users that use a pre-payment meter (PPM). The Fuel Bank provides a fuel voucher to the value of £49 (equivalent to approximately two weeks' dual fuel use).	Evaluation limited in scope with some potential bias. Identified direct and indirect benefits across the sample. Majority of recipients used a proportion of their voucher to repay an emergency credit charge with the remainder used for ongoing consumption. Suggests potential to reach and deliver benefits to vulnerable energy consumers.
Warm Homes, Healthy People	Cumbria, England	<p>Combined objectives of reducing excess winter deaths, reducing fuel poverty and reducing the number of people in Cumbria living in cold homes.</p> <p>Operated 2012-13</p>	<p>Example of a scheme funded under the Warm Homes Healthy People Fund 2012-13. Cumbrian scheme consisted of two parts: Winter Warmth Fund gave grants (£125 – 250) to people who could not afford to heat their homes to a safe temperature; also small grants to community groups in order to build in capacity for tackling fuel poverty.</p> <p>Warm Homes Healthy People Fund closed by UK government 2013</p>	<p>Total of £427,000 expenditure. Had to be spent by March 2012, required very rapid implementation. No evaluation found for Cumbria but overall England Scheme evaluation completed in 2013. Limited information but concluded: interventions provided by the projects referring people to other services that are not time limited have the potential to achieve impact beyond the period of the intervention itself.</p>
Foundations Independent Living Trust (FILT): 'Warm Homes Service'	England	<p>Assist older and vulnerable people at risk from cold weather and prevent cold related harm and illness</p> <p>Operated Nov 2012 – March 2013</p>	<p>FILT obtained £499,200 from the Dept. of Health in winter 2012-13 to operate the scheme. The aim was to equip and fund the Home Improvement Agency (HIA) sector to provide targeted and focused support for those facing fuel poverty. Service included home visits, energy use assessments and interventions to deal with cold homes.</p>	<p>Evaluation noted: 6,469 households benefitted from personalised information and advice, and received signposting to other organisations where needed. 1,148 jobs were completed during the visits.</p> <p>Benefits reported: home temperatures, warmth and comfort, physical and mental health and well-being. Average cost of an intervention was £200 – benefits are estimated to be significantly higher – resulting from cost savings across health, housing and social care. Grant size and time scale severely limited what could be accomplished.</p>

Effectiveness of Interventions

It is relatively straightforward to identify the costs and benefits of schemes and programmes aimed at alleviating fuel poverty. Schemes in Northern Ireland (Northern Ireland Audit Office, 2008) and Ireland indicate significant returns on investment when wider social and physical well-being, and savings in health care are taken into account (targeting urban as well as rural areas). These initiatives can be considered as successful although the evidence from evaluations suggests that households outside them were also implementing a similar range of energy efficiency measures, implying there might be an element of deadweight. One weakness of the evaluations of these schemes is the inability to monetarise the savings to health care and welfare support systems from health improvements arising from people living in warmer homes with less damp and mould.

Fuel poverty is not easy to define. There have been multiple definitions and rapid changes in the numbers of households that are deemed to be experiencing it due to volatility of energy prices. A programme established to alleviate fuel poverty can easily become overwhelmed and fail to meet its targets simply because of increases in fuel prices, while the measures required to reduce energy consumption in large areas of older housing stock (e.g. cavity insulation, new boilers and renewable energy technology, central heating) are expensive and take time to deliver. Retro-fitting older housing can have long term benefits, but the initial improvement costs are high, as demonstrated by the difficulties faced by the Green Deal scheme that operated in England during 2013-15 (National Audit Office, 2016). Attempts to tackle parts of the housing stock that required more extensive work (such as cavity wall insulation) proved expensive and illustrated a lack of ability (or willingness) on the part of property owners to invest in improvements themselves. This is probably a result of previous government subsidy programmes, and/or an illustration that without higher levels of subsidy the more serious problems arising from energy inefficiencies in the housing stock are unlikely to be addressed. Part of the problem is that programme evaluations often lack robust baseline data (National Audit Office, 2016) which hampers the identification of factors influencing the success of fuel poverty programmes.

Linking health care provision, community organisations, and fuel poverty alleviation measures offers greater scope for achieving benefits, as demonstrated by the FILTS Warm Homes Scheme (Centre for Regional Economic and Social Research, 2013), and the 'Home is Where the Heat is' scheme delivered in the Armagh and Dungannon Health Action Zone (Shortt and Rugkasa, 2007; Casson, et al., 2002). In both cases linkages focused on target groups suffering poor health as a result of fuel poverty, and were able to provide service information and advice, as well as reduce problems arising from poor quality housing stock. Similar schemes in Ireland (the Warmer Homes Scheme) and the Warm Homes Healthy People Fund, which operated across England over the winter of 2012-13 also illustrate what

can be achieved from relatively small sums of money. Although these schemes were not targeted specifically at rural areas they offer salutary lessons for the design of fuel poverty alleviation programmes.

The Warm Homes Healthy People Fund amounted to £20 million but was awarded to local authorities through a competitive bidding process which led to leveraging of additional funding from partnership arrangements. It had significant successes using small schemes tailored to local needs. Two examples (presented in Table 1), one in Cumbria, and one more widely delivered across England (FILTS), demonstrated that quite large numbers of households could be supported through measures to alleviate fuel poverty. It is worth noting that rural and urban households could benefit from both schemes, though in the case of Cumbria there was a focus on rural households. The Cumbrian scheme focused largely on grants to households to support payments for heating homes. A total of 6,469 households benefitted from visits with personalised advice, and 1,148 jobs were completed under the FILTS project. The fund also identified problems with trying to address fuel poverty with short term measures. Programme evaluations indicated grant size and short time scales for delivery severely limited what could be accomplished (Brown, 2012; Maddox, 2014).

Schemes delivered outside of government programmes are limited in scope. The most successful has been the partnership between the Trussell Trust and Npower (Stockton, 2015) which makes use of the network of foodbanks across the country to reach those in crisis, who face arrears, or who have self-disconnected from energy supplies. The project relies on both the financial support from Npower to pay for the fuel vouchers handed out to those in need, and the referral system and skills of food bank staff to reach those in need and explain how the system operates. The scheme illustrates the potential for increasing the reach of support through integration of the not-for-profit and private sectors that each have something to contribute. The focus of the scheme is on crisis management rather than alleviation of the causes of fuel poverty, and has implications both for rural and urban areas.

Policy Implications

Fuel poverty is a significant issue across Wales and energy price rises have made it much more difficult to achieve earlier targets to eliminate the problem. The interventions identified in this study suggest that in a volatile energy market, and with a large, poorly insulated housing stock, it is unlikely that fuel poverty will be eliminated in the near future and policy makers should think about addressing residential energy issues in multi-generational terms. This suggests a need for some form of prioritisation process to identify high-risk/high cost sectors of the population, or specific geographic areas with above average needs and/or costs. A risk-benefit analysis that incorporates measures of wider social, economic, and health benefits, and savings in public expenditure from reductions in service delivery, could help guide government policy and programme development in this arena.

The evidence from the interventions identified in this report shows that factors such as market prices and market volatility, which are outside the Welsh Government's control, have a significant influence on fuel poverty.

It is also clear that addressing the causes of fuel poverty can be expensive and the full benefits are not realised immediately. A major cause of fuel poverty is poor quality of housing, which requires expensive investment, although the long-term benefits are likely to be significant. Benefits from investing in improvements of the housing stock include: reduced household expenditure on energy; improved health; reduced public sector health care costs; reduced absence from work and school caused by illness; environmental benefits (e.g. reduced emissions); improved well-being and quality of life; and social inclusion. Such improvements also help to meet key government targets (including reductions in CO₂ emissions, reducing energy consumption and alleviating fuel poverty), but they do not necessarily take households out of fuel poverty altogether, so some immediate support may also be required to deal with vulnerable groups that cannot pay for energy, or self-disconnect.

Household energy efficiency improvements provide greater value for money when linked to health authorities to assist in targeting vulnerable groups. Identifying and addressing the causes of fuel poverty must also be part of any scheme.

It is clear that partnership approaches are more successful at delivering benefits and a 'light touch' broad programme focusing on 'minor' energy efficiency improvements can have multiple benefits in terms of:

- Immediate action in the short-term;
- Providing information on scale and extent of problems;
- Raising awareness of energy efficiency options;

- Providing advice on reducing consumption and identifying cheaper energy;
- Making reductions in energy consumption;
- Improving health and well-being; and
- Reducing exclusion.

Any new initiatives need to build on the current fuel poverty activities centred on the Warm Homes-Nest Scheme, which started operating in 2011 and is now due to end in March 2018 (Welsh Government, 2017). It aims to improve energy efficiency for up to 4,000 low-income households per year (households must meet certain eligibility criteria regarding benefits and energy efficiency of the home). An evaluation conducted in 2014 (Marrin et al., 2015) suggested that the scheme had been successful in reaching older people and those in need of support, but there is some doubt whether rural households had been sufficiently well targeted, and there is concern that households in need of support had not been able to meet the eligibility criteria. Evidence suggests that the scheme has been successful at making recipients feeling more confident and less concerned about heating their homes due to both the measures and advice they had received. There is also some indication of health improvements and one assessment suggests a benefit to cost ratio of 1.29:1, with advice and support received by 61,000 households. Recent findings from a project linking fuel poverty data to the health and wellbeing of recipients of home energy efficiency measures suggest statistically significant improvements in health. The data show positive effects on respiratory health, asthma events, and infections for recipients of Warm Homes Nest measures (Welsh Government Statistics and Research, 2017c).

Given the large number of households (in both rural and urban settings) estimated to be in fuel poverty (Welsh Government, 2017) a realistic, long-term strategy (20-30 years) is required to deliver a series of targeted programmes. These could address the quality of housing stock (prioritising households facing the biggest problems), energy efficiency of appliances (boilers and heating, in particular), support for those facing severe difficulties at the present time (short-term), and support for innovative pilot schemes to test new technology and ideas. Previous reports (Hills, 2012) have identified thermal efficiency improvements to the housing stock as the most cost-effective actions in the long term in relation to reducing CO₂ emissions and alleviating fuel poverty. While it is clearly easier (and there may be some economies of scale) to address problems in urban settings, where there are large numbers of households of similar age and construction adjacent to each other, the benefits in terms of reduced energy bills and health improvements to the household, and reductions in greenhouse gases (GHGs) are going to be similar for both rural and urban areas (for housing stock with the same problems).

Given the limited resources available, any fuel poverty alleviation programme should be prioritising the housing stock based on evidence of measurable benefits, not whether the area is urban or rural. Criteria for targeting energy efficiency improvement programmes should include the following:

- Potential reduction in GHGs;
- Household identified as being in fuel poverty;
- Estimated reduction in fuel bills;
- Estimated health benefits; and
- Enhanced well-being.

In addition, targeting of energy efficiency measures at the housing stock will provide enhanced value for money (VFM) if measures are linked to health related service delivery, potentially resulting in reductions of other public sector costs such as health and residential care, (e.g. reduction in illnesses requiring hospitalisation), reduction in absences from work and school due to sickness, and improvements in overall well-being. Some of these benefits may be greater in rural areas due to the rural premium (e.g. higher energy costs), and scope for larger savings (benefits) from reduced health problems (i.e. people in rural areas have higher costs in accessing health services).

Some recent initiatives (e.g. energy buying 'clubs': there is currently one being piloted in Bethesda) suggest that new technology and collaborative approaches can be utilised to find alternate means of reducing household (and business) energy costs. Community fuel buying schemes are not new, for example Shropshire Rural Community Council operate an oil buying scheme, and a pilot programme for bulk purchasing of wood (Shropshire RCC, 2017). Residents in Wales can also achieve savings through purchasing heating oil through My Consortium (2017). A more comprehensive approach was developed by Ceredigion County Council in 2014, which established an oil buying syndicate (Clwb Cosy) to reduce the cost of heating oil resulting in an explanatory publication aimed at other local authorities (Welsh Government, 2016). Fuel purchasing clubs can reduce household fuel bills (depending on the effectiveness of the club in negotiating price reductions) but do little to address more fundamental fuel poverty problems stemming from inadequate insulation or inefficient boilers and heating systems.

What is now becoming possible through new technologies, such as smart metering and heating controls, which offer greater scope for energy efficiency, is the ability to benefit from electricity price differentials through purchasing and use of local resources (e.g. biomass) to generate and sell energy. Initiatives using new technologies to reduce electricity costs are new and have not been addressed in detail in this report due to lack of evaluative information

available, but they do offer a way forward for small scale rural schemes. Government support may be needed to initiate and build capacity for development of such activities, and pilot schemes and initiatives will be required to test and fully evaluate these approaches before scaling up to target those in fuel poverty.

Community energy generation offers a means for rural communities to generate income streams, which can be used to subsidise energy costs or other community benefits. Communities require support to undertake feasibility studies and build capacity for small-scale energy developments. The Rural Communities Energy Fund (RCEF) in England has demonstrated the demand among local communities for asset building support (through small scale initial feasibility study funding). The change in feed-in tariffs, however, has caused difficulty in taking projects through to completion (Courtney et al., 2017). Another alternative, urban biomass-based district heating (Energy Saving Trust (2015) suggests there is scope for targeting fuel poverty using biomass-based energy generation within some rural communities.

The current Welsh Government Warm Homes programme is currently due to end in March 2018 (Welsh Government Warm Homes, 2017), which may be an opportune time to revise the current fuel poverty strategy. However, concerns have been expressed regarding the limited evidence base on which to develop new policy and programmes, for example, the next Housing Conditions Survey and related fuel poverty data may not be available until late 2018/early 2019 (Welsh Government Statistics and Research, 2017). A household energy efficiency improvement scheme is only one potential (and long-term) approach to addressing fuel poverty. As Table 1 illustrates, there are a range of other forms of intervention that can have significant impacts on fuel poverty. Possible actions include:

Short-term actions

- Support for fuel banks (the Npower fuel bank system in partnership with the Trussell Trust already exists in Wales but the network is limited);
- Introduction of a home energy improvement programme, focusing on low-cost improvements. This could be a short-term, wide-scale programme targeting vulnerable groups to provide advice, raise awareness and fix minor problems in partnership with voluntary sector, housing associations, and local authorities. This will also provide insight into the scale of the problem, provide additional evidence, and assist in targeting more in-depth support.

A current example of this approach in Wales is the Warm Homes on Prescription scheme, focused on support for people with health conditions ‘caused or made worse by living in cold

housing'. The scheme, set up in the winter of 2016-17 provided basic improvements and repair services for those living in certain parts of Wales (Bridgend, Merthyr, RCT, Gwynedd, Ynys Mon, Conwy and Denbighshire). The aim of the scheme is to work with health professionals to prioritise those most in need of home energy improvements (Care & Repair Cymru, 2017).

Medium-term actions

- Direct support for innovative solutions (e.g. community level energy buying clubs and cooperative arrangements).
- Support for small-scale community energy generation. A wide range of potential options exists (including wind, solar, hydro-generation and heat pumps) although some technologies, such as district heating, may not be appropriate, or require further investigation to ensure communities involved receive adequate consumer protection safeguards.

Long-term actions

- Targeted 'total solutions' packages (i.e. energy efficiency improvements to housing stock or changing energy supplies) that lift households out of fuel poverty. The targeting can be linked to assessment of improvements to health and well-being, and delivery can be linked to job creation, skills development and training for young people. Benefits can reduce long-term health care costs. The programme would need to build on the work currently delivered by the NEST (operating since 2011) and Arbed (Strategic Energy performance investment programme established in 2009 to retrofit households and improve energy efficiency) Schemes under the Warm Homes Programme. A recent modelling exercise adds to the evidence base for developing a risk based approach using eligibility criteria to target an energy efficiency scheme at those most vulnerable and using data on the housing stock to model different budgetary options. (Bridgeman et al., 2016);
- A range of small pilot programmes targeted at specific representative rural areas and carefully monitored and evaluated might illustrate more fully the range of costs and benefits that can be achieved and provide useful comparative data with similar improvements undertaken on households in urban areas.

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Appendix 1 – Further information on interventions explored in this report.

Warm Homes Scheme, N. Ireland

In Northern Ireland the Warm Homes Scheme initiated in 2001 had the objective of eliminating fuel poverty amongst vulnerable owner occupiers and private rented households (a massive task given that an estimated 34% of all households were experiencing fuel poverty in 2006).

A total of £109 million was spent over the period 2001-08, of which £11 million came from Northern Ireland Electricity Energy Ltd, funded by an energy efficiency levy. An evaluation conducted in 2010 indicated the scheme had provided energy efficiency measures to 60,000 homes, which provided additional benefits beyond addressing fuel poverty (e.g. improved health, fewer winter deaths, improved air quality and reduced carbon dioxide emissions). The scheme's contribution to eliminating fuel poverty was not measured directly. The evaluation reported that operational targets were exceeded, though it also noted these targets were 'simplistic' and based solely on the number of homes treated which did not provide a useful measure of the number of households taken out of fuel poverty. The evaluation concluded that the scheme was unlikely to achieve its prime objective without a massive increase in expenditure. It was also suggested the scheme was more focused on energy efficiency and not adequate as a mechanism for solving the fuel poverty problem.

Beechmount Energy and Environment

This was the first large-scale community energy efficiency project in Northern Ireland, undertaken in the Beechmount area of West Belfast, an area with old Victorian era housing (e.g. with open fires), high unemployment and benefits dependency. Although carried out in an urban area, the detailed evaluation provides valid data on the wider benefits of improving energy efficiency in houses suffering from fuel poverty. An energy survey was conducted by Bryson House, the Northern Ireland Housing Executive and the Blackie Community Groups Association, following which a range of energy efficiency improvements were undertaken. A total of £1.84 million was invested with the majority coming from the public sector (£1.44 million from the Department for Social Development and £0.4 million from other sources). A wide range of improvements were made to several hundred houses, including:

- gas heating systems;
- heating controls upgrades;

- cavity wall insulation;
- draught proofing;
- loft insulation;
- radiator panels;
- low energy light bulbs;
- hot water tank jackets;
- oil burner jackets;
- low energy lightbulbs;
- new gas central heating systems.

Evaluation of the scheme looked at energy efficiency, household expenditure and health and wellbeing of residents affected. The evaluation report based on interviews and household surveys indicated that on average household spending on fuel and electricity decreased by £10.30 per week and annual disposable income in the area increased by around £192,000.

Following the project intervention, no households reported fuel shortages and there was considerable reduction in condensation, dampness and mould growth. Overall, 25% of residents reported an improvement in their health, and the majority indicated improvements in general comfort, convenience, cleanliness, and financial benefits.

‘Home is where the heat is’: Armagh and Dungannon Health Action Zone

The success of the Beechmount Project in Belfast provided impetus for further integration of energy schemes to tackle fuel poverty within Health Action Zones. The Armagh and Dungannon scheme was focused on a rural area, and utilised a community self-selection process and Householder Survey to identify those most in need of the measures.

The programme was delivered through a partnership arrangement with funding from Northern Ireland Electricity, and the Department for Social Development, and implemented with support from 21 other organisations, including community groups.

An evaluation was conducted through a household survey, suggesting that resources were prioritised to provide fuel for poor households with maximum assistance through ‘total solutions’ packages, i.e. central heating installation, energy efficiency measures and appliances. The evaluation reports that there was a ‘significant reduction’ in the number of houses reporting condensation, mould and damp (the proportion of scheme intervention households reporting the prevalence of damp, mould growth or condensation decreased from 68% to 22 %); fuel expenditure costs reduced for all groups (the average across the

intervention group was a 33% reduction in annual fuel costs); and the project claimed that it was satisfying unmet need as almost 40% of heating system recipients benefitting were not eligible for the Warm Homes Scheme. The evaluation was not able to determine the number of households lifted out of fuel poverty as no pre-intervention data was available, though the report suggested that a significant number on low incomes remained in fuel poverty (Shortt and Rugkasa, 2007).

Warmer Homes Scheme, Eire

Sustainable Energy Ireland (SEI) established the Warmer Homes Scheme (which retrofits private homes with insulation and other energy-saving measures) in response to suggestions that up to 19% of homes in Ireland might be facing some form of fuel poverty. The scheme was based on assumptions that low-income households would not be able to improve fuel efficiency as they lack capacity for capital investment in their homes. The Warmer Homes Scheme targeted low-income households to improve the energy efficiency of their homes, including activities such as: attic insulation, draught proofing, cavity wall insulation and energy advice.

An evaluation of the scheme was carried out over the period October 2006 to February 2009 in the City of Cork and County Donegal. The research was based on a sample of 600 households (257 were in the Scheme and 343 that were not) surveyed both before and after energy efficiency measures were installed. The evaluation suggests the Scheme,

“had a significant impact on reducing fuel poverty...evidenced by a significant decline in the number of intervention households reporting difficulty in being able to afford to heat their home in winter to a temperature that is comfortable, a significant decline in the proportion of intervention households not using rooms in their home because they are not heated or too cold, and a significant decline in the number of intervention households finding it difficult to pay their utility bills on time.”

The evaluation noted that both sets of households in the sample (those in the scheme and those outside it) had an average of four energy efficiency measures installed at the point at which the baseline survey was conducted while at the follow-up stage both sets of households had also increased the number of measures (six for those in the scheme and seven for those not in the scheme). The evaluation also identified additional benefits to those households in the Scheme:

- The proportion of intervention households reporting the prevalence of damp, mould growth or condensation declined from 68% down to 22%;
- Households in the Scheme were more likely to report a fall in condensation level;

- Energy efficiency measures installed as part of the Warmer Homes Scheme led to a significant fall in the proportion of intervention households reporting damp, mould and condensation (thus potentially reducing health risks);
- An increase in households at follow-up reporting that their health is 'good' or 'excellent' (increased from 51% to 74%);
- A fall in number of households reporting a limiting long-term illness or disability (decreased from 62% to 33%);
- Reductions in the prevalence of specific health problems associated with: heart attacks, high blood pressure/hypertension, other heart/circulatory problems, problems with joints/arthritis, headaches, and disability (physical or mental).

In terms of economic effects, the evaluation noted that both intervention and comparison group households reported small savings of approximately €85 on fuel costs at the time of the follow-up survey in comparison to the baseline. Other indicators suggested a decrease in the highest average heating bill in winter and in summer (with a larger reduction for those households in the Scheme) and a larger proportion of households finding it easier to pay their utility bills (thus suggesting a decline in fuel poverty).

Warm Homes, Healthy People Fund , England

This scheme was aligned with the Cold Weather Plan for England with the overall aim of reducing cold related mortality and morbidity. It builds on a previous round of funding in 2011, which was successful so the funding was extended with the provision of £20 million in 2012 from the Department of Health. Upper tier local authorities then had to bid for funding (in partnership with local community, voluntary, and statutory organisations) that could be used in their own areas to reduce the levels of deaths and illness of vulnerable people living in cold housing.

The Fund (operating in 2012-13) had the combined objectives of: reducing excess winter deaths, reducing fuel poverty, and reducing the number of people living in cold homes. An evaluation of the overall England Scheme, consisting of a questionnaire survey, a small number of interviews with local authority personnel and analysis of 21 local evaluation reports submitted by local authorities, was completed in 2013. Limited information is available from the evaluation, although beneficial impacts were reported for the following areas: social isolation, home safety, financial management/budgeting, employment issues, carer support, community resilience and capacity building, housing issues, nutrition and exercise. The report concluded with two main findings:

- interventions provided by the projects that involve the referral of people to other services and that are not time limited have the potential to achieve impacts beyond the period of the intervention itself;

- the effects of the scheme reached into the wider community by using local businesses, which benefited the local economy, provided work experience and encouraged community engagement.

Analysis of the local authority reports indicated that a key challenge was the short time available to local authorities to deliver both the bids for funding and the interventions to the target population. Nearly three-quarters of respondents stated that timescales were a barrier to implementing the schemes, and the short-term nature of the funding made it difficult to get smaller partner organisations to prioritise the work. The short time frame for delivery also resulted in exclusion of (sometimes key) organisations where decisions could not be made quickly.

One example of the fund's implementation is in Cumbria, where the scheme consisted of two parts:

- a Winter Warmth Fund gave grants (£125 – 250) to people who could not afford to heat their homes to a safe temperature and also gave small grants to community groups in order to build in capacity for tackling fuel;
- The Hot Spots scheme gave grants to repair boilers; grants to purchase boiler maintenance contracts and energy efficiency surveys.

Eligibility criteria were broadly inclusive and included pensioners, families with young children, people with serious illnesses and disabilities, and people on a wide range of financial benefits. The county had £427,000 in funding, which had to be spent within the space of a few months (by March 2012), requiring rapid implementation.

An evaluation carried out by Public Health England (2013) also noted the importance of partnership work as key to successful delivery. Specific barriers to delivery included difficulties of engagement with healthcare professionals, which was viewed as a major barrier to those most vulnerable to the effects of cold, and the lack of year-round funding.

Foundations Independent Living Trust (FILT): 'Warm Homes Service' (WHS), England

The overall aim of the scheme (which only operated over the period Nov 2012 – March 2013) was to assist older and vulnerable people at risk from cold weather and prevent cold related harm and illness. FILT obtained £499,200 from the Department of Health to equip and fund the Home Improvement Agency (HIA) sector to provide targeted and focused support to those facing fuel poverty. The WHS included home visits, energy use assessments and interventions to deal with cold homes. FILT funded 55 HIAs (mostly in the £2 – 6,000 range)

across 160 local authority areas (the HIAs had to apply to FILT for the funding). The evaluation noted the following outputs:

- 385 staff received one-day training;
- 3,728 advice sessions given to older and vulnerable people;
- 6,469 households benefitted from personalised information and advice, and received signposting to other organisations where needed;
- 1,148 jobs were completed during the visits.

Benefits included improvements in: home temperatures, warmth and comfort, physical and mental health and well-being. The impact on fuel bills was not clear due to the timing of the evaluation and fuel price rises during the period of intervention. It was estimated that HIAs leveraged in £2.10p for every £1 of WHS funding, while the average cost of an intervention was £200. Benefits were estimated to be significantly higher – arising from cost savings across health, housing and social care (e.g. keeping people in their homes, avoiding residential and hospital care).

The evaluation noted that ability of the partnership, made up of Foundations¹, FILT and HIAs, was able to provide a unique service as it combined a national organisation and a national charitable network, with local service providers capable of quick delivery (Sheffield Hallam University, 2013). The evaluation concluded that although the administrative approach was a 'light touch', the small grant size and short time scale 'severely limited what could be accomplished'.

Central Heating Programme (CHP), Scotland

The Scottish Executive Central Heating Programme (CHP), was introduced in 2001 to provide central heating systems and a package of related measures to households. Those eligible to receive heating under the CHP were either tenants in the social sector whose home lacked any form of central heating system; or households in the private sector in which the head of household was aged 60 or over, and whose home either lacked any form of central heating or contained a central heating system which was broken beyond repair. Qualifying households were eligible to receive:

- an efficient and modern central heating system;

¹ Note that 'Foundations' is the name of the national body for HIAs appointed by the Department for Communities and Local Government; HIAs are local organisations (also called Staying Put or Care and Repair agencies) that help disabled and vulnerable people to live safely and independently in their own homes. There are currently around 200 HIAs, mostly operated by housing associations or local authorities.

- insulation (where possible - cavity wall fill, lagging of boiler and pipes, loft insulation, draft exclusion measures);
- if appropriate - safety alarms (e.g. carbon monoxide, a smoke alarm);
- advice on energy use and the option of receiving a benefit entitlement check.

An evaluation carried out was based on data collected between November 2002 and March 2006 (<http://www.gov.scot/Publications/2007/02/15132708/0>). The sample consisted of a group of 1,281 households which received central heating under the CHP ('recipients') and a comparison group of 1,084 households not enrolled in the CHP. The evaluation reports that the CHP significantly reduced condensation, dampness and cold in recipients' homes, though there was little evidence of a clear and systematic direct impact on health outcomes. Based on self-reported data, there was some evidence that receipt of heating under the programme was associated with a reduced probability of receiving a first diagnosis of heart disease and of high blood pressure. The main findings include the following:

- Two years after installation, the Programme had no clear impact on respondents' current health or their use of health services or medication;
- The prevalence of poor environmental conditions, specifically the presence of condensation, dampness and/or mould was significantly lower for those who received heating under the CHP than for the comparison group. Recipients were also less likely than comparison respondents to avoid the use of rooms due to difficulty in heating them, or to problems of damp or condensation;
- Receipt of central heating under the CHP was associated with a reduced probability of receiving a first diagnosis of heart disease, or of high blood pressure, during the period examined by the evaluation;
- Heating recipients were found not to be significantly different from the comparison group in their use of medications, either prescribed or 'over the counter';
- Those acquiring heating via the Programme were less likely to report any degree of inability to manage financially;
- CHP recipients perceived their homes to be warmer in winter, indicated that their heating was less likely to be a serious problem and reported that they were more satisfied with their heating overall, relative to those who were not part of the CHP;
- Those who received central heating under the CHP reported that in general a greater proportion of the home was heated, and for longer, than was the case for the comparison group.

Habiter Mieux, France

In other parts of Europe there has been less attention paid to fuel poverty. In France, fuel poverty was only recognised recently (after 2000) as an issue. A national programme, launched in 2010 focused on older people living in rural areas. A fund of €500 million was

established with a target of renovating 300,000 low income households by 2017. The programme, which aims at improving the thermal efficiency of homes of fuel poor households by a minimum of 25% is delivered through the *Departements*. Each *Departement* identifies the number of households affected and defines targets for renovation. The programme has reported the need for capacity building among implementation personnel, although no evaluation information has been identified.

Warm Up New Zealand: Heat Smart Programme

Heat Smart is a New Zealand programme for the renovation of homes with poor insulation to reduce energy consumption and improve health. Subsidies are provided to households to help pay for the costs of retrofitting insulation and/or installing clean heating for pre-2000 houses. An evaluation suggests the programme as a whole has net benefits, although it is clear that health benefits dominate, and not all benefits were measured. The central estimate of a cost benefit analysis provides a benefit-cost ratio of 4.8:1. Gross benefits are estimated at \$1.28 billion compared to resource costs of \$0.33 billion. The evaluation indicated that greater benefits may be achievable through implementing the following targeting strategies:

- Prioritise the insulation component of the programme relative to the clean heating component of the programme;
- Target clean heating to houses that use reticulated gas rather than electricity for heating prior to treatment;
- Target insulation to low and middle-income earners and other at-risk groups in terms of illness.

Npower Fuel Bank (pilot phase), England

A non-government pilot programme carried out in a number of areas of England (Co Durham, Gloucester, Kingston and the Wirral) aimed at supporting 'households in energy crisis'; and in particular those at 'immediate risk of self-disconnection and/or rationing of energy'. The scheme operated in 2015-16 in a partnership of the Trussell Trust and Npower, and targeted food bank service-users that use a pre-payment meter (PPM). The Fuel Bank operates through provision of a fuel voucher (valued at £49 and equivalent to approximately two weeks' dual fuel use). By April 2016 over 7000 vouchers had been issued and an estimated 16,000 adults and children had benefited. The data suggested that the fuel bank scheme could reach over 3,000 households across the four pilot areas. The evaluation was limited in scope, with a small number of beneficiary interviews and some sampling issues reported (i.e. some potential bias).

The scheme was extended in April 2016 with the addition of another 10 food banks across the UK and for a further two years (to 2018), using £2.25 million of funding from Npower. The Fuel Bank scheme has been designed to utilise the existing Foodbank referral process developed by The Trussell Trust which requires a referral of individuals who are identified as being in crisis by care professionals, such as Citizens Advice advisers, GPs, social workers or police. They are issued with a Foodbank voucher to redeem at their local food bank.

When the individual goes to the Foodbank with their voucher, if their household is on a prepayment meter (PPM) for electricity and/or gas, they receive a top-up voucher (clients can receive a maximum of three vouchers in six months, and not receive more than one voucher within 10 days). Npower provides the Fuel Bank voucher to the client via text message or email. The client then takes this code to any shop with a PayPoint machine where it can be redeemed against electricity and/or gas using their pre-payment key or card. The Npower Fuel Banks code can only be used for electricity and gas. Once the code has been redeemed the money appears as a credit when the individual puts the relevant pre-payment key or card in their meter.

An evaluation reported a range of direct and indirect benefits across a small sample with the majority of recipients using a proportion of their voucher to repay an emergency credit charge, and the remainder used for ongoing consumption. The report concludes that the scheme has the potential to reach vulnerable energy consumers. It also noted a vital role played by staff at food banks who required a high level of skills to communicate the fuel bank scheme to potential beneficiaries, and to offer support and reassurance. As part of the scheme, food bank staff were trained and given an introduction to operation of the fuel bank systems (e.g. direct text message for issuing codes). This training was identified as essential to the scheme's success.

Fuel vouchers were identified as having both direct and indirect benefits. Direct benefits to recipients:

- enabling reconnection to energy supplies (in cases of self-disconnection);
- helping to prevent self-disconnection where emergency credit is already being used;
- helping to reduce or pay down a proportion of energy debt, including preventing use of emergency credit;

Indirect benefits:

- freeing-up of money in other parts of the household budget to repay or gain control over other debts or areas of expenditure;
- providing relief to those experiencing stress and anxiety worsened by their energy and financial difficulties;

- enabling families access to the basics that are often and rightly taken for granted by most. For example, hot meals, ability to buy essential clothing and to give their children a warm bath.

The extended programme is expected to assist over 10,000 households in its first year.

Energy local clubs, UK

'Energy Local' clubs are a new idea based on using modern technology and making use of the tariff system to reduce energy costs for groups of households. The majority of domestic electricity is sold on a 'flat' tariff but suppliers pay generators different prices at different times of day. For the most part (there are one or two exceptions such as Economy 7) savings from using power at cheaper times of the day are not passed on to the consumer, and small scale generators of energy (e.g. PV panels) only get a small proportion of the value of the power they produce. The aim of Energy Local is to use the price differential to enable a more equitable sharing between local generators and consumers, and to develop groups of households that can buy and use electricity in new ways. The aim is to encourage households to operate as a group using smart meters and energy saving technology to access a 'time of day' tariff, and thus benefit from cheaper prices at periods of low demand and/or high generation, and/or to access locally generated renewable power. Two projects are currently under way, one in Bethesda and one in Oxfordshire.

- Bethesda: by clubbing together 100 households in Bethesda are able to buy energy from the local hydro-power scheme for half the price of their usual energy tariff;
- Project SWELL (Watchfield, Shrivenham and Longcot): a trial of 48 households is testing equipment which has been designed to control electrical devices (in particular storage heaters and water heaters). The controls help 'match' local demand with local solar generation and 'shift' electricity usage into low price periods. (<http://www.energylocal.co.uk/>)

There are a range of other community energy schemes being developed, some under the RCEF (Courtney, et al., 2017) and others developing more independently including Ynni Ogwen Cyf (Ogwen Energy Ltd) aiming to generate hydro power from the Ogwen River. A Community Benefit Society has been established to build and run the proposed community Hydro scheme. (<http://www.ynniogwen.cymru/the-enterprise/>)

Although several schemes both within and outside the RCEF indicate the potential for generating community benefits the main focus appears to be on using any income stream to benefit communities overall rather than address fuel poverty, thus the schemes are not

included in this report. One exception worth reporting is the biomass district heating scheme in Lanarkshire (although this is in an urban setting) which was directly aimed at reducing fuel poverty. West Whitlawburn Housing Co-operative in South Lanarkshire, (one of Scotland's poorest regions), has invested £6.5 million in a biomass (woodchip) district heating system with the aim of lifting 543 homes out of fuel poverty (Energy Saving Trust, 2015). The project is expected to decrease heat and hot water bills by 20% annually (the estimated lifetime of the project is 30 years). The investment follows on from the investment of £22.4 million to improve the energy efficiency of the buildings (e.g. installing cladding, insulation, new windows, re-roofing works and enclosing exposed balconies). More recent reports indicate that the scheme has resulted in significant energy savings for residents through the use of smart technology and meters providing greater control over heat and hot water utilisation, which has resulted in freezing of energy bills for 27 months. In 2016 the project won the top prize in the Environment and Sustainability Awards from the Chartered Institute of Housing in Scotland. (<http://www.wwhc.org.uk/2016/12/newsletter-winter-2016/>)

Green Deal, UK

In 2013 the Department of Energy & Climate Change (DECC) implemented two schemes, Energy Company Obligation (ECO), and the Green Deal scheme to meet three strategic aims:

- reducing emissions of greenhouse gas, such as carbon dioxide;
- improve energy security;
- mitigating fuel poverty.

The overall aim was to improve household energy efficiency to reduce CO₂ emissions with a target of improvements to 1 million homes by March 2015 from both schemes operating together. The idea was that:

“where measures cost too much to meet the conditions for accessing Green Deal loans, the Department expected homeowners to ‘blend in’ contributions from energy suppliers through ECO. The Department also expected suppliers to encourage people to pay partly for ECO measures using Green Deal finance to minimise their costs.” (National audit office, 2016)

The Energy Company Obligation (ECO) requires large energy suppliers to install measures in homes that will cumulatively reduce CO₂ emissions. Suppliers can install measures, or contract installers, either directly or through public auctions over a ‘brokerage platform’. The suppliers pass on their costs to all their customers through energy bills (similar supplier obligations to improve homes’ energy efficiency have been around for more than 20 years). The Green Deal is a finance mechanism which enables householders to borrow money so they can improve the energy efficiency of their homes. They repay this money through their

energy bills ('Green Deal finance'). This is complemented by a framework of advice, accreditation and assurance intended to increase homeowners' trust in the supply chain for home improvements.

DECC wanted the schemes to reduce CO₂ emissions in a way that would achieve other objectives, such as improving energy efficiency of 'harder-to-treat' properties, stimulate private investment, and get households that would benefit to pay for the improvements. There was also an objective to reduce the main cause of fuel poverty so DECC required suppliers to install a number of measures in homes more likely to be occupied by fuel-poor people. However, neither scheme worked as intended and in July 2015, the DECC stopped funding for Green Deal loans, and announced that ECO would end on 31 March 2017.

The National Audit Office (NAO) report (2016) noted that DECC achieved its main target for the schemes ahead of schedule (i.e. putting energy-saving measures in one million homes by the end of December 2014 through energy suppliers meeting their obligations) although it also noted that the target: "does not directly correspond to the schemes' primary aim of reducing CO₂ emissions, due to the variation in energy reductions that different types of measures can achieve". But the NAO Report (2016) also identified a series of failures which resulted in the closing of the scheme. The following list is taken directly from the NAO Report:

- DECC did not set clear success criteria for the Green Deal;
- DECC did not set any expectations for the Green Deal. It did not state what proportion of measures' total cost should be paid for by the households that benefitted, either through Green Deal finance or other means such as savings. Nor did it quantify the amount of CO₂ the Green Deal should save in addition to suppliers' minimum obligations through ECO;
- The schemes have saved substantially less CO₂ than previous schemes, mainly because of the focus on harder-to-treat homes (approximately 29% of the predecessor schemes' achievements);
- Green Deal finance has saved negligible amounts of CO₂;
- Demand for Green Deal finance has fallen well below expectations. By 31 December 2015, 14,000 households had taken Green Deal loans, only 1% of the total number of homes the schemes have improved;
- The schemes have not succeeded in stimulating private investment in energy efficiency
- The schemes have not improved as many solid-walled homes, the main type of 'harder-to-treat' homes, as expected (only around one quarter of what was achieved by previous schemes);
- ECO generated £6.2 billion of notional lifetime bill savings up to 31 December 2015. Suppliers have installed 525,000 measures, mostly boilers, through Affordable Warmth, a sub-obligation of ECO aimed at reducing bills for low-income households;

- Energy suppliers spent £3.0 billion meeting their obligations between 1 January 2013 and 31 December 2015. DECC spent £240 million on the Green Deal up to 31 March 2015. This includes grants to stimulate demand and unexpected costs of supporting the Green Deal Finance Company;
- Other parties have incurred costs from participating in the Green Deal. For example, energy suppliers changed their billing systems to accommodate Green Deal loans, and the supply chain (installers, assessors and finance providers) invested in training and accreditation but these costs were not monitored;
- Overall, the schemes were less cost-effective in terms of saving CO₂ than previous similar schemes. NAO estimates that the schemes have cost suppliers and central government £92 to £95 per tonne of CO₂ saved excluding suppliers' administration costs. This compares with previous supplier obligations, the Carbon Emissions Reduction Target (CERT) and the Community Energy Saving Programme (CESP), which together cost £34 per tonne.

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