Northern Exposure

Alleviating Fuel Poverty in North & West Belfast, Northern Ireland
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This welcome and perceptive report comes at a fitting time in the journey that is tackling fuel poverty in Northern Ireland. It is important to remember that in Northern Ireland, while there is strategic resolve to confront and tackle fuel poverty, too many households still cannot achieve affordable warmth in their home.

It was in the context of Investing for Health (IFH), the public health strategy for Northern Ireland, and specifically within objective 4 of the strategy; ‘to offer everyone the opportunity to live and work in a healthy environment and to live in a decent affordable home’, that the Public Health Agency commissioned NEA NI to deliver the Northern Exposure project. Northern Exposure was developed initially in 2006 and is an action-based project aimed at tackling the high levels of fuel poverty in North and West Belfast using a partnership and community development approach.

As the project developed, NEA NI engaged the University of Ulster to undertake research into the mental health and wellbeing impacts of fuel poverty and how energy efficiency measures including innovative technologies can be used to combat it. A key outcome from the research is that it will demonstrate to key stakeholders, including the Northern Ireland Assembly and the Public Health Agency that energy efficiency measures, including new converging technologies, delivered alongside a managed network of support, can assist fuel poor households and deliver improvements in health and wellbeing.

This report is written by NEA NI and the University of Ulster. It has three main sections. The first section, written by NEA NI, introduces the context to fuel poverty and existing fuel poverty strategies. It also summarises the Northern Exposure project intervention process; the fact that interventions were provided by both the Warm Homes Scheme and the Northern Ireland Sustainable Energy Programme (NISEP). It also outlines all partners involved and the innovative technologies which were trialled.

The second section written by the University of Ulster is essentially the main results and conclusions based on the research carried out with all participants. This includes thirty before and after telephone surveys and six in-depth case studies which detail the lives of householders, their experiences of living in cold or damp homes, their experiences of interacting with the grant schemes and importantly the benefits they have received from having energy efficiency measures installed. While no research can fully capture the daily grind and struggle facing those who live in a cold home, a strength of the research presented in this report is that it does capture the ‘real life’ scenario of the participants and the ‘real life’ difficulties that many face, such as the worry of high energy bills, cold rooms, mouldy walls, burst pipes and leaking oil. The case studies and the surveys conducted with all householders describe how these ‘real life’ scenarios impact on the wellbeing of the householders and how the project interventions addressed these with varying levels of success via existing fuel poverty schemes. The overall results do show clear improvements in mental health, wellbeing and thermal comfort evidenced in the surveys completed after energy efficiency measures were installed.

The final section is NEA NI’s conclusions and recommendations. Conclusions include an analysis of Energy Performance Certificate (EPC) data taken before and after interventions. It also includes how the innovative technologies have been received by householders. The recommendations are particularly important to stakeholders who share an interest in fuel poverty strategies and how they can be implemented to tackle the high levels of fuel poverty in Northern Ireland.

The conclusions and recommendations demand action and not just the development of another ‘strategy’. As mentioned above, there is clearly much positive resolve and policy activity in Northern Ireland endeavouring to tackle fuel poverty. A way forward includes tying together the various policies not least to help deliver a better customer journey for fuel poor households as they navigate their way through schemes. This report provides a microcosm of results delivered through a joined up approach.

The consequences of living in fuel poverty are enormous and well documented here alongside the positive results achieved through intervention. Tackling fuel poverty needs to be seen not as a cost but as an investment in the future health and wellbeing of particularly the vulnerable in our society.

Pat Austin
Director, National Energy Action (NEA) NI
“Strategic responses are required to help bring about the required partnership, systems, boundary spanning approaches and capacity development in staff and communities needed to tackle fuel poverty” (Tod, 2012).
Chapter 1

What is fuel poverty?

1.1. Definition of fuel poverty

The term “fuel poverty” first appeared in 1978, but few social scientists explored the concept before 1991, at which time Brenda Boardman published elements of the current definition:

“Fuel poor households are unable to obtain an adequate level of energy services, particularly warmth, for 10 per cent of income” (Boardman, 1991 p. 207).

Boardman was also the first expert to discuss the possibility of fuel poverty being tackled by a coordinated and policy-led process, of the sort that NEA NI’s Northern Exposure scheme represents:

“A Programme for Affordable Warmth is needed to bring all homes occupied by a low-income household up to a standard that allows them to have adequate energy services for 10 per cent of income” (Boardman, 1991 p. 277).

Ten years later, the UK Fuel Poverty Strategy drew heavily on Boardman’s 1991 formulation, creating an official definition of fuel poverty in the UK which remains in place at present:

UK Fuel Poverty Strategy (2001) definition of Fuel Poverty

"A fuel poor household is one that cannot afford to keep adequately warm at reasonable cost. The most widely accepted definition of a fuel poor household is one which needs to spend more than 10% of its income on all fuel use and to heat its home to an adequate standard of warmth. This is generally defined as 21°C in the living room and 18°C in the other occupied rooms – the temperatures recommended by the World Health Organisation" (DEFRA 2001).

1.2. Causes of fuel poverty

The causes of fuel poverty are the same throughout the UK. There are 3 classic causes;

- poor energy efficiency of housing stock
- increasing domestic energy prices
- low incomes
Additionally, inefficient energy practices among householders are emerging as another contributor to fuel poverty; this source is gaining more prominence in intervention studies aiming to tackle fuel poverty, not least of all because this encourages householders to seek more effective ways of attaining affordable warmth, whether through grants, behaviour change, or investment.

1.3. UK policy context

In 2000, the Warm Homes and Energy Conservation Act (WHECA, 2001) was published; this required the Secretary of State for England and National Assembly for Wales to publish a strategy for tackling fuel poverty; as part of WHECA, targets were set for eradicating fuel poverty as far as practically possible. The 2001 UK Fuel Poverty Strategy was produced as a result of the Act and the targets became statutory at that point: fuel poverty would be eradicated amongst vulnerable households by 2010, and all households by the year 2016. According to Lagdon (2012), the Strategy also outlines the ways in which these targets would be achieved: increasing incomes, reducing fuel prices and improving the energy efficiency of housing. However, despite numerous programmes of intervention (e.g. Warm Front, Community Energy Saving Programme [CESP], Energy Company Obligation [ECO], etc.) targets have not been met. This is largely due to dramatic rises in fuel prices and stagnating incomes over the past decade – making the relative cost of home heating increasingly more expensive (Sunderland and Croft, 2011).

1.4. Northern Ireland’s policy context

Northern Ireland is a devolved administration with a devolved Fuel Poverty Strategy. This has been in place since 2001, and largely reflects the ethos and goals of the UK Strategy. A new Fuel Poverty Strategy for Northern Ireland, Warmer Healthier Homes, was published by the Department for Social Development (DSD) in March 2011. Its vision remained the same as in 2001:

“This strategy sets out our vision for the future: … a society in which people live in a warm, comfortable home and need not worry about the effect of the cold on their health.”

However, the activities aimed at achieving the vision were much more explicit, and grounded in partnership with other organisations:

“We will…

• spend more money to improve the energy efficiency of our housing stock - £31 million will be spent this year in energy efficiency improvements;
• bid for extra money from the Social Protection Fund to further help people in need;
• launch a pilot boiler replacement scheme targeting those in greatest need; and,
• push forward on energy brokering and challenge energy suppliers to drive down energy costs.”

Northern Ireland has led the UK in many aspects of fuel poverty strategy, having for example:

- evaluated the first areas-based approach to targeting (Casson, Whittington and Devlin, 2002)
- published the first scientific evaluation of the Health Action Zone model (Shortt & Rugkåsa, 2007)
- piloted and evaluated an area-based community-led fuel poverty scheme ahead of CESP (Liddell, 2009); this scheme is now fully rolled out across Northern Ireland and has taken 4,000 referrals in the last 12 months
- carried out the first cost-benefit analysis of regional fuel poverty strategy (Liddell, 2008)
- been the first to launch a SMART meter trial amongst customers vulnerable to fuel poverty (NIAUR, 2010).

As documented in the next chapter, fuel poverty in Northern Ireland is also more prevalent than it is anywhere else in the UK, and probably anywhere else in the developed world. The prominence of fuel poverty is matched by a forward-thinking approach to tackling fuel poverty in the region, willingness to trial new technologies, and practices which engage with households over the doorstep. Together, these mean that Northern Ireland is well placed to find innovative solutions to fuel poverty.

1.5. Investing For Health

Investing for Health was the Public Health Strategy published in 2002 by the Department for Health, Social Services and Public Safety (DHSSPS) aimed at solving the inequalities in health and wellbeing. Planned action was driven by partnerships amongst government departments, public bodies, local communities, voluntary bodies, district councils and the social partners. The key aims of the strategy were to improve life expectancy across the population and to reduce health inequalities.

The strategy framework contained two goals and seven objectives. One of these objectives, objective 4, identified fuel poverty specifically as an issue which adversely affects health and wellbeing.

Objective 4 states;

“To offer everyone the opportunity to live and work in a healthy environment and to live in a decent affordable home.”

Specifically within this objective was the target to remove 20,000 vulnerable householders out of fuel poverty by 2004. The rationale behind this is that most ‘vulnerable’ people spend more time in their homes than anywhere else. Therefore it is imperative to remove cold and damp conditions
in households that can attribute to a decline of health and can potentially lead to winter deaths. In the ‘Investing for Health Strategy Review Final Report’, the DHSSPS states that this target was indeed achieved. Investing for Health partnerships and projects continued until a restructuring of the public health arena in 2009. (DHSSPS 2012).

1.6. Public Health Agency

The Public Health Agency (PHA) was established in April 2009 as part of reforms to Health and Social Care (HSC) in Northern Ireland. It is now the main regional organisation for health protection and health and social wellbeing improvement. The PHA is committed to addressing the causes and associated inequalities of preventable ill-health and lack of wellbeing.

Across Northern Ireland, the PHA is working in partnership with the public, private, community, voluntary and academic sectors to research, evaluate and deliver a range of local and regional initiatives to help alleviate fuel poverty.

Chapter 2

The rationale for deep retrofits in Northern Ireland

2.1. Can homes be fuel poverty proofed?

Fuel poverty proofing a property requires ensuring that the level of retrofitting completed reaches a specified standard of energy efficiency. Given rising energy prices and stagnant incomes, this standard rises all the time, with the most recent estimates of what constitutes fuel poverty proofing moving from an energy efficiency rating score or SAP (Standard Assessment Procedure – a method of measuring the energy efficiency of a property) of 65 to SAP 81 (Boardman, 2010). As will be seen in this chapter, this implies that the vast majority of Northern Ireland’s housing stock would require deep retrofitting in order to be fuel poverty proofed. There are a variety of reasons for this, as outlined below.

2.2. Local climate and fuel poverty

To estimate the relationship between fuel poverty and local climate, degree days is the most common metric. This measure stipulates a baseline outdoor temperature below which it is assumed that indoor heating will be required to obtain a satisfactory level of heat within a home. The baseline temperature is usually 15.5°C. Hence, if the outdoor temperature on Day 1 is 14.5°C, then one degree day of heating is required. On Day 2, a temperature of 10.5 requires 5 degree days of indoor heating. The UK has an average national degree day demand for heating akin to that experienced in Denmark. However, being a long and thin island that extends over many degrees of latitude, geographic areas of the UK show wide variation in heating demand. As can be seen on Table 2.1, heating degree days range between 2,144 degree days per annum in London to 3,183 degree days in North Scotland. Northern Ireland requires 83% of the degree days needed in the coldest area (North Scotland), making the region colder than most.
### Table 2.1: Need for heating in regions of the UK – lowest to highest degree day demand

<table>
<thead>
<tr>
<th>Administrative region</th>
<th>Annual heating degree days*</th>
</tr>
</thead>
<tbody>
<tr>
<td>London</td>
<td>2144</td>
</tr>
<tr>
<td>South West England</td>
<td>2304</td>
</tr>
<tr>
<td>South East England</td>
<td>2336</td>
</tr>
<tr>
<td>East of England</td>
<td>2401</td>
</tr>
<tr>
<td>West Midlands</td>
<td>2527</td>
</tr>
<tr>
<td>East Midlands</td>
<td>2550</td>
</tr>
<tr>
<td>Wales</td>
<td>2593</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>2633</td>
</tr>
<tr>
<td>North West England</td>
<td>2690</td>
</tr>
<tr>
<td>Yorkshire &amp; The Humber</td>
<td>2717</td>
</tr>
<tr>
<td>West Scotland</td>
<td>2891</td>
</tr>
<tr>
<td>North East England</td>
<td>2933</td>
</tr>
<tr>
<td>East Scotland</td>
<td>3181</td>
</tr>
<tr>
<td>North Scotland</td>
<td>3183</td>
</tr>
</tbody>
</table>

*Annual average 1961-1990, using 15.50C as the baseline  Source: UK Met Office DCP09.

More detail for Northern Ireland is contained in Table 2.2 from which it can be seen that heating demand in Northern Ireland is spread over all 12 months of the year. Even in the warmer months of July to September, there is a total heating demand of 170 degree days.

### Table 2.2: Heating degree days by month for Northern Ireland

<table>
<thead>
<tr>
<th>Month</th>
<th>Heating degree days</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>334</td>
</tr>
<tr>
<td>February</td>
<td>286</td>
</tr>
<tr>
<td>March</td>
<td>281</td>
</tr>
<tr>
<td>April</td>
<td>215</td>
</tr>
<tr>
<td>May</td>
<td>147</td>
</tr>
<tr>
<td>June</td>
<td>77</td>
</tr>
<tr>
<td>July</td>
<td>43</td>
</tr>
<tr>
<td>August</td>
<td>46</td>
</tr>
<tr>
<td>September</td>
<td>81</td>
</tr>
<tr>
<td>October</td>
<td>167</td>
</tr>
<tr>
<td>November</td>
<td>251</td>
</tr>
<tr>
<td>December</td>
<td>333</td>
</tr>
<tr>
<td>Annual</td>
<td>2261*</td>
</tr>
</tbody>
</table>

Source: VESMA, 2011  *The annual total for Northern Ireland differs from that shown in Table 2.1, reflecting the number and location of observation points used within the region by different databases, as well as the method of combining the results for each observation point (e.g. area weighting, population weighting or non-weighting.*
2.3 Housing quality in Northern Ireland

The energy efficiency of homes in the UK is also measured using a common metric, namely SAP scores. As illustrated in Table 2.3, Northern Ireland homes were of similar SAP status to England’s in 2001, but have shown more improvement.

Table 2.3: SAP05 results in England and Northern Ireland

<table>
<thead>
<tr>
<th>Year</th>
<th>England</th>
<th>Northern Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>1996</td>
<td>42.1</td>
<td>*</td>
</tr>
<tr>
<td>2001</td>
<td>45.7</td>
<td>45.5</td>
</tr>
<tr>
<td>2003</td>
<td>46.6</td>
<td>*</td>
</tr>
<tr>
<td>2004</td>
<td>47.4</td>
<td>*</td>
</tr>
<tr>
<td>2005</td>
<td>48.1</td>
<td>*</td>
</tr>
<tr>
<td>2006</td>
<td>48.7</td>
<td>52.4</td>
</tr>
<tr>
<td>2007</td>
<td>49.8</td>
<td>*</td>
</tr>
<tr>
<td>2008</td>
<td>51.4</td>
<td>*</td>
</tr>
<tr>
<td>2009</td>
<td>53.1</td>
<td>57.0</td>
</tr>
<tr>
<td>2011</td>
<td></td>
<td>59.63</td>
</tr>
</tbody>
</table>

*Data not readily accessible
Source: House Conditions Surveys

By 2009, the average thermal efficiency of homes in Northern Ireland was 4 SAP points higher than in England. At least some of this difference will be accounted for by Northern Ireland’s Warm Homes programme, which has increased SAP scores to higher levels than has England’s equivalent Warm Front. A review of more than a quarter of a million homes that received Warm Front indicated that the average household SAP improvement was 16 points, from 40 to 56 (Warm Front team Annual Report 2006/7). SAP gains in Northern Ireland at about the same time (2005/6) averaged 20 points.

This greater gain in Northern Ireland is particularly notable in that SAP scores incorporate fuel costs; SAP gains in Northern Ireland should have been less, rather than more given significantly higher fuel prices in the region. In addition, average gains in Northern Ireland moved homes across the SAP 65 threshold (from 49 to 69) i.e. across the original target threshold for “fuel poverty proofing” a property (NIAO, 2008). This was less often the case in England (NAO, 2009). In addition to Warm Homes, the heating programme led by the Northern Ireland Housing Executive has contributed substantively to SAP improvements, since these have replaced solid fuel fires with central heating systems in more than 90,000 homes. In the Belfast Metropolitan Urban area, SAP scores are slightly higher (61.24) than the Northern Ireland average.

Chapter 3

Who is fuel poor in Northern Ireland?

3.1 Prevalence of fuel poverty

The latest official estimate of fuel poverty was published in 2012 by the Northern Ireland Housing Executive (NIHE) and is based on Surveys carried out in 2011. This estimates that 42.0% of homes in Northern Ireland were in fuel poverty in 2011, an apparent drop from 43.7% in 2009. However, based on a sample of only a few thousand homes, and relying on a variety of modelling exercises to obtain as accurate a figure as possible, it is probably more accurate to say that a 1.7% change in fuel poverty prevalence simply indicates that prevalence has remained steady over the past 4 years, with just under half of Northern Ireland’s population experiencing fuel poverty.

Comparison with fuel poverty estimates from other parts of the UK are presented on Table 3.1. Whilst mindful of the fact that these statistics do not always pertain to the same year, the prevalence rate for fuel poverty in Northern Ireland in 2011 is likely to be at least double the rate in England, and also significantly higher than the other devolved administrations.

Table 3.1: Fuel poverty prevalence in the 4 regions of the UK

<table>
<thead>
<tr>
<th>Region</th>
<th>England</th>
<th>Wales</th>
<th>Scotland</th>
<th>Northern Ireland</th>
<th>UK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year of survey</td>
<td>2010</td>
<td>2008</td>
<td>2010</td>
<td>2011</td>
<td>2010</td>
</tr>
<tr>
<td>% of homes</td>
<td>16.4%</td>
<td>26.2%</td>
<td>27.9%</td>
<td>42.0%</td>
<td>18.6%</td>
</tr>
<tr>
<td>estimated to be in fuel poverty</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: DECC, 2012

However, an examination of changes in fuel poverty prevalence over time is also helpful in this context (see Table 3.2). Rates in England are rising inexorably, and have almost trebled in the last decade; rates in Wales have increased in similar fashion. In both Scotland and Northern Ireland, however, rates have shown some degree of levelling off. The 5% drop in Scotland between 2009 and 2010 is of sufficient magnitude to indicate that levels of fuel poverty in the region have decreased. Taken together, the trends in the 4 regions of the UK suggest that, whilst England and Wales have yet to experience peak levels of fuel poverty, Scotland and Northern Ireland may be on the cusp of being able to control prevalence, albeit at high levels.
### Table 3.2: Fuel poverty prevalence in the UK regions across time

<table>
<thead>
<tr>
<th>Region</th>
<th>England %</th>
<th>Wales %</th>
<th>Scotland %</th>
<th>Northern Ireland %</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>7</td>
<td></td>
<td></td>
<td>27</td>
</tr>
<tr>
<td>2003</td>
<td>6</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td>6</td>
<td>11</td>
<td>15</td>
<td>23</td>
</tr>
<tr>
<td>2005</td>
<td>7</td>
<td></td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td>12</td>
<td></td>
<td>24</td>
<td>34</td>
</tr>
<tr>
<td>2008</td>
<td>16</td>
<td>26</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>18</td>
<td></td>
<td>33</td>
<td>44</td>
</tr>
<tr>
<td>2010</td>
<td>19</td>
<td></td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>19</td>
<td></td>
<td>28</td>
<td>42</td>
</tr>
</tbody>
</table>

Source: DECC, 2012

### 3.2. Types of households that are fuel poor in Northern Ireland

This is becoming increasingly difficult to ascertain because of the ever-decreasing sample sizes that are used to produce fuel poverty estimates in Northern Ireland. However, there are at least six aspects of demography that are associated with elevated risks of being fuel poor. These are tenure, type of property, when the property was built, how old its inhabitants are, what their income is, and where the property is located.

#### Tenure
The 2011 House Condition Survey data estimate that people living in private rented accommodation are more likely to be in fuel poverty (49%) than any other tenure group. However, there is little distinction that can be made between fuel poverty levels in social housing (40%) and owner-occupied accommodation (41%).

#### Type of property
People living in bungalows are significantly more likely to be in fuel poverty (51%) than any other group, with rates falling as low as 24% for people living in apartments. By and large, bungalows in Northern Ireland tend to be small, old and are more often inhabited by people on modest incomes.

#### Age of property
Almost three-quarters of houses built before 1919 are lived in by people experiencing fuel poverty (69%), and many of these will be homes that are hard to heat and expensive to treat. However, of perhaps as much concern is the fact that more than a quarter of homes built since 1980 are inhabited by people experiencing fuel poverty (27%), indicating the extent to which the need for retrofitting programmes spans almost the entire age range of housing stock in Northern Ireland. Whilst post-1980 builds are more likely to have been built to a higher standard, the cold and damp climate of Northern Ireland requires an energy efficiency level of building specification that almost always exceeds even a Code 4 standard of building. This is explored further in Chapter 6.

#### Age of residents
Homes inhabited by people aged 75 years and older are most likely to be in fuel poverty; of great concern is the fact that two-thirds of this group live in fuel poverty. Of perhaps some consolation is the fact that this figure has reduced by 10% since 2009, if estimates are reliable (from 76% in 2009 to 66% in 2011). More than half of people between the ages of 60 and 74 are also in fuel poverty (52%), a figure largely unchanged since 2009 (53%). In many cases older people in fuel poverty will be living alone, which greatly increases the chances of being fuel poor; this is because a house with two people living in it costs only marginally more to heat and energise than does the same house lived in by only one person, but 2 elderly people will have 2 pensions and other sources of income from which to purchase domestic energy.

#### Income
Almost 80% of households that earn less than £10,000 per annum are in fuel poverty (79.2%) and even those earning up to £15,000 are unlikely to have affordable warmth (64% in fuel poverty). Even among households earning £30,000 or more, 5% are in fuel poverty. It appears that the prevalence of fuel poverty in higher income households has almost doubled in 2 years (from 3.0% in 2009 to 5.3% in 2011). If estimates are correct, there were more than 9,000 higher income households in fuel poverty in 2011. Whilst many of these may be living in older and hard to heat houses, they represent a group for whom energy efficiency is less of a priority than it might otherwise be, and finding measures which they are both willing and able to have installed is – as yet – a largely unexplored domain in Northern Ireland’s policymaking landscape.

#### Location
Fuel poverty is at its highest in isolated rural areas where 1 in 2 properties are in fuel poverty (50%).
3.3. Fuel poverty in Belfast

The 2011 estimates for fuel poverty in Northern Ireland indicate that 41% of households in the Belfast Metropolitan area are fuel poor, which approximates the Northern Ireland rate (42%). However, there is significant variation in fuel poverty levels as can be seen on Figure 3.1. Northern and Western regions of the city are significantly more likely to contain households in fuel poverty than are Southern and Eastern regions. This gave a logical rationale for concentrating fuel poverty reduction programmes such as Northern Exposure in this particular area of the city.

Figure 3.1. Fuel poverty risk scores for Census Output areas of Belfast

Chapter 4

Aims, partners and types of intervention

4.1. Aims

The Northern Exposure project is an integrated programme of work delivered by NEA NI on behalf of the North and West Belfast Fuel Poverty Community of Interest, a cross-sectoral partnership initiative of Investing for Health.

The main aim of the project is to reduce fuel poverty in North and West Belfast while sustaining a community development approach to creating affordable warmth. The project implements a multi-faceted programme of targeted action and capacity building in partnership with local communities and the wide range of organisations and groups represented on the Belfast Fuel Poverty Community of Interest and the Northern Exposure Steering Group.

The project aimed to tackle fuel poverty in North and West Belfast in both conventional and in ‘Harder to Heat’ properties. In working with the Northern Exposure steering group NEA NI established a network of homes that would benefit from the installation of energy efficiency measures; some would also receive innovative low carbon technologies and by doing so, trial their effectiveness for incorporation into existing Energy Efficiency grant programmes. It was hoped that the measures would bring significant energy savings. Householder feedback was obtained in order to advise on the sustainability of new technologies that could potentially be included in grant schemes which aim to assist fuel poor households.

NEA NI commissioned the University of Ulster to carry out research and evaluation of the NE project. The University of Ulster would collate data on the energy efficiency impacts of retrofits, as well as the impacts on the mental health and well-being that fuel poverty might have. The project also endeavoured to trial the effectiveness of new innovative products in helping to tackle fuel poverty. However in regards to resourcing these energy efficiency measures NEA NI needed to identify key partners who would already be in a position to deliver these measures to householders. NEA NI did have some resource available from the PHA to deliver some innovative technologies however this was a small proportion of what would be needed to cover the cost of the technologies.
NEA NI is a referral partner to the Warm Homes scheme via the Northern Exposure project. They approached the Warm Homes scheme managers, Bryson Energy & H&A Mechanical who manage the Warm Homes scheme in different parts of Northern Ireland. An agreement was made that for referrals where the householder was also willing to take part in the research project, a new referral process would be put in place. Essentially this meant that extra time be provided for NEA NI to carry out a home visit and for the University of Ulster to carry out their research before any measures were installed. This time was factored in on the basis that the scheme manager would stay within their Service Level Agreement with DSD on turnaround times from point of referral to the completion of work on a property.

NEA NI is also a referral partner for the Northern Ireland Sustainable Energy Programme (NISEP) Free Insulation and Energy Saver Homes schemes managed by PowerNI. Agreement was also made with PowerNI for extra time to be factored in between survey of the property and works being carried out. Carillion Energy Services (formerly known as Eaga) are contracted by PowerNI to carry out the energy efficiency installations under NISEP so they were also involved and made aware of these agreements.

Carillion Energy Services agreed to provide in kind support to the Northern Exposure project. They produced a specific ‘Greenbox’ of Energy Saving Products for all participants which included the following:

- Standby Off Adaptor
- Home Energy Monitor
- Showersmart

These devices can help householders to save money and they can also help them understand how to reduce the amount of energy they use in the home. The ‘Greenbox’ was also an incentive for householders to take part in the research project as this was an addition to the normal energy efficiency measures they would receive via the grant schemes.

**Standby off Adapter**

Leaving appliances on standby does use electricity. It is estimated that a householder could save up to £35 per year by switching appliances off standby (Energy Saving Trust 2012). The Standby Off adaptor helps householders to control their appliances, for example, the householder can plug in their digital set top box into the ‘always on’ socket of the standby off adapter. When the digital set top box is switched to standby, the other appliances are automatically switched off until the digital set top box is brought back on again. The Standby Off adaptor was delivered to all research participants.

**Figure 4.1. Standby Off Adaptor**

Image Sourced from Carillion Energy Services
Home Energy Monitor

The Home Energy Monitor is an easy to read device giving the householder an up-to-the-minute display of their electricity usage; the cost of electricity used and an estimate of their home’s greenhouse gas emissions. The home energy monitor can help householders gain more understanding of their energy use on a day to day basis and in doing so could encourage householders to use less energy and therefore save money. The Home Energy Monitor was delivered to all research participants.

Showersmart

Showersmart is a product designed to regulate the flow of the water to an existing shower. It is designed to help householders reduce their water consumption. Showersmart is only for non-electric showers which do regulate the water pressure automatically. Even though in Northern Ireland we do not have a ‘water bill’ as such, it is good practice to help householders understand that saving water is important; it can contribute towards behaviour change in terms of energy saving. The Showersmart was only delivered to householders who had a shower connected to their mains water supply and not an electric shower.

The in–kind support package from Carillion Energy Services also included the following:

- Participant access to a help line at the Carillion Call Centre for support, education and change management
- Marketing support for participant information packages in relation to the Greenbox.
- Thermal imaging for harder to heat properties
- Energy Performance Certificates (EPC’s) for all NISEP referrals.
It was important that an EPC was taken for all research participants. The Warm Homes Scheme does this as part of the package of measures it delivers, however it is not part of NISEP and therefore this support from Carillion was extremely helpful in ensuring consistency across the project. It also enabled NEA NI to identify the improvements in the energy efficiency of the house once energy efficiency or innovative products were installed.

4.3. Products Agreed

NEA NI trialled innovative technology to test its effectiveness in tackling fuel poverty. The innovative technology agreed and installed in some of the participants’ homes included:

**BAXI Multifit GasSaver Unit**

The Multifit GasSaver unit is an innovative product that sits between a combi boiler and the flue and it recycles the heat from the flue gases. The GasSaver unit captures heat from the flue gases which would normally be lost through the boiler flue. The heat is recycled to increase the temperature of the water coming into the boiler from the cold mains supply with the result that the boiler doesn’t have to raise the temperature so much; less gas is therefore used to heat the water to the required temperature. The Multifit GasSaver unit could reduce the gas used to heat hot water by up to 37% annually. Not only can gas consumption be decreased leading to a saving on the gas bill, but flow rate can be increased and hot water supplied faster from the combi boiler.

Some of the advertised benefits of the Multifit GasSaver unit include:
- Multifit GasSaver is an Energy Saving Trust Recommended product and endorsed by Waterwise
- A low carbon solution, reducing carbon emissions by up to 700kg per annum
- Increases boiler efficiency - saves up to 37% of the gas used to heat hot water annually
- Reduces cold water consumption by up to 7%
- Maintenance free - no moving parts and no annual servicing required
- No controls or settings - easy to use
- Unique design stores extra energy, delivering maximum benefit at times of greatest need, such as cold winter periods
- Simple to install - designed for easy and fast fitting
- Flexible design ensures that the Multifit GasSaver unit is suitable for most property types and sizes.

(Information source: BAXI)

NEA NI and BAXI approached the NIHE (who is the contract administer for the Warm Homes scheme) to highlight the benefits of the Multifit GasSaver unit. As the GasSaver unit needed to be installed with a new gas central heating system, the householder needed to be eligible for the Warm Homes Plus scheme and be eligible for a conversion to gas from no central heating, solid fuel or economy 7.

It was agreed that via the Warm Homes scheme, NEA NI could add the GasSaver unit to the installation of a new gas central heating system for an eligible householder. BAXI provided training to the installers and were on site to ensure the GasSaver unit was installed to standard. One Northern Exposure research householder had the GasSaver unit installed.

**VPhase: Voltage Optimisation**

FuelSaver NI brought the VPhase unit to NEA NI’s attention. The VPhase unit is designed to remove any electric over supply coming into the home and optimise it to 215 volts, which could reduce the electricity used and give a saving of 10-12% per annum for the household in electricity costs. It also has the potential to prolong the life of some electrical appliances used throughout the home.

As discussed in Chapter 12, VPhase has been trialled and tested by Ofgem. The trial included 50 homes and has led to the VPhase device being awarded CERT (Carbon Emission Reductions Target) credits for its proven ability to save at least 2.5kg of CO2 over the life of the CERT measure. There have also been other trials of VPhase in England, for example with 40 housing associations including Southern Counties Housing Group, Croydon Churches Housing Association as well as Birmingham City Council and Norwich City Council. It has also been recently announced by the Department of Energy & Climate Change (DECC) that voltage optimisation will be recognised as a ‘Green Deal’ product and a specific ‘Green Deal SAP’ will be developed to include it.
Voltage Optimisation technology has been widely used in industry for many years, however VPhase is the first company in the UK to bring the technology to the domestic sector. While VPhase’s own test results demonstrate savings of up to 12%, the majority of savings are coming out around the 10% mark. The VPhase device has also been designed to incorporate a safety bypass system, which ensures that at no point will the power supply to the house ever be lost as a result of the VPhase unit. The VPhase device must be installed by a qualified electrician who is trained to 17th Edition Regulations. NEA NI also requested that the electrician be a professional member of the National Inspection Council for Electrical Installation Contracting (NICEIC) or an equivalent body.

Properties with mains voltage can have a VPhase unit installed. The savings claimed are based on the ‘whole house’ saving potential. Savings will vary and will largely be dependent on four main factors:

- The number and type of appliances used in the home
- The number of occupants in the home
- The incoming voltage
- The VPhase set point configuration.

VPhase may also extend the life of electrical appliances in the home. Research undertaken by Manchester University suggests that managing the voltage to a 220 volt set point will double the life of motor pumps and be beneficial for other appliances (VPhase 2012).

To include VPhase as part of the Northern Exposure research project, it needed to be installed in research participants’ homes where a SMART meter had already been installed via the SMART meter trial so that electricity readings could be tracked and monitored to indicate any savings the VPhase could make over a 12 month period. Six Northern Exposure research householders had the VPhase unit installed.

**Kingspan Internal Solid Wall Insulation**

Internal Wall Insulation is a type of insulation used in properties where there are no cavities to fill. Most houses built pre 1930’s will be of solid wall construction. There are various internal wall insulation products available on the market. The installation process for internal wall insulation is very different and much more complex compared to that of cavity wall insulation. The rooms where it is applied will require redecoration afterwards and the loss of space also needs to be taken into account. Recent and innovative products do account for this and are being made to reduce this loss of space as much as possible.

H&A Mechanical who manage the Warm Homes scheme in certain areas of Belfast install the Therma TW56: Insulated dry-lining plasterboard as part of Warm Homes Plus scheme for solid walled properties. Houses are identified on a case by case basis.

The Therma TW56 is dry-lining and vapour control in one board. It is unaffected by air filtration and it is resistant to water vapour which can help to control condensation in a property. It is a high performance thermoset insulation type suitable for retrofitting purposes. (Kingspan, 2012).

NEA NI wanted to include an internal wall insulation product to see what difference it could make to harder to heat homes. Two of the Northern Exposure research participants received this internal wall insulation via the Warm Homes Plus scheme.

**SMART meters and inhouse displays**

The installation of smart meters in people’s homes is expanding at an unprecedented rate in Europe, and is set to continue expanding. The EU Energy Package, for example, includes a mandate to roll-out smart meters in all Member States with 80% coverage by 2020, and was endorsed by the European Parliament in Spring 2009. At the same time, most householders already perceive a meaningful role for some of the features of smart meters e.g. their potential for delivering rapid feedback and tariff switching (Ipsos-MORI, 2007).

Research and trials of smart meters which have been carried out so far in Europe have advocated an approach in which vulnerable customers, including those in fuel poverty, “are protected from the impacts of smart meters”. This is based on the premise that fuel poor and vulnerable customers may be unable to benefit from the control and feedback opportunities which a smart meter offers. The University of Ulster was commissioned by NIAUR to lead a pilot project in which smart meters are installed in the homes of fuel poor and other vulnerable customers, together with a series of tailored support mechanisms which:

- prepared them for its installation
- mentored them in the earliest few weeks post-installation
- provided them with real-time feedback through a portable inhouse display (see Figure 4.6).
Through preparation, mentorship, and supported feedback of this kind, the University of Ulster aimed to maximise the potential of smart meters for vulnerable customers. Six Northern Exposure customers were given a SMART meter and in-house display as part of the research project.

**Figure 4.6.** The SMART meter’s in-house display

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## 4.4. Other Products Considered

NEA NI originally considered various other technology and products and for various reasons discussed below they were unable to be included in the project.

**Spacetherm: Internal Solid Wall Insulation**

The Spacetherm product range uses Aerogel insulation which is usually made up of one or more layers of Aerogel with board material laminated to one side. There are different versions of the product including the Spacetherm Fermacell board, Spacetherm Plasterboard, and Spacetherm Plywood and Plasterboard. These products are more similar to other dry-lining products so NEA NI wanted to explore the ‘wall liner’ version which is basically one layer of Aerogel with a membrane, a paper or plastic sheet on each side which allows it to be stuck to the wall similar to the way that wallpaper is. (Proctor Group, 2012).

The main attraction with the Spacetherm wall liner was that it is a hydrophobic product and so it protects against moisture transference. This along with the foil which is incorporated as part of the application of Spacetherm would help to guard against condensation. Because of its performance only half the thickness of Spacetherm is needed compared to other dry lining materials. This was making it a real innovative technology and attractive to NEA NI. However, the manufacturers were having some difficulties with getting the Spacetherm wall liner to market within the timescales of the project and there were also some issues on the pricing of the product which increased in the time of discussions between NEA NI and the manufacturers.

**Glen Dimplex: SMART RAD**

The SMARTRAD is a convector heater which is designed for use in homes with standard oil or gas fired central heating systems. When used with high efficiency condensing boilers, the high heating outputs obtained by SmartRad at 55°C water temperature means the boiler can run more effectively in condensing mode and could run more efficiently than when operated with conventional radiators at higher temperatures.

The SmartRad utilises a high efficiency heat exchanger and intelligently controlled fan to assist convection and delivery of heat into the room. This significantly increases heat output, meaning that despite much lower water temperatures the SmartRad is significantly more powerful and as a result can be 3½ times smaller than a conventional steel convector radiator with the same level of output. Utilising fan assisted convection also provides the advantage of even distribution of warm air throughout the room, unlike conventional radiators which heat a room unevenly and tend to leave colder air at lower levels. Ultimately this can also lead to further energy savings as rooms feel more comfortable at lower temperature. (Glen Dimplex, 2012). This is what was particularly attractive to NEA NI, and why it was considered for the research project.

**BAXI Ecogen Combined Heat & Power**

The Baxi Ecogen is a micro-CHP boiler. CHP stands for ‘combined heat and power’. This means the Baxi Ecogen is a dual energy system, so at the same time as providing efficient gas central heating and hot water like any other boiler, it also generates up to 1kWh of electricity. It is a low carbon technology offering savings to householders. BAXI estimates that by generating electricity at the same time as providing heat and hot water, a householder could expect to save up to £600 on their annual fuel bill. These estimated potential savings could perhaps lift someone out of fuel poverty; the BAXI Ecogen is a product which NEA NI wanted to include in the research project for this reason but for factors outlined below it was not brought to fruition. (BAXI, 2012).
4.5. Summary of Reasons for products not incorporated into the project

The main reason was price: NEA NI applied for additional funding beyond what the Public Health Agency was providing for the research project to fund some of these innovative technology products.

NEA NI made funding applications to various organisations. They also contacted the NIHE in regards to the Warm Homes scheme to see if they could incorporate the Solid Wall Insulation Spacetherm product as part of their ‘hard to treat’ Warm Homes Plus measures. However there is an upper limit set by DSD for this Warm Homes Plus grant and the cost of the Spacetherm was much higher than this limit therefore it could not be incorporated into the research project via the Warm Homes scheme. The Therma TW56 product was used instead.
5.3. Other recruitment channels used by NEA NI

NEA NI used communication channels through the community and voluntary sector to promote the Northern Exposure research project to invite participants. This generated some interest in the project. Householders did phone NEA NI directly to find out more about it and subsequently were referred to the research project rather than coming through a 3rd party such as one of the community or voluntary groups that disseminated the information for NEA NI.

Information Events

As part of Northern Exposure, the project coordinator carried out various information sessions with the community and voluntary sector in North and West Belfast and attended community information days to help promote the Northern Exposure research project. This method of recruitment did work and many referrals were generated in this way. It was easy to speak to householders face to face to explain the research element which was an addition to the normal referral to a grant scheme.

‘Normal’ Referral Process

Many of the research referrals were identified over the phone. When householders contacted NEA NI in regards to the Northern Exposure main project and the grant schemes it promotes, the project coordinator would assess the candidate’s eligibility for the schemes but also suitability to the research project.

Harder to Heat Properties

NEA NI needed to identify harder to heat properties in North and West Belfast. The steering group were able to help by sending through some maps produced for another project which outlined the age of the property. Houses built pre 1930’s are likely to be solid walled properties. NEA NI also identified some likely streets within Belfast and sent a letter to homes in these areas asking for participants to come forward for the research project. However, only one of the householders subsequently came from this mail shot of approximately 100 letters.

5.4. Protocol

Figure 5.1 illustrates the protocol followed by NEA NI and the University of Ulster in the implementation of this project:
5.5. Research Candidate Information Pack

When the referral was made to the appropriate scheme, the scheme manager would send a surveyor out to the property to determine what measures are required and to double check eligibility. Provided that the householder did need energy efficiency measures and that they met all criteria, then the NEA NI project coordinator carried out a home visit with the participant and provided them with a Northern Exposure Research Information pack.

This pack included the following:

- Welcome letter from NEA NI.
- Information Sheet from the University of Ulster.
- Information Sheet from Carillion on the ‘Greenbox’ and helpline.
- Consent forms to be signed.

Once the research consent forms had been signed the NEA NI project coordinator contacted the University of Ulster and provided the researcher with the telephone number of the householder. The researcher then undertook a telephone survey. If the householder was identified as a case study the researcher arranged a house visit to complete an in-depth interview. Once this was completed the Scheme manager was notified and works undertaken. A second telephone survey or interview was conducted about 12 months after this date.

5.6. Cancellations from the Research

In order to meet a target of 60 householders, NEA NI decided to recruit more than 60 to allow for cancellations. There were 90 householders referred to the research project initially, however when the inspection was completed by the scheme managers, some householders did not actually meet the criteria and others did not need the energy efficiency measures they had originally requested. On other occasions the householder changed their minds and withdrew from the research but went on to have energy efficiency measures installed via the grant schemes.

The referral process did not always work due to the additional time required for home visits and research to be carried out, also energy efficiency measures may have been installed prior to the telephone survey being completed. In these instances the participation in the research element of the project was cancelled but the householder still received the energy efficiency measures.

The number of householders who did not complete the 2nd telephone survey or in-depth interview with the researcher was significant. Several attempts were made to speak to some of householders; on some occasions the telephone line was disconnected, some householders had moved property and others did not want to complete the 2nd stage of the research.

Details of the number and demography of the participants in the University of Ulster evaluation are contained in Chapter 8. In brief, Ulster completed before and after interviews with 30 households, and case studies with 6 households.
Chapter 6

The Northern Exposure programme: Policy context

6.1. Context

Northern Ireland’s flagship fuel poverty intervention scheme is Warm Homes, which is financed and administered by the Department for Social Development Northern Ireland (DSDNI). The Northern Ireland Housing Executive (NIHE) produce an annual HECA (Home Energy Conservation Authority) report, the most recent of which describes the following fuel poverty reduction activities in the 2011/12 and 2012/13 financial years:

- DSDNI’s Warm Homes Scheme: 7,287 insulation measures and 370 heating measures at a cost of £6.8M (£4.9M on insulation and £1.9M on heating)
- NIHE Renovation Grants which funded insulation measures in 106 dwellings
- NIHE Replacement Grants which funded the construction of 53 new dwellings.

In addition, 76 heating systems were provided in 2011/12 under various grants including Disabled Facilities, Home Repair Assistance and Renovation Grants. A little later, a Boiler Replacement allowance was also initiated by the Department for Social Development, and has been over-subscribed since its inception.

Beyond these government subsidised schemes, gas boiler incentives were funded by private gas utilities, and the NI Sustainable Energy Programme financed heating and insulation projects from a Levy imposed on all customers as part of their electricity bills.

6.2. Reaching the fuel poor?

Recent audits of anti-fuel poverty initiatives indicate inefficient targeting both in Northern Ireland (NIAO, 2008) and in England and Wales (NAO, 2009). To be eligible for support, households only need to satisfy social criteria. They must either:

- be in the ‘vulnerable’ category (containing either someone over 60 years, a child/children under 16 years, or someone with a disability or long-term illness)
or

- be in receipt of specified social welfare benefits (‘passport’ benefits).

The quality of the dwelling is not considered, even though doing so would almost certainly capture more of those in the most severe fuel poverty (Boardman, 2010).

The eligibility criteria have the double disadvantage of creating both false positives and false negatives. In the former group are a large number of households receiving non-means tested benefits (e.g. disability living allowance) who may not in reality be fuel poor. In the latter group are non-vulnerable people (those under 60, with no children or disability) and benefit non-claimants (those in work or those entitled to social welfare benefits but who do not claim) (NIAO, 2008; Boardman, 2010). These criteria ensure there is good coverage across vulnerable social groups, but also generate a great deal of leakage on either side. Households merely satisfy the eligibility criteria; many are not fuel poor (Liddell et al., 2011). According to the NIAO (2008), only 16% of energy efficiency grants went to the least energy efficient households (SAP < 30) between 2000 and 2008.

A further problem which generates leakage stems from the fact that, to avail of assistance, households must refer themselves. This process of ‘self selection’ means that not everyone who is eligible will know about, or will choose to apply for support (Armstrong et al., 2006; NAO, 2009). Given that households in real fuel poverty are diverse in terms of their individual characteristics, needs, energy preferences and behaviours, they are not easily defined. Households may not realize that they are fuel poor and cannot be relied upon to refer themselves (Waddams Price et al., 2007; Dubois, 2012). They miss out on crucial support to which they are entitled.

Current fuel poverty policy cannot effectively identify fuel poor households, let alone those in most severe fuel poverty, and affords relatively high protection and support for households who are not in hardship. This inefficiency has important ramifications: public money is effectively wasted and those in greatest need are missed. There is considerable scope for improving policy to better target the fuel poor.

As with all policies, perfect targeting is unlikely, given that there are trade-offs between accuracy and costs (Dubois, 2012). Targeting the least efficient houses would capture a higher percentage of the fuel poor. Whilst detailed energy efficiency data for individual dwellings should eventually become accessible through a national database, it is currently not available and would be costly to collect. If fuel poverty is to be effectively addressed, a solution must be found to minimize these errors and maximize the proportion of recipients who are fuel poor (Sefton, 2004).

6.3. Does the Strategy’s work remove households from fuel poverty?

Retrofits in Northern Ireland vary from shallow (e.g. a loft insulation top-up from 200mm to 300mm thick) to deep (e.g. installation of central heating and a condensing boiler, coupled with solid-wall and loft insulation). It is vital that retrofits leave homes fuel-poverty-proofed for at least 5 years in order that the time and investment made achieves the Strategy’s goals. Given the scale of rising energy prices and static incomes, this will require deep retrofitting measures in the vast majority of homes.

The distribution shown in Figure 6.1 is based on an analysis of Warm Homes (WH) interventions that have been completed in almost 60,000 homes (Walker et al., 2012). It indicates that the majority of WH interventions undertaken so far in Northern Ireland have been small scale i.e. costing under £600. A smaller peak is observed at around £4,000 indicating more comprehensive retrofits. A median of 4 measures was installed per household at a median cost of £616. A small number of very ‘deep’ retrofits (costing up to £14,000) skew the mean expenditure to £1,560.

Figure 6.1. Retrofit costs for all households that received WH assistance (N=58,868)

The shallow nature of these retrofits is made more evident when Figure 6.1. (for Northern Ireland) is compared with Figure 6.2. (for the UK).
A median expenditure of £616, and more than 90% of all retrofits in Northern Ireland being in the “under £2000” range indicates significant shortfalls of investment, if the aim is to tackle fuel poverty comprehensively. Cambridge Econometrics (2012) estimate that 25% of UK homes will require an average of £6,500 in order to be fuel-poverty-proofed; it is evident from Table 6.1. that almost no homes have been provided with that level of investment in Northern Ireland.

However, it is important not to be overly critical of the work carried out so far in Northern Ireland. Figure 6.3 elaborates on this, showing the delivered energy savings from measures of this kind.

### Table 6.1: Measures received by households in NI

<table>
<thead>
<tr>
<th>Intervention type</th>
<th>Measure</th>
<th>Number households (%)</th>
<th>Average cost (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heating</td>
<td>New Boiler</td>
<td>13,086 (22.2%)</td>
<td>1,500</td>
</tr>
<tr>
<td></td>
<td>Convert from Economy 7 heating</td>
<td>1,005 (1.7%)</td>
<td>2,830</td>
</tr>
<tr>
<td></td>
<td>Convert from Solid Fuel heating</td>
<td>326 (0.6%)</td>
<td>2,400</td>
</tr>
<tr>
<td>Insulation</td>
<td>Loft Insulation (all)</td>
<td>35,050 (60.0%)</td>
<td>5.50/m2</td>
</tr>
<tr>
<td></td>
<td>Cavity Wall Insulation</td>
<td>20,309 (34.5%)</td>
<td>4.20/m2</td>
</tr>
<tr>
<td></td>
<td>Draught-proofing</td>
<td>13,324 (22.6%)</td>
<td>120</td>
</tr>
<tr>
<td>Minimal</td>
<td>Low energy light bulbs (CFLs)</td>
<td>52,986 (90.0%)</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>Hot Water Tank Jacket (HWTJ)</td>
<td>19,200 (32.6%)</td>
<td>12</td>
</tr>
</tbody>
</table>

Source: Energy Bill Revolution, 2012

Source: Dowson et al., 2012
Even the most common installation in Northern Ireland (low energy light bulbs) has delivered energy savings (see Table 6.2), and over and above these savings, they have probably played a very useful role in garnering public support for using low energy bulbs, ahead of conventional light bulbs being phased out. Studies indicate widespread acceptance and implementation of low energy light bulbs in the UK, which can be attributable in part to the widespread distribution of free bulbs to most households in the region. More importantly, large-scale loft insulation (especially where none or little was in place beforehand), as well as Northern Ireland’s high prevalence of cavity wall installations and new boilers will have achieved significant impact.

### 6.4. Where have WH installations taken place?

The spatial distribution of Warm Homes installations is shown in Figure 6.3. Areas of highest WH penetration are found in rural areas e.g. Cookstown, Omagh and Newry & Mourne. West Belfast has benefitted more than the rest of Belfast, commensurate with the higher levels of fuel poverty in this part of the city (see Chapter 3).

**Figure 6.3:** Percentage of homes that have had Warm Homes retrofit measures

![Map showing WH penetration in Northern Ireland](image)

Source: Walker et al., 2013

However, this fails to provide a complete account, since more in-depth analysis of Belfast installations indicates lower than average spends per household around Belfast and much higher expenditures in rural areas, particularly in Fermanagh, Cookstown, Omagh and Dungannon.

Hence, although Warm Homes has reached many more homes than average in Belfast, the level of retrofit was considerably shallower than in more rural areas of Northern Ireland, diminishing the likelihood that homes were left fuel poverty proofed (Walker et al., 2012). Belfast remains, therefore, under-resourced in the larger landscape of fuel poverty strategy in Northern Ireland.
Chapter 7

The benefits of tackling fuel poverty

7.1. Lifestyle impacts

Being in fuel poverty often means that households need to find ways of cutting expenditure on other items, in order to stay warm. This creates significant burdens on people’s lifestyle choices. Figure 7.1. compares the ways in which income is spent in all UK households (the upper pie chart), with expenditure in households experiencing fuel poverty (the lower pie chart). Housing, fuel and power consume 15% of the average UK budget, but 22% in fuel poor households. The figure illustrates how fuel poor households shrink their spending on entertainment, transport, and clothing, probably leading to a more confined lifestyle with fewer opportunities for activities that provide variety and have the potential to enhance wellbeing.
Figure 7.1 represents UK households as a whole. It under-states the lifestyle burdens imposed by fuel poverty in Northern Ireland, which are both more widespread and more severe. A recent report commissioned by the Joseph Rowntree Foundation (Smith et al., 2009) found that, when compared with people in Great Britain:

- Pensioner couples in Northern Ireland needed 30% more to cover their household fuel costs.
- Single pensioners needed 27% more.
- Single adults of working age needed 23% more.
- Couples with 2 young children needed 29% more.
- Single parents with 2 children needed 17% more.

The most influential summary of the impacts of fuel poverty on human wellbeing is that published by the Marmot Review Team in 2011. Box 7.1 summarises its deliberations.

Box 7.1: Excerpt from the Marmot Review Team's executive summary

This report reviews the existing evidence of the direct and indirect health impacts suffered by those living in fuel poverty and cold housing. It makes the case for aligning the environmental and health agendas and reviews the evidence on the health benefits of reducing fuel poverty and improving the thermal efficiency of the existing housing stock.

The main findings on the direct health impacts of cold housing and fuel poverty are:

- Countries which have more energy efficient housing have lower excess winter deaths (EWDs).
- There is a relationship between EWDs, low thermal efficiency of housing and low indoor temperatures.
- EWDs are almost three times higher in the coldest quarter of housing than in the warmest quarter (21.5% of all EWDs are attributable to the coldest quarter of housing, because of it being colder than other housing).
- Around 40% of EWDs were attributable to cardio-vascular diseases.
- Around 34% of EWDs are attributable to respiratory diseases.
- There is a strong relationship between cold temperatures and cardio-vascular and respiratory diseases.
- Children living in cold homes are more than twice as likely to suffer from a variety of respiratory problems than children living in warm homes.
- Mental health is negatively affected by fuel poverty and cold housing for any age group.
- More than 1 in 10 adolescents living in cold housing are at a risk of multiple mental health problems compared to 1 in 20 adolescents who have always lived in warm housing.
- Cold housing increases the level of minor illnesses such as colds and flu and exacerbates existing conditions such as arthritis and rheumatism.
- The main findings on the indirect health impacts of cold housing and fuel poverty and on other social benefits deriving from improved housing are:
  - Cold housing negatively affects children’s educational attainment, emotional well being and resilience.
  - Fuel poverty negatively affects dietary opportunities and choices.
  - Cold housing negatively affects dexterity and increases the risk of accidents and injuries in the home.
  - Investing in the energy efficiency of housing can help stimulate the labour market and economy, as well as creating opportunities for skilling up the construction workforce.

Many different population groups are affected by fuel poverty and cold housing, with various levels of health impacts relating to different groups:

- Children: Significant negative effects of cold housing are evident in terms of infants' weight gain, hospital admission rates, developmental status, and the severity and frequency of respiratory symptoms.
- Adolescents: There are clear negative effects of cold housing and fuel poverty on the mental health of adolescents.
- Adults: There are measurable effects of cold housing on adults’ physical health, well-being and self-assessed general health, in particular for vulnerable adults and those with existing health conditions.
- Older people: Effects of cold housing were evident in terms of higher mortality risk, physical health and mental health.

Improving the energy efficiency of the existing stock is a long-term, sustainable way of ensuring multiple gains, including environmental, health and social gains.

Government policy documents and reports, including the Chief Medical Officer report of 2009 and the recent Public Health White Paper lay the tangible impacts of cold housing and fuel poverty on people's health and well-being.
**Impacts on physical health**

Since the Marmot Review was published, a wide variety of research studies have helped clarify the health impacts of fuel poverty. For example, people living in fuel poverty had poorer lung function than those who were not (Webb et al., 2012), and a combination of fuel poverty and living in rented accommodation appears to generate increased risks of paediatric illness (Telfar-Barnard, 2011). It is also associated with poorer wellbeing, particularly as people progress through retirement (Howden-Chapman et al, 2011).

Exact causal pathways are not yet understood, which means that the links between fuel poverty and poor physical health are more circumstantial than proven at the present time. This is not uncommon in health and social sciences. Even the causal link between smoking and lung cancer (now considered incontrovertible by scientists and most of the public alike) was pre-dated by more than a decade of circumstantial evidence that could not be categorically proven because there were insufficient studies of scientific quality and epidemiological rigour. It is widely agreed that clients report significant improvements in their physical health post-retrofit, and it is unlikely that hundreds of clients are all wrong. However, identifying clinical improvements in complex illnesses that people have suffered for many years is a difficult challenge, and requires much larger and longer epidemiological studies of fuel poverty’s impacts than have yet been carried out.

**Impacts on mental health**

Much more convincing are the impacts of fuel poverty on mental health. Comparing the effects of fuel poverty programs on the mental and physical health of adults, evaluators in 4 different countries have concluded that effects are more prominent in the mental health domain; in fact effects on mental health have been reported from virtually every study in which this has been measured (Liddell & Morris, 2010). For example the evaluation of Warm Front in England and Wales found that the GHQ12 scores of participants living in homes that were warmer post-intervention indicated lower levels of anxiety and depression after adjustment for covariates. The GHQ12 is one of the most widely used short survey instruments (12 items) for assessing mental wellbeing in a normal population. In simple terms:

> “…prevalence of anxiety or depression fell from 300 to about 150 per 1,000 occupants after Warm Front measures. This is a significant impact. For every 10,000 properties (with two adults) improved by Warm Front about, 3000 occupants will be relieved of anxiety or depression” (Green & Gilbertson, 2008, p. 18).

Many evaluators have speculated about why mental health seems to be the prime beneficiary of fuel poverty interventions. If heating becomes more affordable, some argue, householders might:

- decide to spend the same amount of money on heating, which would enable them to have a warmer home (the so-called rebound effect)
- obtain significant relief from the stress associated with debt or the threat of it
- be less burdened by having to go without some of life’s essentials in order to meet their energy bills.

All three changes post-retrofit could significantly reduce vulnerability to borderline anxiety and depression. Evaluators have concluded that a reduction in perceived financial strain was likely to be the “…main route from fuel poverty to health gain” (Green & Gilbertson, 2008, p. 19) i.e. bullet points 2 and 3 above.

Warm Front participants reported reductions in their energy bills of as much as 40% post-intervention (Green & Gilbertson, 2008), Perversely, though, Warm Front data on actual consumption often indicated an average increase in expenditure on heating (Hong, et al., 2006). It could be that mental wellbeing gains arise because householders view their homes as more energy efficient post-intervention, and hence perceive greater value for money from their expenditure on heating. Increased value for money, and a greater sense of control over how heat is “spent” (i.e. efficiently) may make the cost of heating a home seem less problematic. If so, the attainment of better thermal comfort (bullet point 1 above) might have more salience than previously thought. Whatever their origins, gains in their mental wellbeing post-retrofit, are very important. A recent international review of the impacts of improved mental wellbeing concluded that mental health was one of the primary drivers of healthy development from birth onwards (Beddington, et al., 2008). The following quote from a qualitative study of 49 households (undertaken as part of the Warmfront evaluation of their Fuel Poverty retrofit program) illustrates the range of mental health impacts which participants themselves perceive:

> “There were reports of improved family relations, an expansion of the domestic space used during cold months, greater use of kitchens and improved nutrition, increased privacy, improved social interaction, and an increase in comfort and atmosphere within the home. Greater warmth and comfort also enhanced emotional security, and recipients were more content and at ease in their homes.” (Gilbertson et al, 2006).

Some years later, the same sorts of findings are reported in Walshaw (2010):

> “Residents in the study area reported feelings of increased comfort and ease in daily life brought about by the improved efficiency and functionality of the home. Even the language that residents employed to describe their homes conveyed feelings of increased well-being. For example, residents repeatedly made references to feeling “more relaxed”,...”
“comfy”, or “cosy” in the home, or to their property feeling more “homely” or “like home”. One commented that “Before it was just somewhere where you come and go to bed, it wasn’t somewhere you could relax. Now it’s smashing really, nice and cosy. We love spending time in it”.

There has been a clear step-change in the way residents feel about their homes, which could be described as a transition from viewing their property as a house to somewhere that was a place of safety and comfort. These sentiments resonate with the concept of a home as a place where individuals can derive an enhanced sense of emotional security. Reflecting further on this, residents made reference to doing more housework and generally feeling more house proud. A number of respondents stated that they were more likely to invite friends and neighbours into their home post-improvement, as they no longer felt embarrassed by or ashamed of its condition.”

Evidence such as this underlines the broader social and emotional significance which tackling fuel poverty has on people who are part of programmes such as Northern Exposure, over and above the impacts it may or may not have on their physical wellbeing.

### 7.3. Impacts on indoor temperatures

It is becoming increasingly clear that UK households do not always attain the WHO standards recommended for health and safety (i.e. 21°C in living rooms and 18°C in all other inhabited rooms). It is doubtful whether WHO should have been so prescriptive when stipulating indoor temperatures, Changes in indoor temperatures have been noted over time, as illustrated on Figure 7.2. In 1971, the average temperature inside a home during winter (GB) was 13°C. In 1989, with similar outdoor winter temperatures prevailing, this had risen to 15°C. By 2006, similar winter temperatures were associated with indoor temperatures of 17.5°C. These changes are thought to be associated at least in part with the installation of more efficient and extensive heating and insulation (Uttley & Shorrock, 2008). Even so, whilst average indoor temperatures rose from 12°C in 1970 to 18°C in 2006, this (at best) attains the WHO guideline temperature for bedrooms and should most certainly be higher if WHO Guidelines are to be viewed seriously.

It is seldom clear why people elect a particular indoor temperature. It most likely reflects a mixture of thermal comfort, capability of heating sources to deliver higher temperatures, and the cost of heating. Results from the UK’s Warm Front evaluation indicate that, prior to retrofit householders’ maintained daytime temperatures of around 19°C and 17°C in living rooms and bedrooms respectively. After retrofit, temperatures increased to 21°C and 20°C in living rooms and bedrooms respectively. Even so, post-retrofit temperatures lower than 16°C prevailed in 21% of living rooms and almost 50% of bedrooms (Oreszczyn, et al., 2006). Variability remains the order of the day, which is why there is much to recommend augmenting actual temperature data with information based on the client’s own sense of thermal comfort, as this Northern Exposure evaluation has endeavoured to do.

Residents do notice (and appreciate) the improvements in temperature that become possible post-retrofit, notwithstanding the fact that WHO standards are quite seldom attained. Walshaw (2010) reports that increased warmth emerged as one of the most significant self-reported benefits of having new radiators and boilers installed in people’s homes.
7.4. Impacts on energy bills and carbon

Before fuel poverty programmes were first implemented, energy specialists estimated the amounts of energy (and hence carbon) that would be saved as a consequence of fuel poverty programmes like Warm Front and Warm Homes. They over-estimated these savings, largely because they took scant account of the fact that the majority of households might increase their indoor temperatures to attain better thermal comfort.

The average increase in energy bills for homes retrofitted as part of the English Warm Front scheme was 12%. This is not so much a problem as a solution – people in fuel poverty are more likely than any other group to live in cold homes, and part of the aim of a fuel poverty alleviation program is to ensure they no longer do so. Current models of energy efficiency gains now commonly factor in a 40% rebound effect: in other words almost half of any potential energy and carbon savings fail to be delivered because householders increase their indoor temperatures.

In this context, it is important to note that the UK’s Committee on Climate Change (CCC) has set a target for a 35% reduction in buildings emissions by 2020, primarily through improvements in energy efficiency and increased deployment of renewable heat. These are central to the region’s legally binding carbon reduction commitments for 2020 and 2050. Finding ways to ensure that the fuel poor are able to save on energy and thereby reduce carbon is an important issue for the short term. Retrofits will need to adopt much more radical low carbon solutions for people living in fuel poverty, if they are to be enabled to deliver the carbon savings needed to meet statutory carbon reduction targets.

A recent evaluation of new low carbon homes in a low income area of Belfast found that triple glazing, triple layer cavity wall insulation, high specification air-tightness, and the provision of air source and solar power could allow consumers to spend 50% less on energy than similar consumers in conventional homes built for a similar cost (Liddell & Lagdon, 2012). Until these sorts of solutions become more widely available to people in fuel poverty, programmes such as Warm Homes are unlikely to make significant impacts on carbon emissions, and for a perfectly justifiable reason.

7.5. Impacts on NHS costs

The first report estimating savings that could be made to the NHS if fuel poverty were eradicated was done in Northern Ireland (Liddell, 2008). It concluded that for every £1 spent on fuel poverty programs in the region, 42p could be recouped through quality of life savings that included:

- reduced hospital admissions
- fewer hospital procedures
- fewer GP appointments and prescriptions
- a reduction in the requirement for home-based or community care.

The Chief Medical Officer’s Annual Report for England in 2009 endorsed this estimate. Since then many other studies have attempted to quantify how much saving could be made to the NHS if fuel poverty were eradicated. The most recent analyses estimate this to be at least £600M per annum in the UK (Consumer Focus, 2012). Pro rata, this would be at least a £20M saving in the annual NHS bill for Northern Ireland, which exceeds the total annual amount invested in the region’s Warm Homes programme. There is, therefore, ample justification for a much greater investment in tackling fuel poverty, especially through funding allocated to this purpose from the NHS budget.

7.6. Are people in Northern Ireland aware of these impacts on health and wellbeing?

The short answer to this question is: abundantly. In 2011, a large sample of people in Northern Ireland were asked to rate 90 items in terms of whether they were necessary for a decent life or not. 92% rated a dry and damp-free home as necessary for a decent life; similarly, 92% rated having access to heating so that a home could be kept adequately warm as essential. Of the 90 items rated in this way 2 items (a warm and dry home and enough to pay a heating bill) were nominated as necessary for a decent life more often than any other items. They outstripped items like having two meals a day (88%) and being able to celebrate a special occasion such as Christmas (79%).

A warm dry home and an affordable heating bill were accorded this supreme level of priority by men and women alike in Northern Ireland, by blue and white collar workers alike, and by people of all religious persuasions. For people who had children, however, affordable warmth increased further: 96% of this group regarding it as an essential for decent living (Kelly et al., 2012).
7.7 Impacts on job creation and social regeneration

In one of the most comprehensive reports of its kind, Cambridge Econometrics (2012) modelled the impacts of improving domestic energy efficiency for England and the UK’s devolved regions. It considered the benefits that could accrue from widespread implementation of standard retrofitting programmes, such as those currently available in regional Fuel Poverty programmes (e.g. Warm Front in England and Warm Homes in Northern Ireland).

The team note that energy efficiency programmes have many advantages:

- these programmes are ‘shovel ready’ and therefore fast to mobilise
- they stimulate economic activity and jobs in all regions of the UK
- they employ workers in construction and allied sectors where there is surplus capacity – so that investment is less likely to ‘crowd out’ alternate economic activity.

Cambridge Econometrics estimates that 71,000 new jobs could be created through an expansion of energy efficiency programs, with the greatest benefits accruing to Wales and Northern Ireland. However, their modelling relies on a number of assumptions which the findings from retrofit programs thus-far in the UK do not yet meet. Here too, the team relied on modelling retrofits which reduce the amount of money consumers spend on energy; this leaves more for people to spend on other products and services, which are in part supplied domestically. The savings they hope will be achieved amount to more than £200 per annum for the average household that was previously fuel poor (at 2008 energy prices). Few if any retrofit programmes within the UK’s fuel poverty portfolio have delivered savings of that order, further highlighting the urgent need for deeper retrofits, and more realistic models of what people in fuel poverty can reasonably be expected to contribute to carbon reduction programmes.

Chapter 8

The University of Ulster evaluation

8.1 Aims of the University of Ulster Evaluation

The University of Ulster was commissioned to evaluate the impacts of Northern Exposure’s fuel poverty interventions. Impacts were defined as being:

- impacts of the fuel poverty interventions on the health and wellbeing of residents
- impacts of the interventions on the energy consumption of residents.

The assessment of impacts was based on two types of evaluation:

a) before-and-after surveys of residents, which were carried out with all consenting households that participated in NEA’s Northern Exposure Intervention
b) six case studies, involving home visits to consenting residents both before-and-after they have received interventions.

8.2 Evaluation design

The “before” surveys and first case study visits provided baseline information on the households at the time when they were awaiting interventions to be carried out (Time 1). 48 households consented to participate in Time 1 surveys. Some were identified as living in ‘Harder to Heat’ homes. All of the households subsequently received intervention work (either insulation and/or heating improvements).

Follow up surveys and second case study visits took place a year later (Time 2). 30 households could be traced for Survey at this time and 6 Time 2 case study visits were also completed. The effectiveness and impact (if any) of energy efficiency improvements (including the installation of innovative technologies to selected homes) was assessed by comparing participant responses at Time 1 & Time 2. Hence, the results cited in this evaluation are based on:
Time 1 data: Quantitative & Qualitative baseline data collection

- 30 questionnaire based telephone surveys were completed in order to establish a baseline response from participants BEFORE any measures had been installed in the homes
- 6 case study interviews were completed with selected individuals at their home BEFORE any measures have been installed in the home.

Time 2 data: Quantitative & Qualitative follow up data collection

- 30 questionnaire based telephone surveys were completed AFTER installation measures to the homes
- 6 case study interviews were completed with the same individuals at their home AFTER installation.

8.3. Participants and where they lived

Approximately one-third of participants reported themselves as employed, another one-third were retired, with the remainder being unemployed. Three-quarters of households contained 1-2 residents, 21% of households had 3-4 residents, and 5% had more than 4. A quarter of the participant households had children, some of them very young babies. Most of the householders that were targeted for participation in the Scheme lived in North and West Belfast i.e. high density urban areas with housing types being mostly terraced or semidetached. An example of some of the homes people were living in can be seen from Figure 8.1.

Walker et al (2012) noted that the highest risk areas of Belfast are widespread in West Belfast with moderately at risk areas being located in East Belfast and the Southeast. When participant post codes were mapped onto the Northern Ireland Fuel Poverty Risk Map, the majority of targeted householders resided in higher risk areas of Belfast (see Figure 8.2.).
8.4. Before-and-After Survey instruments

Specific items for baseline and follow up telephone surveys were selected based on the aims of the study. All participants’ identities remained anonymous to the University of Ulster team with only a contact telephone and identification number provided by NEA NI.

Where possible, these consisted of standardised and internationally accepted scales.

8.4.1. Fuel poverty indicators

These included four questions which were adopted from the 2007 European Union Statistics on the Income and Living Conditions Survey (EU-SILC), which are designed to assess Energy Insecurity. They provide a subjective measure of fuel poverty and are subsequently combined to provide a global measure. The questions assess the participants’ perspective of whether or not they ‘feel fuel poor’, and are:

- Last winter, how often did your household go without heating because of the cost?
- Last winter, did you go without other things, such as treats or luxuries so that you could keep your home warm?
- Do you worry about the cost of heating and powering your home?
- During the WINTER, or more generally when it is cold outside, do you feel that your household can afford to heat the home to a temperature that is comfortable?

8.4.2. The Warwick-Edinburgh Mental Well-Being Scale (WEMWBS)

The Warwick-Edinburgh Mental Well-being Scale (WEMWBS) comprises 14 items that relate to an individual’s state of mental well-being (thoughts and feelings) in the previous few weeks (Brown & Janmohamed, 2008). Responses are made on a 5-point Likert scale ranging from ‘none of the time’ to ‘all of the time’. Each item is worded positively and together the items cover most, but not all, attributes of mental well-being (Tennant et al., 2007). Factor Analysis previously carried out on the WEMWBS suggested that the scale consists of 1 factor measuring overall mental well-being (Liddell, 2011). The layout and content of this scale can be seen on Figure 8.3. Test-retest reliability has been reported in other studies (alpha = 0.83, e.g., Brown et al, 2011) suggesting the scale is a reliable measure of mental well-being.

D1. Please tell me how well each of these sentences fit how you have been feeling over the last month (CIRCLE FOR EACH)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Never</th>
<th>Rarely</th>
<th>Some of the time</th>
<th>Often</th>
<th>All of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I've been feeling optimistic about the future this past month</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling useful</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling relaxed this past month</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling interested in other people</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've had energy to spare this past month</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been dealing with problems well</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been thinking clearly this past month</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling good about myself</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling close to people over the last month</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling confident</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been able to make up my own mind about things</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling loved this past month</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been interested in new things</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>I've been feeling cheerful this past month</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
8.4.3. Coping with everyday activities

We asked participants to rate, on a scale from 1 to 5, how easy it was to:

- Get up in the morning
- Get washed
- Do the shopping
- Have people around to visit.

8.4.4. Physical Health

Physical health was rated using a self-report measure of general health. Participants were asked to rate their general health on a scale of 1 to 10, 10 being excellent and 1 being poor. We also asked respondents about any illnesses or medications they had taken in the past month, and whether they had been to hospital, an A & E department, or a GP in the previous month. For respondents who were employed, we also asked how many days work they had missed due to illness.

8.4.5. Attachment to Home Scale

Home attachment was measured using selected items from Buckner’s Neighbourhood Cohesion Scale (1988). Buckner’s scale has 18 items, for this study only 6 items were included. Liddell (2011) noted that many of the items in the original scale are concerned with neighbourhood rather than home, hence 6 home-related items were adopted similar to Liddell (2011); she reported good reliability i.e. alpha = 0.85 when measuring for positive and negative attitudes towards the home. Other studies assessing this scale’s reliability indicate reliability coefficients of 0.91 (Lawrence et al, 2006). “The Neighbourhood Cohesion Scale thus appears to be stable across societies, and shows systematic relationships with background variables” (Robinson & Wilkinson, 1995, p.17). Items adopted run on a five point Likert scale ranging from ‘Strongly agree’ to ‘Strongly Disagree’ (see Figure 8.4). Participants are asked to mark the most appropriate point on the scale that matches their attitudes to statements relating to their perceptions of home.

8.4.6. Thermal Comfort

As noted by Darby and White (2005, p. 6): “The simplest way of assessing comfort is to find out what people have to say about it”. As noted in the previous chapter, people’s own assessments of their thermal comfort are sometimes more helpful in understanding changes in thermal standards, since they are based on people’s own preferred temperatures, rather than fixed WHO standards. Perceptions of thermal comfort can be affected by radiant temperature, relative humidity and air velocity (Darby & White, 2005). We relied primarily on the ASHRAE thermal sensation scale, which was developed for use in quantifying people’s thermal sensation (Charles, 2003). Individuals were asked to rate the temperature of each room in the home on this scale, which can be seen in Figure 8.5.

![Figure 8.4: Attachment to Home Scale](image)

![Figure 8.5: The ASHRAE Thermal Comfort Scale](image)
Qualitative Analysis: Case Studies

Six before & after case studies were carried out. All case study interviews took place in the homes of the participants. NEA NI selected these 6 homes based on their ‘Hard to Heat’ characteristics. A number of open ended questions were asked of each householder, with room left for both householder and researcher to elaborate and explore any areas of relevance and interest.

Some of the standard questions included in the BEFORE interviews were:

- How did you come to hear about the Northern Exposure Project?
- Was there any particular reason you were interested in the scheme?
- How long have you lived in this house?
- Do you live by yourself?
- What level of heating do you have in your home?
- What is your main source of fuel at present?
- How would you normally pay for your electricity and heating?
- Has the household had to go without heating in the last 12 months?
- The winter just past, what was the home like? Warm, cold, etc.
- Can you tell me what everyday life is like for you at the moment?
- How easy or difficult did you find the Northern Exposure process and did you have any concerns about taking part?
- What do you think will be the greatest benefit in taking part in the scheme?

Some of the questions asked in the follow-up interviews were:

- What measures have you received through the NE scheme?
- Have you found this to be a help in your home?
- Did you receive energy advice through this scheme? Maybe from the people that carried out the work?
- Did this change how you use energy in your home? If so, what sort of changes did you make?
- During the winter just past how did the home feel, cold, warm?
- Do you feel you can afford to heat your home to a comfortable level of warmth without any difficulties?
- Can you tell me what everyday life is like for you at the minute?
- Do you feel that you have saved financially speaking, since having the Vphase measure put into your home?
- What do you think has been the greatest benefit in taking part in the scheme?

9.1. Mental wellbeing scores before and after Northern Exposure

Preliminary testing of the psychometric properties of the Warwick and Edinburgh Mental Wellbeing Scale (WEMWBS) produced excellent results. For example:

- Cronbach’s alpha coefficients for the 14-item scale were 0.90 and 0.92 at Time 1 and Time 2 testing.
- Item deletions did not improve the coefficients, indicating consistent Scale reliability across all 14 items.
- WEMWBS is designed as a single factor measure of wellbeing and factor analysis of our data confirmed this structure for both T1 and T2 results.

Together these outcomes indicate that the Scale performed at an exceptionally high structural level, and that results can be considered reliable and replicable.

Table 9.1 provides details of the before and after scores averaged across the 30 participants who completed both Time 1 and Time 2 Surveys. A higher score indicates better levels of mental wellbeing.

| Table 9.1: Average scores on the WEMWBS – Time 1 and Time 2 |
|----------------|----------------|----------------|----------------|
|               | Mean | N | Std Deviation | Std. Error Mean |
| Time 1 Mental Wellbeing | 44.03 | 30 | 11.36 | 2.07 |
| Time 2 Mental Wellbeing | 49.93 | 30 | 10.30 | 1.88 |

These scores were then analysed using a paired-Sample T-test to assess whether the differences between T1 and T2 scores were statistically significant. Results are contained on Table 9.2 and indicate a highly significant difference between T1 and T2 scores, with T2 scores being higher.
There are several features to note in these results. In the first instance, the Scottish national average mental wellbeing score is 50.7 (out of a maximum score of 70). Time 1 scores were, therefore, low (averaging 44) and indicate poor mental health status before Northern Exposure. After Northern Exposure, the results indicate wellbeing approximating the Scottish average (50). Secondly, there is a wide variety of scores, as indicated in the high standard deviation values on Table 9.1. This means that the wellbeing of the 30 participants was very diverse. In fact, at Time 1, scores ranged between 19 and 68 (out of 70). At Time 2 the range had narrowed somewhat but was still wide (25-68). At the start of this Scheme, many of the participants were probably classifiable as borderline depressed, but fewer were at Time 2.

Comparison of the 14 item averages at T1 and T2 is also helpful in understanding these results. These are contained in Table 9.3. Items where the average change in score was greater than 0.5 are highlighted in bold type. From this it is evident that people feel more useful, confident, cheerful and relaxed, as well as better about themselves. There was little or no positive change in other items, such as “being able to make up my mind” and “thinking clearly”. In other words most of the items where improvement is notable are items which have to do with mood, disposition, and self-worth – in short features related to happiness.

We also examined levels of everyday functioning in terms of how hard or easy respondents found getting up in the morning, getting washed, doing the shopping, and having people around to visit. For these items we found no significant change, indicating that they were coping at the same level with everyday routine events before and after Northern Exposure.

### Table 9.2: Paired-sample T-test results

<table>
<thead>
<tr>
<th>Mean diff</th>
<th>T value</th>
<th>df</th>
<th>Sig. (two-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T2 score - T1 score</td>
<td>5.9</td>
<td>4.0</td>
<td>29</td>
</tr>
</tbody>
</table>

### Table 9.3: Comparison of scores on individual items of the WEMWBS

<table>
<thead>
<tr>
<th>Item</th>
<th>T1 Mean</th>
<th>T2 Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>I've been feeling optimistic this past month</td>
<td>3.03</td>
<td>3.13</td>
</tr>
<tr>
<td>I've been feeling useful</td>
<td>2.87</td>
<td>3.63</td>
</tr>
<tr>
<td>I've been feeling relaxed this past month</td>
<td>2.57</td>
<td>3.10</td>
</tr>
<tr>
<td>I've been feeling interested in other people</td>
<td>3.33</td>
<td>3.70</td>
</tr>
<tr>
<td>I've had energy to space this past month</td>
<td>2.47</td>
<td>2.80</td>
</tr>
<tr>
<td>I've been dealing with problems well</td>
<td>3.57</td>
<td>3.73</td>
</tr>
<tr>
<td>I've been thinking clearly this past month</td>
<td>3.27</td>
<td>3.53</td>
</tr>
<tr>
<td>I've been feeling good about myself</td>
<td>2.97</td>
<td>3.53</td>
</tr>
<tr>
<td>I've been feeling close to people over the last month</td>
<td>3.43</td>
<td>3.87</td>
</tr>
<tr>
<td>I've been feeling confident</td>
<td>3.00</td>
<td>3.57</td>
</tr>
<tr>
<td>I've been able to make up my own mind about things</td>
<td>4.10</td>
<td>3.97</td>
</tr>
<tr>
<td>I've been feeling loved this past month</td>
<td>3.77</td>
<td>3.90</td>
</tr>
<tr>
<td>I've been interested in new things</td>
<td>2.97</td>
<td>3.40</td>
</tr>
<tr>
<td>I've been feeling cheerful this past month</td>
<td>2.70</td>
<td>3.77</td>
</tr>
</tbody>
</table>

### 9.2. Routes to improved wellbeing: changes in general physical health

26 of the 30 Northern Exposure households hoped that participation in the scheme would lead to improvements in the health of residents, and given that 6 of the households contained a child with asthma, and 5 an adult with asthma, this was not at all unreasonable.

Participants’ ratings of their physical health were compared using a paired sample t-test. This indicated no significant change between T1 to T2 (t = 1.71, df = 29, p = 0.86). The mean ratings were 6.10 and 6.17 at T1 and T2 respectively (out of a possible score of 10, where 10 is excellent).

We also asked respondents about any illnesses or medications they had taken in the past month, and compared their answers at T1 and T2. There was no change in items such as whether they had been to hospital, an A & E department, or a GP in the previous month, nor on whether they were on medication or not. For the 15 respondents who were employed, we also asked how many days work they had missed due to illness, and there was no change in this either (averaging 1 day in the past month at both T1 and T2).
9.3. Routes to improved wellbeing – the Attachment to Home Scale

This 6-item scale produced Cronbach’s alpha coefficients of 0.76 at T1 and 0.84 at T2; item deletions did not yield substantial changes to the coefficient. In other words, the scale had excellent reliability. At Time 1, the factor structure indicated a single factor that explained 52% of the variance; at Time 2, the factor structure indicated a single factor which explained 65% of the variance. Both of these results indicate a robust factor structure.

When comparing T1 and T2 scores on this measure, results indicated no significant differences. Respondents were no more attached to their homes when followed up after retrofit than they had been beforehand (t = 0.70, df = 29, p = 0.49). On average scores were 13.27 at Time 1 and 12.70 at Time 2. Given that the maximum score for the Attachment to Home Scale was 30, an average score of 13 overall is low, indicating that the cohort as a whole felt little attachment to or fondness for their homes. Comparison of responses on the scale’s individual items indicated that responses showed no change in any of the 6 items.

9.4. Routes to improved wellbeing – energy-related responses

We compared respondents’ T1 and T2 scores for a variety of energy-related items on the Survey, in order to see if this shed light on why mental wellbeing scores had improved significantly.

9.4.1. Indoor environmental quality

As has been found in many similar studies, retrofitting had no significant effect on damp in the home (e.g., Liddell, 2011). Before retrofit, 11 homes had damp, and only one household reported that this had disappeared after retrofit.

However, while 10 households had reported mould growth in their home before the retrofit program, only 4 did so afterwards.

Similarly, 9 homes had problems with condensation before, but only 5 afterwards.

Indoor air quality also improved notably, with 7 households having been dissatisfied with this before retrofit and only 2 afterwards.

Likewise, dissatisfaction with the ventilation in their homes reduced from 8 before to 1 afterwards.

9.4.2. Thermal comfort

Table 9.4: Perceived thermal comfort before and after retrofits (1 = always, 5 = almost never)

<table>
<thead>
<tr>
<th></th>
<th>Too hot</th>
<th>Fine</th>
<th>Too cold</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before retrofit in summer</td>
<td>4.1</td>
<td>2.5</td>
<td>4.4</td>
</tr>
<tr>
<td>After retrofit in summer</td>
<td>4.7</td>
<td>2.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Significant difference?</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Before retrofit in winter</td>
<td>4.8</td>
<td>3.3</td>
<td>2.6</td>
</tr>
<tr>
<td>After retrofit in winter</td>
<td>4.8</td>
<td>3.1</td>
<td>3.8</td>
</tr>
<tr>
<td>Significant difference?</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

From Table 9.4 it is evident that homes were almost never too hot, whether in winter or summer, or before or after retrofit. In summer months were, therefore satisfactory. In winter, there was an improvement in thermal comfort after retrofit, with participants finding the home “too cold” significantly less often. This was, in effect, the only significant change in their thermal comfort, but certainly the one which was most favourable.
9.4.3. **Energy affordability**

We asked a variety of questions around this theme, some of which are listed on the Table below.

### Table 9.5: Energy affordability – mean scores before and after retrofit

<table>
<thead>
<tr>
<th>Item: “In past year...”</th>
<th>Mean score before</th>
<th>Mean score after</th>
<th>Significant difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility threatened to cut off power (1 = yes, 2 = no)</td>
<td>1.9</td>
<td>1.9</td>
<td>No</td>
</tr>
<tr>
<td>Used stove to heat home (1 = yes, 2 = no)</td>
<td>1.9</td>
<td>2.0</td>
<td>No</td>
</tr>
<tr>
<td>Gone without heat</td>
<td>3.9</td>
<td>4.7</td>
<td>Yes</td>
</tr>
<tr>
<td>Supplier refused to deliver oil/coal (1 = yes, 2 = no)</td>
<td>2.0</td>
<td>2.0</td>
<td>No</td>
</tr>
<tr>
<td>Gone without treats for heat (1 = often, 4 = never)</td>
<td>2.4</td>
<td>3.1</td>
<td>Yes</td>
</tr>
<tr>
<td>Worried about cost of heating (1 = often, 4 = never)</td>
<td>2.4</td>
<td>2.8</td>
<td>No</td>
</tr>
<tr>
<td>Afford the temperatures you want (1 = yes, 2 = no)</td>
<td>1.9</td>
<td>1.6</td>
<td>No</td>
</tr>
<tr>
<td>Notice the cold indoors coming home (1 = not at all, 6 = for a few hours)</td>
<td>4.2</td>
<td>2.3</td>
<td>Yes</td>
</tr>
</tbody>
</table>

There was no change in the extent to which households experienced issues related to debt, although this was probably because almost all of the participants were debt-averse and avoided it as a matter of principle. After retrofit, householders still worried just as much about the cost of heating, which could be explained by the fact that heating and electricity prices had increased substantially during the interim between before and after surveys. In the face of these increases, one might have expected scores concerning worry about affordability to have risen, so retrofits may have helped stabilise levels of worry. After retrofit, householders were less likely to feel chilly when first entering their home. They had also, less often, gone without treats in order to purchase energy after retrofit. The likelihood that they had gone without heating during the winter past was also reduced post-retrofit, and is more fully described on Table 9.6.

### Table 9.6: Last winter how often did you go without heating because of the cost?

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency before</th>
<th>Frequency after</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very often</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Often</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Occasionally</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Never</td>
<td>19</td>
<td>25</td>
</tr>
</tbody>
</table>

The table illustrates that, before retrofit, 6 households had gone without heating “often” or “very often” because of cost. None of the households had this experience after retrofit.

Taken as a whole, these results indicate that the improvement in wellbeing scores after retrofit was more likely to have occurred as a result of at least two factors: improved thermal comfort, and greater energy affordability. There were no measurable improvements in levels of worry about energy affordability, or in physical health, or in attachment to home – these were unlikely to have accounted for improvements in wellbeing.
10.1. Electricity consumption

Five of the participants in Northern Exposure had reliable data transmitted from their Smart meter. This data consisted of their electricity consumption, transmitted to a data gathering unit on a half-hourly basis. The five were part of a larger group of 56 Smart meter customers, all of whom were low income families vulnerable to the effects of fuel poverty. At their follow-up survey, as well as during monthly courtesy calls that were part of the Smart meter Trial intervention, these participants were asked about their experiences with the Smart meter. These were almost all uniformly positive; some of their comments are illustrated on Figure 10.1.

Figure 10.1: Comments from participants who had Smart meters installed
The figure below compares the Northern Exposure group in terms of their electricity consumption with the remaining 51 customers that had Smart meters.

**Figure 10.2:** Northern Exposure customers \( (n = 5) \) compared with other low-income customers \( (n = 51) \): electricity consumption from Smart meter data

The Northern Exposure clients were significantly lower consumers of electricity than the other customers in the larger Smart meter trial. The peak around January to March 2012 is largely attributable to one householder’s consumption during those months (see section 11.6.), but overall these clients were low consumers of electricity, using an average of 3,636 kWh in a year, as compared with 4,344 kWh for the other Smart meter trial customers.

However, neither group showed any evidence of reducing their electricity consumption during the year, with both groups showing only the customary seasonal changes that occur with lighter nights and warmer weather in the summer months. The data show no convincing evidence of a reduction over time beyond what would be expected through seasonal change. In November 2011, for example, Northern Exposure participants consumed an average of 293 kWh, and 11 months later (October 2012) they had consumed almost exactly the same amount (300 kWh).

10.2. VPhase impacts

In total, 4 units were both:

- installed in the homes of Northern Exposure participants.
- and were paired with Smart meters that relayed data reliably.

The objective was to use the combination of a Smart Meter and a VPhase unit to establish whether the VPhase unit was associated with any changes in electricity consumption. Smart meter data was available for 6 months before VPhase installation and 5 months after installation.

For all the VPhase customers, the installation was said to have been quick and non-disruptive. During the course of the 5 months that they were in situ, all of the Units worked without fault or breakdown. VPhase customers were generally satisfied with the Unit, although (as described in the Case Studies section) it generated distress for two customers who believed that an overestimated electricity bill had been caused by the Unit. As will become evident in the case studies Chapter, VPhase units had nothing to do with these customers' experiences, and these matters were resolved to both of the customers' satisfaction. In reality, the problem had been caused by misunderstandings concerning the Smart meter's billing protocol.

The Northern Exposure project was not able to assess the extent to which voltage had been smoothed and costs reduced, since voltage data were not transmitted via the Smart meter. However, when asked, most of the VPhase customers believed that the device had either saved them money over the first 5 months, or had made no difference they could discern. Admittedly, this can be difficult for people to assess, given that seasonal fluctuations in electricity consumption mean that less electricity is consumed in the summer and autumn months than is consumed in the winter and spring months (because of lighter nights in the former, more time spent out of the house, and less need for appliances such as tumble dryers etc.). The units had been installed in early summer, so the after-phase lasted from June to October. The very small numbers of VPhase units installed also made it impossible for Ulster to assess with any degree of confidence whether the units had cut down on consumption.

Nevertheless, Ulster made an attempt to estimate whether any significant changes in energy consumption were evident, by matching the 4 VPhase customers (i.e. those that had operational Smart meters) to a control group of 4 customers from the rest of the Smart meter trial (who did not have VPhase). Each member of the selected control group had almost identical consumption to one of the VPhase customers at November 2011. Table 10.1 provide results of this broad and very rough comparison.
Table 10.1: Average fortnightly consumption before and after VPhase installation

<table>
<thead>
<tr>
<th></th>
<th>Controls</th>
<th>VPhase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before: Average kWh per fortnight</td>
<td>192.7</td>
<td>211.5</td>
</tr>
<tr>
<td>After: Average kWh per fortnight</td>
<td>119.8</td>
<td>117.8</td>
</tr>
<tr>
<td>Change</td>
<td>72.9</td>
<td>93.7</td>
</tr>
<tr>
<td>N</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

Both groups consumed over a third less after VPhase, which reflects normal seasonal changes in consumption. It also appears that VPhase customers consumed an average of 6% less after VPhase than did the controls. However, such a small sample size makes this finding, at best, indicative of a possible saving rather than evidence of it. Many more customers will be needed in a trial of this kind – hundreds rather than 4 – for this question to be addressed with any degree of certainty. What can be concluded from Northern Exposure is that these Units are readily accepted by customers and cause no disruption either while being installed or at any time in the first 5 months thereafter.

11.1.1. Taking care of the pennies: Mr J in June 2011

**Single Householder - Retired**

- **House Type:** Pre 1930’s solid wall end terrace
- **Tenure:** Home owner
- **Existing Heating System:** Gas central heating system with additional open fire and log burning stove
- **Fuel Type:** Electricity, gas, wood
- **Payment Methods:** Quarterly credit for both gas and electric
- **Scheme Referred to:** Warm Homes and Smart meter trial
- **Measures Installed:** Smart Meter & VPhase Unit
- **Changes to Payment Method:** None

Mr J is a retired gentleman who lives with one of his daughters in their terraced house which is almost a hundred years old. He has lived at this property for around twenty years. Mr J fathered seven daughters and four sons, and family is very important to him. He likes to keep in regular contact with his children. In recent years, his wife and one of his daughters have passed away. This saddens him but he feels that life must go on while it can.

Mr J’s home has full gas central heating which is programmed to come on twice a day. He also relies on a solid fuel open fire in the living room. However Mr J notes “there is no back boiler which would be really helpful”. Mr J gets a free supply of wood pallets for his open fire from a yard near where his daughter works, “I just break them up myself, it does great”. Mr J’s cooker uses bottled gas which cost around £25 to refill every 12 weeks.

Mr J has a daily routine which he enjoys each day. He gets up in the morning, gets washed and dressed, has his breakfast and then heads off to Mass at his local chapel. Mr J later goes for his
shopping at nearby stores, before heading home to make a meal followed by walking the dog before bedtime.

Mr J was referred to the scheme by members of the Northern Exposure Steering Group. Mr J lives in a very old property and seemed suitable for the research. NEA NI then contacted Mr J to check eligibility criteria for the grant schemes and to ensure he wanted to be part of the research project which he confirmed. Mr J commented that he found the application process very easy and thought that the people he was in contact with regarding the Scheme were “very nice and helpful”. Living in a home which was almost a century old, Mr J was initially informed that his home may receive solid wall insulation which he was very pleased about; “because the walls are exposed to the elements, the house can become very cold as the heat won’t stay in”. He looked forward to the wall insulation being completed, and hoped that it would help to keep the heat in and the cost low.

Mr J explained that the home had been very cold during the winter that had just past. He had mainly relied on the open fire in the living room, which was much cheaper because of the wood he obtained for free, rather than paying for the gas; “it has become very expensive”. Between the increase in prices for domestic heating and electricity and the low standard of insulation within the home, Mr J found his current living situation somewhat distressing.

Mr J anticipated that he would not mind work being completed on his home when the time came, even if it were extensive. He explained: “might as well get it all done at the one time anyway”. Mr J was in the process of having his kitchen replaced (for the first time since Mr J had moved in), and the house was also being rewired. Mr J noted that the house became very unsettled and dusty due to the work, but he felt that the effort would be worth it in the end and his home would be more comfortable.

11.1.2. Follow-up in July and November 2012

Mr J was referred to the Warm Homes scheme for solid wall insulation. After a survey was completed by the scheme manager, the application was turned down because the cost of installing solid wall insulation in this property would have been over the grant limit set by the Warm Homes Scheme that had been set up by the Department for Social Development NI. In the end Mr J received no energy efficiency measures through the Warm Homes scheme. During Mr J’s November 2012 interview, he noted once again that his home was very cold especially during the winter as “the walls are exposed to the elements making it hard to keep the heat in”. This is a continuous issue that he is very aware of and finds problematic.

NEA NI were still able to signpost Mr J onto the SMART meter trial and subsequently arranged for the installation of a VPhase unit. Mr J commented that the process of the VPhase installation only took a couple of hours and he did not have any problems. Mr J finds his SMART Meter to be of great benefit. His In-house Display is prominently positioned in the living area where he spends most of his time. “It sits right there in front of me and I can always see what I’m using”.

Mr J noted an issue in the early days of having his SMART Meter; “the guy couldn’t read the meter”. This resulted in Mr J receiving an inaccurate estimated bill which under charged Mr J. When the meter was next read, Mr J owed the electricity company more money than he had anticipated. He remarked “a good thing I was in credit or I would not have been able to pay the bill” Unfortunately, this high bill arrived not long after his VPhase unit had been installed. Mr J quite reasonably assumed that VPhase had malfunctioned. Together with Mr J, representatives of FuelSaver NI and NEA NI were able to unravel the root cause of the problem and assist Mr J in reading his own meter directly from the In-House Display. Mr J has always paid for his electricity and gas through quarterly bills. Mr J would have previously saved around £10 a week, which had left him with sufficient credit to cover the corrected meter reading. Following his experience, he decided to call the electricity company and ask (based on his consumption), what he should be putting away. He was advised that £12 a week would be more appropriate; he now saves £15 a week instead. “I’m always in credit,” he remarked. According to Mr J’s recent electricity and gas bills he would spend £32 per month on gas and £30 on electricity (£744 per year), making him a low energy consumer.

Mr J was asked if he had felt that he was spending less on his energy usage as a consequence of SMART and VPhase, he was doubtful; “I do imagine that I have saved something”. However, he has only been a part of the VPhase mini-trial for a short while and he feels that it will take closer to a year to see any benefit in terms of reduced cost.

Mr J still uses his open fire during the winter period which for him is an essential solution to costly energy bills: “it can be cheaper at times”, and finds that it heats the living area very quickly. Mr J lit his open fire during his November interview and both researchers noticed how quickly the room was heated. Mr J also recently installed a log burning stove in the dining room. He now uses this on occasion as he likes this method of heating because he says it is “simple and easy to use – it is cheap heat”.

Mr J is a very energy efficient gentleman, probably by nature rather than as a consequence of participating in Northern Exposure. He recently added measures like draft excluders to his kitchen doors in order to keep the heat in. Mr J described his home as cosy and comfortable. The researcher did find a noticeable difference in the temperature in parts of Mr J’s home, no longer a damp cold feeling in the living area, rather a comfortable level of warmth. However, the first visit had been made when his home was being rewired, which meant that all of the carpets had been lifted, exposing bare floorboards.

Overall Mr J was happy with the Northern Exposure process. He found the Welcome Pack that was provided through the SMART Meter Trial very helpful. The Pack included energy saving goods such as light bulbs which Mr J found of benefit “they are very durable”. He doesn’t use the Stand-By Off adaptor provided as part of the Green Box, because he already “switches everything off by the mains and doesn’t leave things on standby”. He recalled the energy efficiency advice he was provided with during the home visit undertaken by Carillion Energy Services, but found this to be only of little help, probably because he was already focused on achieving energy efficiency in his home. However, Mr J
enjoys the added control that the new technology in his home provides. Knowing and understanding what he is using ensures that Mr J does not feel overwhelmed by bills and can save appropriately to cover his energy costs.

Mr J is a very practical man and values the features that contribute to his home's comfort and heat levels. It is without doubt that solid wall insulation would have been of great benefit from both a practical point of view and for the overall well-being of the householder. As a pensioner, the prospect of chopping up free wood pallets in order to stay warm—something which he will have to do more of because of his second wood-burning stove—is not a long-term or ideal solution to his energy needs.

Mrs E has lived in the same street her whole life, moving with her husband into her current semi-detached home over 20 years ago. She feels very comfortable in her neighbourhood, as this is where she grew up. Her son still lives at home with her, and most of her extended family lives nearby.

Mrs E heard about the Northern Exposure Scheme from her brother, who had also taken part in the Scheme. At the time she was already exploring the possibility of having her oil-fired central heating system converted to gas, but she had concluded that this was too expensive for her to afford. She applied to Northern Exposure initially thinking that she would be getting her home heating converted from oil to gas through the Scheme. This was one of the main reasons that Mrs E decided to take part in the research project. However, after discussions with NEA NI about receiving some financial help she was advised about an alternative scheme which partially funds this heating system conversion, as the Warm Homes and NISEP Schemes do not cover the conversion from oil to gas.

Mrs E wanted a conversion to gas because she perceived it as being more affordable and more manageable in terms of paying bills. The home often went without heating for a number of months. “I would have gone without heating or resorted to using a credit card to pay for oil, now I top up £10 a week and that does the heating and the cooker”. Previously, she usually chose to go without heating because of the cost, and the family put on extra layers of clothing in order to keep warm. Over the very harsh part of the previous winter the family were in Australia and so did not spend any money topping up on oil. But while they were away, one of their pipes burst due to the freezing weather and her brother had to put oil in the tank to prevent any more burst pipes. Mrs E found this very distressing as it was an extra cost that needed to be paid back once the family returned home from the holiday of a lifetime. Mrs E recalls these types of situations as being very difficult and distressing.

**11.2.1. Family is everything: Mrs E in October 2011**

<table>
<thead>
<tr>
<th><strong>Couple with one child</strong></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>House Type:</strong></td>
<td>Semi-detached home post 1930’s</td>
</tr>
<tr>
<td><strong>Tenure:</strong></td>
<td>Home owner</td>
</tr>
<tr>
<td><strong>Existing Heating System:</strong></td>
<td>Oil fired central heating</td>
</tr>
<tr>
<td><strong>Fuel Type:</strong></td>
<td>Electricity and oil</td>
</tr>
<tr>
<td><strong>Payment Methods:</strong></td>
<td>Prepayment meter for electricity</td>
</tr>
<tr>
<td><strong>Scheme Referred to:</strong></td>
<td>Warm Homes</td>
</tr>
<tr>
<td><strong>Measures Installed:</strong></td>
<td>Solid wall insulation &amp; gas central heating via Snug Plus</td>
</tr>
<tr>
<td><strong>Changes to Payment Method:</strong></td>
<td>Prepayment meter for Gas CH</td>
</tr>
</tbody>
</table>

**Family is everything: Mrs E in October 2011**

Couple with one child

<table>
<thead>
<tr>
<th><strong>House Type:</strong></th>
<th>Semi-detached home post 1930's</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tenure:</strong></td>
<td>Home owner</td>
</tr>
<tr>
<td><strong>Existing Heating System:</strong></td>
<td>Oil fired central heating</td>
</tr>
<tr>
<td><strong>Fuel Type:</strong></td>
<td>Electricity and oil</td>
</tr>
<tr>
<td><strong>Payment Methods:</strong></td>
<td>Prepayment meter for electricity</td>
</tr>
<tr>
<td><strong>Scheme Referred to:</strong></td>
<td>Warm Homes</td>
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</tr>
<tr>
<td><strong>Changes to Payment Method:</strong></td>
<td>Prepayment meter for Gas CH</td>
</tr>
</tbody>
</table>
While there were times that the home went without heating, Mrs E always ensured that she could pay any other outstanding bills. Mrs E’s whole family, including her son, would sit down and work something out as paying the bills has always been a priority. Mrs E was very appreciative of having a supportive family around her.

Mrs E highlighted her concerns about the damp and cracked walls in her son’s room and mould growth at the back of her wardrobe. The damp and mould would affect her clothes if she left them in the wardrobe for too long.

11.2.2. Follow-up in July 2012

Mrs E was able to make the conversion to gas via a partially funded scheme. Mrs E felt that this had made “a tremendous difference” to the home. Mrs E felt more able to keep on top of the cost of heating and powering the home due to the new system, finding that she could now afford a comfortable level of warmth without any difficulties.

Mrs E has found that prepayment cards for her electricity and gas meter alleviated the anxiety of paying quarterly or of having to bulk buy oil. It means that when she has some extra money, the meters can be topped up, but that this leaves some “breathing space” in times when she needs the money for something else, lowering the risk of not being able to pay any outstanding bills.

Mrs E also received internal solid wall insulation through Warm Homes via Northern Exposure. Since it was installed, Mrs E has found that her home is noticeably warmer and she has fewer problems with damp and mould in her home.

Overall Mrs E does not believe this assistance has saved her any money, because of the increase in home heating and electricity costs. However, she noted that “the house is holding the heat a lot better”.

Mrs E also recalled the energy efficiency advice that was provided through the Northern Exposure Scheme. She found that the gentleman who provided her with this advice was very helpful and she now uses energy saving light bulbs around the home; she had never done so before. Mrs E believes she is now noticeably more energy aware “I switch things off and don’t put as much water in the kettle anymore”. Mrs E found the advice has helped her change her energy usage within the home and that “it’s now just part of the routine”.

Mrs E is a lot more comfortable in her home, with the internal wall insulation contributing most of all to this: “the rooms would have been really cold before, but they are warm now”. She would now put her central heating on for less time compared to before the measure was put in place. Mrs E has also found that her son is a lot happier in the home since having the insulation completed, “His room would have been cold before but now he turns the heating off in his room because he gets too warm”.

Mrs E seemed very happy and content. The home was noticeably warm and comfortable during the interview, more noticeably so as the weather was very damp and cold that day. Mrs E was dressed very lightly and had doors open throughout the house. Mrs E would gladly recommend the scheme to anyone and was very happy to have taken part. She praised the Northern Exposure process and how helpful the staff had been.

During the initial interview with Mrs E in 2011, it was clear that the cost of heating and powering the home had been a great worry for her, and that without her family to fall back on she would have felt under constant pressure to save money for energy bills. This made Mrs E feel uncomfortable and distressed. During the second visit with Mrs E it was clear how much more relaxed the home atmosphere had become. Mrs E talked more contentedly about her family and her home. Having solid wall insulation, the conversion to gas central heating at a reasonable cost, and knowing how to implement energy efficiency advice, all greatly benefited this household.
Ms and Mr A are working parents who live in their semi-detached home with their children (ages 5, 7 and 18) and their grandchild of 14 months. They have solid fuel central heating, including a glass-fronted fire in the living room. They heard about the free heating and insulation Scheme through ‘word of mouth’ from their next door neighbour. Ms A gave her details to her neighbour who in turn passed these on to NEA NI.

NEA NI contacted Ms A and explained the possible heating and insulation options. Ms A was happy that she would be able to get her existing solid fuel fire changed to natural gas as this would allow her to spread the cost of paying for gas with a Paypoint ‘top up’ card. She already used KeyPad TopUp to pay for electricity and liked this ‘pay as you go’ method. She also had gas central heating in her previous home and liked the idea of ‘just pushing a button’ and not having to clean the fire every morning.

During the researcher’s first visit in 2011, Ms A said her living room is always very warm because of the glass fronted fire; however the rest of the house is cold. She has to ‘blast’ the fire to ‘get the heat around the house’. The younger children prefer eating their breakfast in the living room which is usually warmer than the kitchen. The bathroom is cold, noticeably so after bathing. Even though there is always plenty of hot water from the back boiler when the fire is lit, Ms A had to use the electric immersion in the mid-summer months.

During the first visit with Ms A she explained that there is no coal delivery service in the area she lives in and she was ‘sick, running down the road to get bags of coal’. She bought two large bags every three to four weeks. She believed that each bag cost £35, which may have meant that these were large re-packaged bags. During the severe winter weather in 2010 she bought coal in bulk from a supplier in the area where Mr A is originally from. Bulk purchasing here was about £80 cheaper than buying in her own area (Greater Belfast) and Mrs A is sure the saving meant she did not have to compromise on anything else for the family; they stayed warm through the extreme weather. This saving meant she could put money aside for additional energy use. She bought oil filled radiators that year to supplement the heat in the kitchen and upstairs rooms. This added an extra £5 to £10 a week to her electricity bills.

Ms A was looking forward to having gas central heating installed but was confused about the process. NEA NI carried out a home visit with a householder information pack to help explain the process of the research project; however as there were numerous parties involved, Ms A, received many visits from a number of people and she was not always sure who they were, the names of their companies and their respective roles. One of these visits was from a surveyor who phoned about an hour before he visited to check if she was at home. He was wearing an ID badge when he arrived but did not leave a card with his contact details, which Ms A feels would have been helpful. An ‘eco guy’ also came from the ‘electric board’ and gave her a StandBy Off adaptor and a home energy monitor. This visit was also arranged at short notice by phone. Another person came and measured all the radiators. Ms A doesn’t know his name or where he was from. The placement of the gas meter box was not discussed with Ms & Mr A and they are not happy with where it was ultimately located. Mr A feels it would have been better placed elsewhere.

At the time of the interview Ms A believed that the work would be starting the next day, having learnt this only that day by asking a workman who was installing heating under the same Scheme in other homes in the area. She did not know the name of the contractor who is installing her heating, nor did she know what time the workers would arrive at, or what preparation is required from her. She was worried about this, especially as she thinks her floorboards may have to come up. A neighbour’s experience has ‘put the frighteners on’. She does not know ‘where the boiler is going’ and is worrying about ‘the mess’. On hearing this, NEA NI made a number of calls on her behalf. It appeared that she does not have to move anything, unlike her neighbour who had ‘to move everything at 7.00 in the morning’, but she remained doubtful that she will be exempt from this the next day. It was clear that the neighbour’s experience had caused Ms A trepidation about the work that would take place.

Ms A’s younger children were starting their school holidays the next day i.e. when the work was being completed. She had to make sudden arrangements to have them looked after while the heating was being installed. She and her partner were also working on that day. In the end, her daughter and grandchild moved out for a fortnight while the work was being completed in order to avoid exposure to dust etc. As there was not much notice given on the start date, it was difficult for anyone in the family to make plans. Ms A was also not sure if she is getting a redecoration grant – she thought not - but was not clear about this. NEA NI would have been able to clarify this if asked.

It was clear during Ms A’s first interview that she was facing the installation day with some trepidation. Better communication about the process would have saved her from having to make numerous phone calls and making sudden arrangements for the family.
calls, cut down on her worry, and would have minimised the disruption experienced by a family of working parents, children and grandchild.

11.3.2. Follow-up in November 2012

Ms A received loft insulation and a full gas central heating system through the Warm Homes scheme and a BAXI Multifit GasSaver unit funded through the Northern Exposure project.

During the second visit with Ms A, she explained that her oldest daughter and grandchild had moved out since the last visit, and that she herself had given birth to her fourth child. During the first visit, Ms A noted that the home was always cold and the children ate and dressed in the living room with its glass-fronted solid fuel fire. The children now eat and do their homework in the kitchen, spend most their time running up and down the stairs, and “know how to work the system if they need to”. Ms A remarked how easy it is to use her new gas system, “you just flick a switch”, and it makes it easy for her children to use if they get cold.

Previously Ms A estimated that she spent £80 every few weeks on bulk buying coal for the fire and an extra £5 to £10 a week on electricity during the cold weather in order to run oiled filled radiators that she placed around the home in order to maintain a level of thermal comfort in parts of the house that were not sufficiently heated by the solid fuel system. When asked how much she now needs to top up her gas per week she remarked “the last time I topped up was about £10 two months ago” (although the second visit did take place during the warmer summer months). Ms A praised the new gas system for being so easy and cheap to run. She believed that the household was saving an average of £250 during the summer months. She did state that her house can now be too warm and that she only puts the heating on for an hour at a time.

NEA NI asked Ms A if they could contact her gas supplier for a breakdown of ‘Top-up’s’ made in the last 12 months, which Ms A very kindly agreed to. Ms A’s gas statement shows that she has topped up a total of £630 from October 2011 to September 2012. From Ms A’s perspective she felt she was saving more than she actually was, possibly a reflection on the fact that she now pays for only one source to heat the home. The loft insulation she received as part of the scheme will also have meant that she requires less heating to maintain comfortable temperatures as she is losing less heat through the roof of her property.

The gas meter box sits on the wall very close to the ground outside of the home. It has a large lid attached which needs to be lifted before the householder can ‘top up’. This lid has no stable hinges and needs to be held open with one hand which makes it difficult to enter the prepayment card to ‘top up’. Ms A commented that it is very unsuitable and it would have been better placed in a more accessible area.

Overall Ms A finds her new system to be a lot faster at heating the home and maintaining heat, “you have to turn it off before it gets too warm…the radiators are always warm”. Ms A is also very happy and satisfied with the amount of hot water in the home as the combi boiler means the household has instantaneous hot water.

When entering the home for the second visit, the home felt a lot warmer than it had on the first visit. Ms A and her children were all dressed in fairly light clothing and the children seemed happy running in and out of rooms around the house.

In the end, after the work had been completed Ms A looked back and said that the whole scheme was “just brilliant”. She would gladly recommend it to a friend. Ms A no longer worries about the cost of heating her home and would not describe it as cold at all. Ms A is now also thinking of having solar panels put onto her home.

Ms A was asked what she thought about the Scheme’s process from applying to the Scheme until the work was completed. Ms A had some very understandable concerns in the beginning, brought about by lack of communication about the timeline and what processes would be taking place. Ms A worried about the extent of disruption to her home whilst the work was being completed. However, Ms A noted that she was very happy in the end; she had received a lot of advice about how to work her new system, the workmen cleaned up after themselves and all in all, although a long process, in the end a very efficient and easy one, “It took a long time but once it was done it was done”.

Ms A no longer worries about the cost of heating her home and would not describe it as cold at all.
11.4.1. A home fit for polar bears: Mr M in October 2011

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<td><strong>Existing Heating System:</strong></td>
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Mr M has lived in his second floor flat for around three and half years and, while his girlfriend sometimes stays over, he lives mostly by himself. The building used to be a house but has been converted into 3 flats. The flats are all heated by Economy 7 and there is no insulation in the property. During the researcher’s first visit with Mr M it was very obvious that Mr M was unhappy with his living situation and uncomfortable with the researcher having to come to his home. The first thing the researcher took note of on arriving at Mr M’s was how cold and damp it was inside the building, and inside Mr M’s flat.

Mr M is presently unemployed, and had heard about the project on a “fluke” when his friend (in the flat below him) told him that he was taking part in the Scheme. He was interested because the flat was cold, saying that the “house is barely liveable”. He spoke of a significant time during the last Christmas period when “ice formed on the inside of the windows”.

Mr M has Economy 7 heating, however as he explained “it was installed in the house during the 1970’s and doesn’t really work very well”. There are storage heaters in each of the rooms. Mr M has very high electricity bills which he struggles to pay.

Over the past 12 months Mr M has had to go without heating several times due to the expenses associated with trying to heat a cold and damp home with an inefficient system. He feels he is forced to stay in one room most of the time and sleep with four or five duvets over the bed in order to keep warm. That being said, he still manages to keep a sense of humour joking that polar bears would love it.

Mr M felt that regardless of the amount of money that he was investing in heating the home, it did not seem to make much of a difference. The feeling of lack of control, and inevitable low temperatures left Mr M feeling that heating was “a waste of £40 a week”. He feels he is paying for electricity “to heat a home that will not heat”. Mr M feels that this money could be spent on other things and thus does not budget for his electricity costs as he feels he cannot afford to. Mr M explained that the cold affects numerous aspects of his life. Socially speaking, friends and family would not come round very often to visit anymore. It was clear that discussing this factor made Mr M very distressed. He also explained that he felt his health was deteriorating. Mr M has only one kidney, and feels it is very important that he does not get sick too often; however over the last few months he has been to see his doctor with chest pains on a number of occasions. He also worries about the mould growth around his flat and what impact this may have on his health.

While he was eager to get his home “fixed up”, he felt his landlord wasn’t very interested in helping out. This was a significant barrier since he needed to get permission from his landlord for any retrofitting. Mr M felt that there is a lot which could have been done to the home in order to make it more “liveable”. He was hopeful that taking part would make the place warm and keep the heat in, which will in turn make him feel healthier and encourage his friends to come round more often.

11.4.2. Follow-up in November 2012

The property was referred to the Warm Homes scheme for Gas Central Heating with a GasSaver Unit to be supplied through Northern Exposure. However, these installations were postponed due to difficulties obtaining the landlord’s consent. Permission was granted several months later, after much correspondence between the Warm Homes scheme, NEA NI and the landlord. However by this time Mr M had decided to move out of the flat and therefore the referral was cancelled before any work was completed.

The living situation of this householder was less than ideal, causing the householder a great deal of stress resulting in him feeling unhappy and quite hostile. It was clear from the first visit with this gentleman that he was in need of assistance and having his home heating system replaced would have relieved a lot of his stress and anxiety as well as providing potential benefits to his overall health. Although Mr M no longer resides at this property, the problems relating to the insufficient insulation and heating system still exist for any new tenant.
**11.5.1. From loneliness to a warm welcome: Mr B in June 2011**

**Single Householder, Unemployed**

- **House Type:** Pre 1930's terraced house
- **Tenure:** Private renter
- **Existing Heating System:** Gas CH
- **Fuel Type:** Electricity and Gas
- **Payment Methods:** Prepayment Meter for both
- **Scheme Referred to:** Warm Homes
- **Measures Installed:** Solid Wall Insulation
- **Changes to Payment Method:** None

Mr B lives alone in his three bedroom terraced house in Belfast. Mr B rents his home from a private landlord and has lived at the property for only a few months. Mr B likes the area he lives in as his friends and family live close by and the area provides convenient access to the city centre, “it’s only a few minutes’ walk away”.

Mr B is currently unemployed and as this is his first year out of work since he started his career, he is finding it difficult. Mr B has always been a ‘working man’. Staying at home and being out of work makes him feel stressed and useless. He goes running as a way of keeping fit and occupied. Most of his current daily routine is made up of running, looking for jobs or catching up with friends.

Mr B heard about the Northern Exposure Scheme through his landlord, who had in turn heard about the Scheme through word-of-mouth. She suggested that he apply to the Scheme because he had already remarked that the home was very cold. She thought that the Scheme could help. “I found the winter very harsh”.

Mr B’s landlord later completed the application form herself for the property and became the first point of contact for NEA NI.

Mr B uses a Pay-As-You Go method to pay for his gas and electricity. He feels that this method is more manageable and works well for him. Mr B has found that he tops up quite a lot, especially on gas.

Mr B described the process of being involved with the Scheme, and his dealings with key workers as very easy, “anyone that I have met has been very friendly and helpful”. Mr B’s landlord has also communicated with him well with regards to scheme information. For example, he has been kept updated on timescales for key worker visits. He felt prepared for these visits and they have caused no disruptions so far. Mr B feels very positive about the whole experience to date.

He explained that a surveyor had already come to the home and assessed the property in terms of potential measures. This survey also revealed that the house was a solid wall property and therefore could not get cavity wall insulation. He hopes that when the work is completed, the home will feel warmer, and that he will save a little money along the way.

During the first visit with Mr B, the researcher found the home noticeably cold. Mr B seemed a little irritated when discussing his current unemployment and living situation. It seemed that being unable to control his unemployment exacerbated the problems associated with his thermal comfort.

**11.5.2. Follow-up in November 2012**

Mr B was referred to the Warm Homes scheme and received internal solid wall insulation, loft insulation and the hot water tank and pipes were also lagged. Afterwards, Mr B remarked that the "whole home feels much warmer". Mr B still uses a Pay-As-You-go Top up method for his Gas and Electricity, and he feels that he is paying less for both. During the winter months he sets aside £15 a week for gas and £10 a week for electricity (if he does not require substantial topping up of these savings when he needs to vend, this would mean he was consuming relatively little energy).

Mr B did explain that although the home does feel warmer, the back bedroom can still feel cold at times. ‘When they came to do the work, they could not do anything about the back bedroom and just had to leave it, I think it was already insulated, but not well’.

Mr B did note that when the measures were being put in place, this caused a lot of disturbance in the home. Mr B explained that there was a lot of dust caused by the work being done and the home became very messy. Mr B was worried that his electronic valuables such as his laptop would get destroyed “dust was everywhere”. Due to this, he gathered many of his valuable possessions and stayed with his mother while the work was completed. Mr B explained that "they did clean up after themselves", but moving out of his home was, he felt, a big disruption.

Mr B also noted that after the work was completed there were a few problems with a ‘cubby hole’ in the living room no longer opening and a leak occurred in one of the pipes. Mr B made the Scheme workers aware of these problems and found that they were quickly resolved. When Mr B was asked if
he received a Green Box with energy saving products or any energy saving advice he could not recall this. Mr B did say though that he feels that he has always been energy aware anyway, using energy saving light bulbs around the home and making sure to turn off lights and not leave things on stand-by.

Mr B also noted that since the work was completed through the Northern Exposure Scheme the landlord has also replaced the boiler from a Standard gas boiler to a Combination boiler. The home’s old radiators have not been changed but he feels the home heats up a lot quicker “it only takes about 15 minutes” and the instantaneous hot water has been a great benefit of the new system.

Mr B benefited greatly from having worked completed. That being said, the householder reported that he did not receive any energy advice or the Green Box of energy saving goods that should have been provided through the Scheme. Records indicate that these were provided to the household but due to the time lapse between Before and After interviews, it may just have slipped Mr B’s mind. This particular householder did not complain about this, being much more focused on the end result of insulation measures and a new boiler being put in place. The home’s domestic heating costs seem to have lowered according to the householder and higher levels of thermal comfort have certainly been achieved.

Mr B has also had more social visitors coming to see him than he did before the retrofit. Friends and family come to visit frequently and he feels comfortable that everyone will be warm enough. Mr B would gladly recommend the Scheme to a friend but feels that he would have to warn them first of all about the “mess” when the work is being completed.

Ms G is a retired lady who lives alone in an end row terraced house in Belfast. She rents the property. Ms G is very family focused. She is one of seven girls with most of her siblings living in and around the Belfast area. Ms G meets her sisters every Monday for a “cup of tea and a catch up”. Ms G also has two sons, a daughter, and two grandchildren. She is very close to her daughter and grandchildren noting that they would come to visit her on a regular basis. While her daughter and grandchildren live very close by, her two sons immigrated to Australia a few years ago. Ms G feels that she has found great friendship with her daughter over the years, probably because her daughter has become a mother herself, and even more so since her sons moved away.

Ms G has lived in her home for 13 years. She lived in Australia before this with her children but wanted to move home to be near the rest of her family. Ms G describes herself as having good neighbours and living in a nice area, although over the years Ms G’s original neighbours and friends have moved away to quieter areas of Belfast; “you have to be careful where you bring up your kids”.

Ms G normally spends her days at home alone or visiting her family. Ms G’s mother recently passed away which she has found very hard to deal with. Ms G describes herself as having “bad nerves” and at times can find it difficult to eat and sleep which she attributes to her mother’s death. The support of her daughter and family has helped her very much during her bereavement.

Ms G has oil-fired full central heating in her home. The house had double glazed windows installed in the front of the house a few years ago, but the rear of the home still has single glazing. The windows were installed by the landlord and his friend, and they are surrounded by a peculiar wooden border. Ms G feels that these windows were never put in properly. She explained that when there is a breeze and the window is closed, you can still see the blinds moving.
Ms G came to hear about the Northern Exposure Scheme at her local parish hall. She had seen a few flyers for the Scheme, and later a friend suggested that she should apply, and her local community forum helped with informing Ms G of all the necessary details regarding the Scheme. Ms G found the Northern Exposure process very easy and with her daughter’s help, she had no difficulties. She hopes to receive insulation to the walls and attic as this will mean the home will retain more heat so that she can feel more comfortable at home. Ms G believed that the work being completed will leave the place “a bit of a mess” and so opted to stay with her daughter whilst the work was being completed.

### Follow-up in July and November 2012

Ms G’s home received cavity wall insulation but only to the kitchen extension. Loft insulation was not included as the loft had been converted to another bedroom. Ms G was also referred for solid wall insulation but this was later cancelled as it was over the grant limit set for this under the Warm Home scheme. Mrs G also had both a SMART meter and a VPhase unit installed.

#### July 2012

When asked if she had noticed any difference in the temperature of the extension she explained “I think it has made an improvement, you could have hung meat in there before, no one wanted to go in there”. Ms G thought that during the summer the room felt warmer, although during the winter she did recall times that the extension was still a bit cold. Ms G also feels that there has been no improvement to her downstairs bathroom. She explained “I think it’s because it has a dirt floor so it may make it difficult to heat anyway”.

Ms G feels that the winter this year had been milder than in previous years, making it difficult to assess if the measures have made any great impact. Ms G was still using electric heaters around the home on some occasions but this is much less than before. She explained that she has also had problems with mould and damp in her living room. She pulled away one of her sofas to show the researcher the damp that was rising up the wall and mould growth. Ms G had papered her walls but because of the damp the paper had come off, “then I painted it but the paint came off too”. Ms G noted that she has frequently cleaned down the area where the damp and mould are developing but it continues to be a major problem. Ms G is afraid that it will eventually ruin her furniture.

When the home is heated by the central heating system, it maintains a good level of heat, but Ms G explained that the last time she had been able to use oil was December 2011 (7 months ago), because of the cost or refilling the tank. Ms G noted that she relies entirely on electric heaters placed around the home, making her electricity bills very high. However, Ms G worries more about her daughter’s energy needs more than her own; she lives close by and would spend around £40 a week on gas alone, “and you have to do all that before you eat”. Ms G worries that her daughter and grandchildren “have to go without” so she contributes to her daughter’s bills as much as she can. “I can live on a dozen eggs a week, so if it will help her, I will”. Ms G became very upset when explaining her daughter’s current financial situation and the struggle that is “heating or eating” for the family.

The researcher suggested that she may wish to have a pre-payment meter put into the home to make payments more manageable, but Ms G was not attracted by the idea. Ms G explained that if she did not top up her meter the electricity would turn off, this would not happen with a credit meter. Ms G pays her domestic bills every fortnight at her local post office, paying around £20-£25 on her electricity bills as this is what she can afford. “It all gets paid in the end even if I am robbing Peter to pay Paul”.

Ms G receives an electricity bill every quarter; her bill in July 2012 was for £311 and shocked her as this is almost double her normal quarterly bill. Whilst her routine of paying a set amount off her bill every fortnight was crucial in making this bill manageable for Ms G, the sheer fright of receiving it was a significant stressor. She spoke with some of her sisters about how high it was. Ms G’s sisters have energy needs more than her own; she lives close by and would spend around £40 a week on gas alone, “and you have to do all that before you eat”. Ms G worries that her daughter and grandchildren “have to go without” so she contributes to her daughter’s bills as much as she can. “I can live on a dozen eggs a week, so if it will help her, I will”. Ms G became very upset when explaining her daughter’s current financial situation and the struggle that is “heating or eating” for the family.

The researcher was very concerned about Ms G’s living situation, when visiting the household. The home felt incredibly cold. Although Ms G had a good sense of humour about the situation, it was clear that the circumstances were very upsetting. The matter was referred through to NEA NI. The project coordinator called out with Ms G in order to investigate the very high electricity bill.

Over time, the reason for this high bill became clearer, and her Smart meter was particularly useful in unravelling the cause. Some months earlier, the meter reader called to read her meter for the January to March period. Ms G was not home. Although she was left a card asking her to send in her reading, she had not responded to this. In fact, it would have been difficult for her to read her consumption...
by herself, since the University of Ulster had not included guidance on reading a credit meter in the
IHD manual. Ms G’s quarterly bill for January to March had, therefore, been estimated. In the event it
was a very low estimate. She was home for the next meter reading and her quarterly bill for April to
June included a correction for the Winter underestimate. Up until this point, problems with mould
had been her chief concern related to electric heating. However, the reliance on electric heaters was
also responsible for the trebling of her electricity bill; this had gone undetected because of the missed
meter reading, and so only appeared in her July bill.

NEA NI contacted the Northern Ireland Oil Federation (NIOF) and explained Ms G’s circumstances. As
a one-off gesture due to the hardship she was facing at the time, 145 litres of oil were delivered to Ms
G and paid for by NIOF. This was delivered in August 2012, but had been used at the second follow-
up in November 2012. This was greatly appreciated by Ms G in a time where she was facing financial
difficulty.

The team were able to show Ms G her electricity consumption since November 2011 (see Figure
11.1). The dotted line reflects outdoor temperatures expressed as degree days (the standard
metric representing indoor heating demand). Ms G’s electricity use tracks heating demand much
more tightly than does the average for other customers, making it most likely that the increased
consumption was related to her use of electric heaters. Whilst little more than cold comfort, the Smart
meter data could be used to explain the cause of Ms. G’s predicament, and provided an opportunity
to support her into considering saving for oil in the same way as she saved for electricity, in order that
she could revert back to her oil-fired central heating system.

What is perhaps of even greater concern is the extent to which Ms G has culled her electricity
consumption since this unfortunate event. Analysis of her half-hourly consumption indicated that Ms
G has cut her baseline consumption (between midnight and 06h00) by more than half; her baseline
consumption became the lowest of any of the 56 customers in the Smart Meter Trial. Furthermore
her consumption for September and October 2012 was 184 kWh and 194 kWh respectively, compared
with the average for all participants in the trial of 369 and 380 kWh respectively.

**November 2012**

A second follow-up visit was arranged because of Ms G’s particularly stressful circumstances, in order
to ensure that matters felt more manageable for her. Ms G remarked that her electricity bills had
become a lot more manageable and had almost reduced by 50%. When the meter was last read,
(October 2012) Ms G’s quarterly bill for electricity was £107, which she had saved in the Post Office for
this purpose. This gives some indication of the low level of electricity consumption in Ms G’s home,
since it is less than £1 a day. The fact that Ms G uses electric heaters much less will have contributed
greatly to this reduction since the top up of oil from the NIOF meant she had used her OFCH system
instead of electric heaters.

Ms G commented that her SMART meter and In-House Display were good to have in the home. She
noted that she would keep a good eye on the Display as she likes to know what she is using. Ms G
thought that taking part in SMART was worthwhile. She liked the energy saving goods she received,
and now uses energy saving light bulbs in all rooms of her house. Ms G feels that she has always been
energy aware but since taking part in SMART she is taking more precautions to ensure she uses less
electricity “I turn lights off everywhere now if I’m not using them…I have been telling my daughter
and grandchildren too”.

Ms G found that although the VPhase installation process took a few hours, it did not really disrupt her
home. Ms G explained that when the engineer had come out to install the VPhase unit he had found
a number of problems with her electric wiring. Ms G had noticed herself that there was a buzzing
noise coming from some of the electrical sockets in the home and thought this was a problem.
The electrician contracted to undertake the VPhase installation carried out an electrical inspection
in Ms G’s home. As a result some of the switches had to be replaced and other electrical work was
undertaken before the VPhase unit was installed. Ms G was very glad the engineer could help, and this
is now less of a worry.

At her November visit, rooms felt noticeably cold to the researchers, and Ms G was dressed in a heavy
robe over her clothes. She continued to rub at her hands for warmth throughout the interview.
The home also had a distinct smell of oil around the rooms; Ms G explained that her oil tank had
developed a leak. Ms G has decided not to top up her oil for the winter just yet. “It is £315 for 500
litres of oil”, and Ms G feels it would be a waste for it to lie around the back garden, “there is oil in the
puddles out the back…it’s all over the place”. Ms G feels she will have to order oil soon as her whole
family are coming to visit over the Christmas period.
Ms G feels that being part of the Northern Exposure Scheme has been greatly beneficial, and she was very grateful for the help she has received. It is obvious when meeting Ms G that she takes great pride in being self-sufficient when she can, and views all situations in life with a healthy sense of dark humour. Ms G is clearly also a very generous woman and, quite literally at all costs, takes care of the well-being of her family before her own. Ms G has faced a number of difficulties in the past few years, many of which relate directly to her current living situation, “Sometimes you feel that you are just beating your head against a brick wall”. With good reason, Ms G does not see the value of investing her own scarce resources in her home’s heating system as the return would be minimal. As a result Ms G continues to live in a state of thermal discomfort.

Chapter 12

Evaluation conclusions

12.1. Recap of aims and approach

As indicated in Chapter 8, the University of Ulster was commissioned to evaluate the impacts of Northern Exposure’s fuel poverty interventions. Impacts were defined as being:

- impacts of the fuel poverty interventions on the health and wellbeing of residents
- impacts of the interventions on the energy consumption of residents.

Impacts were defined as impacts on:

- self-reported changes in the health and wellbeing of residents
- self-reported changes in energy affordability.

Assessment of impacts was based on two types of evaluation:

a) before-and-after surveys of residents, which were carried out with all consenting households that had participated in NEA’s Northern Exposure intervention (n = 30)
b) a set of case studies, involving home visits to consenting residents both before-and-after they have received interventions (n = 6).

These 2 types of evaluation permitted Ulster to assess user-perspectives only. In other words, there was no undertaking to monitor actual health status before and after intervention (e.g. through monitoring actual or documented repeat prescriptions, GP consultations, or days spent off work through illness, etc.). Similarly, energy consumption before and after retrofits was based on self-reported estimates rather than comparison of utility bills, with the exception of a very small sample of customers for whom electricity consumption could be objectively assessed through Smart meters. Mini-Trials of new technologies contained very small samples, and could not be expected to yield substantial data, other than in terms of how customers found having these devices in their homes.

Reliance on self-report is not uncommon in evaluations of the impacts of tackling fuel poverty, since energy consumption over a period of 1-2 years is governed by many factors that cannot be controlled. These include differences in the weather from year to year. Table 12.1 indicates how weather is likely to have affected heating demand for many of the participants in Northern Exposure. It documents the
degree days for the 4 winter months of 2010/2011 and the same months a year later i.e. the winters before and after retrofit respectively. Temperatures during the winter prior to retrofit were associated with a significantly greater heating demand (35% more) than the winter after retrofit. It is likely that, on this basis alone, Northern Exposure participants would have used less energy for heating their homes in the year post-retrofit.

### Table 12.1: Degree days for the winters before and after retrofit

<table>
<thead>
<tr>
<th>Degree days</th>
<th>Dec 2010 - March 2011 Winter before</th>
<th>Dec 2011 - March 2012 Winter after</th>
</tr>
</thead>
<tbody>
<tr>
<td>December</td>
<td>484</td>
<td>296</td>
</tr>
<tr>
<td>January</td>
<td>406</td>
<td>284</td>
</tr>
<tr>
<td>February</td>
<td>231</td>
<td>241</td>
</tr>
<tr>
<td>March</td>
<td>270</td>
<td>207</td>
</tr>
<tr>
<td>Winter totals</td>
<td>1391</td>
<td>1028</td>
</tr>
</tbody>
</table>

Source: Vesma, 2012.

There are ways around this difficulty. Baseline data on actual energy consumption prior to retrofit can be prospectively modelled to estimate heating demand and energy need for the following winter, controlling for degree days. However, few studies have undertaken this depth of analysis, largely because temperatures are only one of many sources of annual variation in domestic energy consumption. Others include:

- changes in household activities
- purchase of more appliances and equipment
- replacement of old energy-inefficient equipment with newer efficient models
- changes in time spent away from home e.g. at work or on holiday
- children being born, and residents passing away (both of which were not uncommon experiences in the Northern Exposure sample).

### 12.2. Recruitment

Signing up participants for the Northern Exposure project proved to be more difficult than anticipated, and took considerably longer than planned. The first participants were recruited in June 2010 and the last in October 2011. This is not unusual. Similar problems in recruitment were encountered in the larger Smart meter trial that ran alongside Northern Exposure, as well as in the OFGEM-approved 2011 trial of VPhase units, and the CSE’s 2012 solid wall insulation project (all of which are referred to in more detail later on). In times of austerity, and when Utility companies are especially distrusted, it is difficult to recruit participants. Nowadays too, all elements of best practice need to be followed for obtaining informed consent, and these are often formidable and somewhat off-putting for people considering taking part in “experiments”.

In future Trials, more effort and investment of resources may need to be set aside for intensive recruitment drives during the first few months of the project. Where funders are concerned, a greater awareness of these difficulties with recruitment is also needed, since this has important consequences for the time and funding required to gather (and retain) a sample of sufficient size.

In terms of retention, there was considerable drop-out of participants between the before and after surveys, with 48 baseline surveys completed but only 30 completed post-retrofit. In some cases, this was because participants had passed away, or had moved home, but in others it was because participants declined to be re-surveyed. The Trial offered no financial incentives to participate, and it is possible that future Trials of this nature might need to offer these so as to ensure an unbiased body of evidence that includes the views of virtually all those who enrol in a programme.

However, most of the participants that were recruited into, and then stayed with the Trial were clearly classifiable as vulnerable clients. Consumer Focus (2012) identifies 9 classes of vulnerability:

- Lack of self-confidence
- Low financial capability
- Low or insecure income
- Unemployment
- Caring responsibilities for infirm people
- Physical impairments
- Mental health difficulties
- Private renting
- Lone parenting.
The six case studies alone highlight indicators of all 9 of these, demonstrating quite clearly the extent to which people in vulnerable positions are often multiply vulnerable at any one time.

Recruitment events in central locations were a major part of the initiative to find participants. Yet what emerged from the case studies was the extent to which participants joined the scheme as a simple result of a friend or neighbour suggesting the scheme. Four of six case studies were recruited into Northern Exposure in this way. Word of mouth is a vital aspect of recruitment and one which is seldom harnessed to full effect. Ensuring that “good news stories” reach the media ahead of recruitment into new schemes (rather than afterwards as is more customary) is a strategy worth exploring in the future. This approach was followed by Kirklees Borough Council before it undertook retrofitting programmes, and their environmental health team estimate that there was a period before launch when they spent more time on radio and television than they did in their offices (Liddell et al., 2010).

In this context, Ms A’s case study also illustrates the potency of “bad news stories”. Ms A’s past experiences of retrofitting left her and her family in extreme distress at the thought of impending doom and destruction the night before the work was due to start. The family’s manifest delight post-retrofit came as a welcome, though not altogether surprising, antidote – not surprising because the Warm Homes scheme is now 12 years old, and Scheme managers have achieved a near immaculate record in terms of quality of installation and post-installation customer care.

That being said, there is no doubt that much of the retrofit work was disruptive and dirty; it required fortitude from residents, which may be a matter that they could be better prepared for in future Trials. Three of the six case studies moved out while the work was being done, and any opportunities for this should always be explored with applicants at the time of their enrolment into retrofit schemes. Making sure that people know what to expect at all times is not only common sense, but should also be a mandatory requirement for energy efficiency agencies. As the case studies illustrate, there are still many gaps to plug in this context, with householders sometimes feeling bombarded with visits from people who did not sufficiently identify themselves or the purpose of their visit.

Word of mouth strategies and good news stories could also be usefully extended into the domain of private landlords. The case studies provide us with excellent examples of both “good” and “bad” landlords. Mr M and Ms G endured the latter, whilst Mr B was encouraged to apply by his landlord and then supported by her throughout the process. Promotional campaigns which focus on landlords and their tenants are, as yet, underutilised in Northern Ireland, as are the roles which local City, District, and Borough Councils could play in developing a more organised approach to attracting landlords into retrofit schemes of this nature.

12.3. Impacts on wellbeing

The wellbeing measure selected for this evaluation (WEMWBS) proved to have exceptional psychometric quality. Reliability scores indicated high alpha coefficients (α= 0.90 and 0.92 at T1 and T2 respectively), where the maximum coefficient is 1.00 and any score exceeding 0.70 is considered psychometrically acceptable. Its single factor structure was also confirmed. High reliability and coherent factor structure jointly mean that the before and after scores derived from WEMWBS can be deemed both reliable and robust.

This strengthens the confidence with which the before-and-after wellbeing scores can be interpreted. A maximum score of 70 was possible, which would indicate the highest level of mental wellbeing; scores before retrofit averaged 44. This suggested that participants in the survey had rather poor mental wellbeing status before retrofit. Post-retrofit, wellbeing scores had increased to an average of 50, with a closer clustering of scores.

Not everyone’s mental wellbeing score increased between T1 and T2. Improvements were evident in 20 participants, with 1 participant showing no change, and 9 showing a decline. Decline over time was to be expected for some of the people who responded to the Survey, not least of all because some had been newly diagnosed with serious illnesses in the T1 to T2 interval, or had experienced substantial declines in their health in the interval as a result of long-standing serious illnesses. For these participants, improvements in wellbeing could not have been expected. However, across the 30 participants, levels of decline were less extreme than were trajectories for improvement in wellbeing. The highest deterioration in before- and after- wellbeing scores was 7 points, whereas the highest improvement was 20 points.

As indicated in Chapter 9, a paired-sample t-test indicated that the overall difference between T1 and T2 scores for mental wellbeing (44 at T1 and 50 at T2) was statistically significant, and at the highest level of probability (p = 0.000, where any p value lower than 0.05 indicates significant effects). Despite being a very small sample, improvements in wellbeing were both consistent enough and large enough to pass a stringent test of statistical significance. This suggests that the wellbeing impacts of retrofits are very consistent, having the capacity to cut across age, gender, demographics, energy use patterns, personal circumstance, and household composition.

In other words, improving the energy efficiency of a home through retrofitting is associated with improvements in wellbeing that are significant despite small samples, variations in who lives in the home, and in how they use energy. In this context, though a small study in both size and scope, the Northern Exposure evaluation confirms the findings of national studies such as the Warm Front evaluation for England and Wales (Gilbertson et al., 2012), the Scottish Central Heating Programme evaluation (Platt et al., 2007), and the HIHS evaluation in New Zealand (Howden-Chapman et al., 2007).

The WEMWBS was designed to have a single factor structure, and the Northern Exposure data confirm this structure; as such it is slightly unorthodox to carry out an item-by-item analysis. However, this
is nevertheless illuminating because improvements were most notable in particular areas of mental wellbeing, especially those to do with mood and disposition (see Table 9.3). Retrofit was associated with improvements in general outlook, more-so than it was with how respondents related to other people, or with how they coped with new experiences, or problems. Their everyday worlds and the challenges they encountered remained the same, but they framed these in a more positive light.

When viewed in the context of regional averages, these results indicate that participants moved, on average, from below the regional mean for Scotland (in other words their mental wellbeing was below average before retrofit) to being at the regional mean.

Having said this, the six case studies offer important additional insights into mental wellbeing. Case studies convey the extent to which participants actively sought solutions to problems and challenges:

- Ms G replaced doors and a floor in her home when the landlord proved elusive, and lived on a dozen eggs a week in order to make ends meet;
- Mr B took up running when he lost his job in order to find something constructive to fill his day;
- Mrs E explored financial solutions with her family when bills seemed insurmountable;
- Mr M packed his belongings and moved home when the landlord did not consent to a retrofit.

The case studies give no indication of people who had given up, or who felt without the ways and means to find solutions.

Participants in Northern Exposure were dealing with bereavements, illnesses, burst pipes, leaking oil tanks, redundancy, loneliness, and probably many more undisclosed stressors.

The grinding worry associated with energy bills was one stressor among many for most of them; it was, however, a problem unlike many others in that it had a solution. It is deeply regrettable that so many Northern Exposure participants were turned down for assistance because of limited funds in government and commercial schemes – schemes that were meant to support people precisely like them.

UK-wide, there is now convincing evidence that the easier and cheaper measures for tackling fuel poverty are being over-subscribed to. Recent evidence from the Committee for Climate Change, for example indicates patterns illustrated in Table 12.2.

<table>
<thead>
<tr>
<th>Type of retrofit</th>
<th>Goal</th>
<th>Completed</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loft insulation</td>
<td>1.6M</td>
<td>3.1M</td>
<td>49% over-subscribed</td>
</tr>
<tr>
<td>Boiler replacement</td>
<td>3.0M</td>
<td>3.6M</td>
<td>20% over-subscribed</td>
</tr>
<tr>
<td>Cavity wall insulation</td>
<td>1.8M</td>
<td>1.6M</td>
<td>11% under-subscribed</td>
</tr>
<tr>
<td>Solid wall insulation</td>
<td>200,000</td>
<td>39,000</td>
<td>81% under-subscribed</td>
</tr>
</tbody>
</table>


12.4. Routes to mental wellbeing effects

Confirming the impacts of retrofitting on mental wellbeing is not sufficient on its own, since this does not move understanding further on. What contributes to this improvement in wellbeing? Using the Northern Exposure data, it was possible to test the role of a number of potential contributors, including seasonal confounding, improvements in physical health, changes in a variety of indoor environment measures, and improvements in energy affordability.

12.4.1. Seasonal confounding

People were recruited into Northern Exposure over a period of 16 months, and were not always able to be surveyed and re-surveys in the same season. One of the most obvious explanations for improved mental wellbeing might be that most before surveys were carried out in the depths of winter, whilst most after surveys were gathered during much warmer periods of the year. Seasonal differences in mood and disposition are well documented, even among people who display no clinical symptoms of seasonal affect disorder. Further checks indicated that:

- 14 participants completed a T1 survey in winter and a T2 survey in summer;
- 5 participants completed a T1 survey in summer and a T2 survey in winter;
- 11 participants completed their T1 and T2 surveys in the same season.

Hence 14 participants might have shown a confounding seasonal effect, with 16 being unlikely to have done so. Seasonal confounding was further assessed using a one-way analysis of variance test with change in wellbeing scores as the dependent variable (i.e. T2 – T1 scores for wellbeing), and three levels of season as the independent variable (i.e. same season at T1 and T2, T1 winter-T2 summer, and T1 summer-T2 winter). This indicated no statistical difference between the change scores for the 3 groups ($F (df 2,27) = 1.15, p = 0.33$).
Hence, there is almost no likelihood that the improvements in mental wellbeing scores could be accounted for by seasonal confounding.

12.4.2. Changes in self-reported physical health

Some (but by no means all) studies assessing retrofit impacts have reported improvements in self-reported physical health post-retrofit; these are more likely to emerge where participants have respiratory problems such as asthma (Howden-Chapman et al, 2009). In this context, it is worth reiterating that almost all (26 of 30) participants in Northern Exposure, when surveyed before retrofit, said that they hoped to experience improvements in their physical health post-retrofit. Since 11 family members in Northern Exposure households had problems associated with asthma, there was some possibility that improved mental wellbeing scores might have emanated from improvements in physical health. This possibility was not supported when changes in physical health status were assessed using a paired sample t-test; mean ratings of health were low before retrofit (averaging 6.1), and remained so after retrofit (averaging 6.2).

This is not surprising since, as indicated earlier, the Northern Exposure sample consisted of several participants who were already in declining health at T1, or who became so before the T2 survey. This is reflected in the pattern of individual change scores between T1 and T2, where:

- 8 of 30 participants showed no change in physical health score between T1 and T2
- 10 showed a decline in health score between T1 and T2, of which most (n = 7) declined by 1 point
- 12 showed an improved rating, of which half were improvements of 1 point.

In other words, one-third of participants reported a decline in physical health between T1 and T2. Even where respondents did report an improvement, half were very modest improvements.

These results are important in the context of managing customer expectations. In the past, improvements in heating and insulation have been widely proclaimed as leading to better physical health, especially for people with respiratory or cardiovascular problems. The likelihood of such improvements are, however, still contested, as some studies (including the present one) return non-significant results for physical health. A recent meta-analysis of these studies found that hardly any confirm clinical changes in physical health (e.g. Liddell & Morris, 2010). This should not be taken to imply that there are no physical health benefits from tackling fuel poverty, merely that these are taking longer to identify and understand than was previously anticipated. Also noted earlier, the link between smoking and lung cancer, first speculated on more than 50 years ago, took more than a generation to establish beyond reasonable doubt. Links between fuel poverty and physical wellbeing almost certainly do exist; however they are difficult to find and require more studies to clarify in terms of extent and duration of impacts. In the future it may be appropriate to calibrate public health messages aimed at encouraging uptake of fuel poverty measures, so that public expectations more accurately reflect what we can, at present, deliver through retrofit programmes. This revolves around better mental wellbeing through a combination of thermal comfort and reduced worry about the affordability of heating.

In conclusion, there is no evidence that improved mental wellbeing post-retrofit was a direct result of improvements in physical health. Nevertheless, it is important to note that some of the participants who did not complete T2 surveys had passed away in the interim and many were manifestly unwell. This predominance of poor physical health and the seriousness of many of the illnesses people were coping with highlights the extent to which Northern Exposure had succeeded in recruiting an above-average number of participants who were at their most vulnerable, and therefore most in need of a warm and comfortable home. All of the recipients of the Programme appear to have been well targeted and manifestly in need of the assistance which Northern Exposure was able to deliver.

12.4.3. Changes in attachment to home

As with all the other off-the-shelf measurement instruments used in this evaluation, the psychometric properties of the Attachment to Home Scale proved to be excellent, yielding results that are likely to be reliable and robust. There appeared to be no change in respondents’ attachment to home, which was low at T1 (13.27 out of a maximum score of 30) and remained low at T2 (12.70). Participants were, in the main, living in homes for which they felt little affection or attachment. This may in part reflect the relatively high proportion of participants who were living in privately rented accommodation.

There is no support for the possibility that improved mental wellbeing scores were associated with people feeling more attached to their home post-retrofit.

12.4.4. Changes in indoor environmental quality

Not all householders expressed dissatisfaction with their indoor environment before retrofit. However, 11 householders had problems with damp at T1, and this proved to be a stubborn problem that was almost unaffected by retrofit (only one respondent reported improvement). A failure to resolve damp problems has been noted in other retrofit impact studies, which is of concern because many householders express the hope that damp will be resolved through improvements in heating and
insurance (Liddell & McKeegan, 2010). This represents another area of public misunderstanding, since the effective treatment of damp cannot be achieved through conventional fuel poverty measures. Making this clear to people who are contemplating retrofit is another aspect of ensuring expectations can be reasonably well met.

Although damp remained a problem for those troubled by it before the intervention, many other aspects of indoor environmental quality improved post-retrofit:

- 6 out of 10 householders who had mould at T1 reported less mould at T2
- 5 of 9 households who had problems with condensation at T1 reported fewer problems at T2
- 5 of 7 who were dissatisfied with their indoor air quality at T1 were no longer dissatisfied at T2
- 7 of 8 who were dissatisfied with indoor ventilation at T1 were no longer dissatisfied at T2.

These are substantial improvements in indoor environmental quality for the subset of participants who had indoor environmental quality problems at T1. The case study portfolio illustrated well the sorts of problems which mould, in particular, created for householders. Participants reported clothes becoming mouldy in wardrobes, wallpaper and paint peeling off walls within a short time after redecorating (itself an expensive undertaking), and sofas becoming stained with black mould spots.

However, given that participants who had problems with indoor environmental quality represent a minority of the full sample, it is unlikely that indoor environmental quality is the primary driver of improved mental wellbeing scores for the group as a whole.

12.4.5. Changes in thermal comfort

As outlined in Chapter 9, all 30 respondents at T1 indicated that they hoped the retrofit would leave them with a warmer home; enhanced thermal comfort was, therefore, a universal expectation. At T1, results from the ASHRAE scale indicated that most participants experienced few thermal comfort problems during the summer months – they were neither too hot nor too cold. They were, most often “fine” in terms of thermal comfort (a score of 2.5). In winter, by contrast, they were most often “too cold” (a score of 2.6), and virtually none of the participants had ever felt too warm indoors during winter.

After retrofit, summer scores remained most often “fine” (a score of 2.5 again). For winter, scores now also clustered around a rating of “fine” (a score of 3.1). Statistical testing indicated a significant improvement in thermal comfort for winter, but not for summer. In terms of tackling fuel poverty, and based on a baseline of satisfaction with summer thermal comfort, this is precisely the result that would have been hoped for. People were not experiencing summer over-heating as a result of improvements in heating and insulation, but they were experiencing warmer conditions in winter.

This is the first indication of a sample-wide change in conditions which could be associated with the improvements in mental wellbeing. How such a relationship might come about merits further exploration. Figure 12.1 indicates thermal conditions in a typical low income end-of-terrace home before a conventional retrofit.

**Figure 12.1: Outdoor temperatures and indoor variations in temperature in a typical 1947 end terrace before retrofit** (Sunnika-Blank et al., 2012a)

A number of features merit attention:

- the extent to which indoor temperatures throughout every room of the house are responsive to outdoor temperatures, clearly reflecting the extent to which an energy inefficient home lacks sufficient protection from conditions outdoors
- the range of temperatures which the inhabitants experience in the average week, with indoor temperatures moving between 10°C and 27°C. Even the core temperature range sits between 16°C and 22°C, a range of more than 30%
- The extensive heating and cooling demand that would be required in order to achieve a steady thermal state throughout a home of this nature.

Sunnika-Blank and colleagues comment on the extent to which inhabitants of the household were bothered by these fluctuations, and these temperature data offer an important insight into how poor the level of thermal comfort is in many average UK homes. When these conditions persist for many months on end, year on year, as they do in Northern Ireland, and when maintaining satisfactory
warmth would require so much effort and expense, it is not surprising that the improvement in thermal comfort which householders hoped for (and achieved) by participating in Northern Exposure has led to such strong associations with improved mental wellbeing.

Even post-retrofit, several of the homes were still too cold for real comfort, indicating that more needs to be done before some of the homes can be considered fully fit for habitation. Retirement, ill health, and redundancy had all meant that most of the case study participants were spending more time in their homes than they had previously, and all of these life changes were in themselves risks for mental and physical wellbeing.

The Northern Exposure case studies at baseline are especially helpful in illustrating the extent to which households had to “work” to attain thermal comfort. Mr J, an elderly man of limited means spent increasing amounts of time sourcing and chopping up free wood pallets, and had invested in a second wood burner between baseline and follow-up visit, using his free time to restore it to functionality. All of the case study participants gave the impression that thermal discomfort was a matter they were constantly trying to fend off, whether through going without food (living on a dozen eggs a week so as to save money to pay for more heat), or asking family members for assistance with bills, or in extreme cases such as Mr M’s packing up and moving. A cold home distressed all in our case study group, for some of whom the main stress came from not feeling able to have friends and family members visit them at home. Some apologised to the researcher for the cold conditions, and it was sometimes difficult for the researcher to sit without a coat on when taking notes for the case study portfolio.

The case studies also illustrate the extent to which homes become a shrunken resource for people if the house is too difficult to heat. Most of the case studies describe shutting off spare rooms that are too cold in winter, and our interviewees described conditions in colourful terms: rooms where one could hang meat, rooms which are like fridges whilst others are like freezers, and homes that would appeal to a polar bear. This dark humour is accompanied by accounts which reveal that even essential parts of their home become intolerable, such as bathrooms and children’s bedrooms.

As indicated in previous chapters, few studies are able to detect significant energy bill savings in circumstances where self-reports can be checked against data on actual consumption (e.g. Grimsley et al., 2012). Whilst consumers customarily believe that retrofitting saves them money, it seldom does. This is particularly so for low income customers, where rebound effects (“spending” potential savings on purchasing extra energy) are prevalent (e.g. Chitnis et al., 2012). It is likely that the inarguable improvements in energy efficiency which retrofits permit are perceived by residents as improvements in their bills; in fact the improvements are probably more often located in their satisfaction with the energy they are paying for.

Evidence from the recent Irish trial of Smart meters provides corroborating evidence in this context. Table 12.3 illustrates the difference between customer estimates of savings and actual bills.
In terms of overall bill, customers thought they had saved more than double what they actually had saved, and in terms of consumption, they estimated a reduction that was 4 times greater than it actually was.

A second study by Sunnika-Blank and Galvin (2012) is also informative in this context. This study compared:

- how much energy a home could be expected to consume (based on its energy efficiency rating).
- how much energy was actually consumed.

For homes that were highly energy efficient, the amount actually consumed was 17% lower than the expected consumption estimate. However, for homes that were energy inefficient, actual consumption was 60% lower than it should have been, based on what the house required in order to achieve a healthy level of thermal comfort. The same pattern of results has recently been reported for New Zealand households, where low income households under-consume energy in a range between 28% too little and 66% too little (O’Sullivan, 2012). In harmony with this finding, Milne and Boardman (2000) also report significantly greater rebound effects among low income households than among high-income households.

The likelihood that participants in Northern Exposure have chosen to invest in putting more heat into their homes post-retrofit is, therefore, especially likely. It lends even more support to the argument that people living in fuel poverty should not be expected to make significant contributions to energy demand reduction or to carbon savings. As noted by many other researchers (e.g. Chitnis et al., 2012), customers may choose to use the same amount of energy post-retrofit, but in ways which provide them with an improved quality of life. In the case of the Northern Exposure participants, this appears to have been in increased thermal comfort, rather than savings. As Chitnis and colleagues note: “the higher rebound for low income households should not be regarded as a problem”.

A new study by the Centre for Sustainable Energy (CSE, 2012) indicates the extent to which financial savings are rather limited even when deep retrofits such as solid wall insulation are installed. Figure 12.2 indicates the percentage spend of income on heating for 10 homes which were retrofitted in this way. As the researchers remark, even this level of deep retrofit removed only one of 7 households out of fuel poverty. Inspection of Figure 12.2 also suggests that, for 7 of 10 households, the reduction in percentage of income spent on energy was 2% or less. Given the excellent insulation qualities of solid wall insulation, this means rebound effects were almost certainly at work, with participants choosing more heat and thermal comfort over financial savings. Earlier, Hong et al. (2006) found the same pattern of “comfort-taking” in a larger study of Warm Homes participants in England and Wales.

![Figure 12.2: Spend on energy before and after solid wall insulation](image-url)

Earlier studies suggest that participants seldom distinguish between monetary energy savings and a more efficient investment in energy. However, this derives in part from the types of questions researchers have asked them. “Do you think you have saved any money on energy bills since the installation?” is a generic question that leaves a great deal to the respondent’s imagination. In the present study, we aimed to minimise the risk of confounding perceptions with reality by:

- asking much more specific questions
- asking these both at baseline and after retrofit.

This approach required much less guess work on the part of participants. Hence we included 8 questions on energy affordability (see Table 9.5).

Results indicated that for 3 of these 8 questions, respondents answered significantly differently after retrofit, indicating that, post-retrofit, they had:
In other words, the findings confirm what others have found: residents had been able to afford other items more post-retrofit. Furthermore, they had gone without heat less often, and they felt their home was running at a higher temperature (which had also been confirmed by their responses to the ASHRAE scale).

Of the 30 participants in the Northern Exposure Trial, 6 had gone without heating “often” or “very often” in the winter before retrofit, as a result of not being able to afford it. No participant had done so post-retrofit. Whether these responses reflected the fact that respondents felt it was worth investing in energy that was not wasted so much post-retrofit, or whether they were indeed saving on energy bills, remains unclear. One of the case study participants described his pre-retrofit investment in heating as “£40 a week wasted”, and another described the heating “being held in the house” more post-retrofit, both of which reflect issues related to value for money. Whatever the impact, energy had become more affordable for them, whether as better value for money and/or as a result of lowered consumption.

12.5. The mini-trials: Smart meters and VPhase units

The Northern Exposure programme sought to make use of “converging technologies” as far as possible. In other words, it attempted to combine multiple energy efficiency interventions into single packages. These are particularly recommended for clients on low income and in vulnerable positions (Consumer Focus, 2012), and Smart meters and VPhase units were an excellent example of this. In future Trials, a larger deployment of both Smart meters and VPhase units could help unravel this longstanding difficulty of establishing what the balance is between customers saving money on energy and customers spending more or the same but perceiving more value for money in their energy spending. Although both were used as part of a mini-Trial in Northern Exposure, results are not substantial enough to help unravel this important distinction. Both mini-Trials do, however, merit evaluation in terms of preliminary learning and their potential for future research in Northern Ireland.

12.5.1. Smart meters

Introduced at short notice, and involving only 5 participants for 12 months, it is difficult to conclude whether the combination of early customer support and on-going opportunities for feedback from the in-house display yielded any significant savings. GB and Irish Trials suggest that more is needed than early support and in-house displays for feedback. Financial incentives (such as time-of-use tariffs), and/or more detailed quarterly bills that incorporate customer comparisons and target-setting were required in order to generate significant savings on electricity use. These can save between 3% and 10% for customers, averaging 5% overall (e.g. CER, 2012). Where incentives and targets are then withdrawn, consumption tends to regress to baseline levels (Darby, 2012).

Given that no financial incentives or target-setting was introduced for the Smart meter customers in this mini-trial, it would have been ambitious to have expected sustained savings over the 12 month period. Given also the size of saving that such Trials lead us to expect, and the variability in domestic energy consumption across all households, it is widely recognised that Trials containing thousands of customers are needed to detect impacts (Darby, 2012).

The question must also be raised as to whether reductions in electricity consumption were ethically appropriate for these 5 customers. Figure 10.2 highlighted how little electricity the Northern Exposure customers were using, when compared with the rest of the Smart meter trial customers: they consumed 16% less electricity over the year of the Trial than did the other 51 customers. It is possible that the 5 Northern Exposure clients who were using Smart meters were already paring their consumption down to levels that held little additional opportunity for saving.

This is an important consideration in any Trial of energy efficiency products, although few such Trials have begged the question: should we press all customers to save money, even those whose baseline consumption is already extremely low? In this context, the Northern Exposure mini-trial has been invaluable in illustrating the extent to which participants in the project were indeed likely to be vulnerable people, many of whom were under-consuming electricity at rates that indicated risk. The results demonstrate quite clearly the potential of Smart meters for helping Utilities and fuel poverty agencies identify households that are most in need of protection.

At a more general level, the 5 smart meters were installed with due regard to a wide range of best practices, and these merit noting here. The deployment took heed of the recently published findings from Smart meter trials in Ireland and Great Britain (GB), which highlighted the importance of providing customers with support at the time a meter is installed, as well as soon thereafter so that any emerging problems or queries can be resolved early on. As part of the learning from these Trials, DECC outlined the requirements for a licence backed Smart Metering Installation Code of Practice (SMiCoP). The current draft of this states that:

“The Smart Metering Installation Code of Practice specifies the standards for Code Members to follow in relation to the Customer facing aspects of the installation of Smart Metering Systems.”
The aim of the Code is for the Customer experience of the installation process to be positive, to protect Customers during the process, for Customers to be given appropriate assurances over what will take place during the installation process, and to facilitate longer-term behavioural change necessary to deliver programme benefits.” (DECC, 2012b).

To adhere to aspects of the Draft SMICoP, NEA NI devised and led a training programme for NIE meter installers, aimed at ensuring customers knew from the start what Smart meters were and how to operate their IHD. The one-day training programme improved installers’ understanding of effective communication with vulnerable customers, especially around the potential anxieties customers might feel about this new technology being installed in their homes. NEA NI and University of Ulster also designed a series of booklets that the installers left with the customer, including who they should contact if they had queries, and a ‘How to use the IHD’ booklet written in plain English.

To provide the follow-up visit, staff at Carillion Energy Service were trained by NEA NI and University of Ulster to provide additional information and support during a home visit that took place soon after the Smart meter had been installed. Staff were also trained to provide a Carillion Energy Services’ Smart telephone helpline for participants.

The Northern Exposure customers were asked about their experience with the device, its installation, and the levels of support offered. These were monitored both during the Smart meter Trial’s monthly courtesy calls, and during any case study visits or follow-up survey calls. Feedback about Smart meters was not just positive, but usually very enthusiastic.

This stands in marked contrast to what most other studies have reported when Smart meters have been installed without incentives, but simply as part of a wider energy efficiency retrofit. For example, Sunikka-Blank and colleagues (2012a) reported that a deep retrofit which included a Smart meter had saved them money. As demonstrated in Chapter 10, it was impossible to confirm a Smart telephone helpline for participants.

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This stands in marked contrast to what most other studies have reported when Smart meters have been installed without incentives, but simply as part of a wider energy efficiency retrofit. For example, Sunikka-Blank and colleagues (2012a) reported that a deep retrofit which included a Smart meter yielded no efficiency gains through the Smart meter. They conclude:

“Technically, Smart Meters are advanced, but the user interface of the system leaves a lot to be desired; at this moment, the meters tend to give raw, unprocessed data in figures. As it is many households are not even interested:”

By contrast, Smart meter participants in the Northern Exposure trial were all positive about their Smart meters, and had actively engaged with them to the extent that most of the households believed that a Smart meter had saved them money. As demonstrated in Chapter 10, it was impossible to confirm or deny whether their perceptions were accurate, because of the relatively short interval during which their consumption could be monitored; this had led to confounding with seasonal changes in electricity use. However, the active engagement with smart meters is likely to be a consequence of a variety of factors including:

- their self-referral into the Smart meter intervention – they actively decided to have a Smart meter installed
- the level of customer support and guidance offered by trained NIE and Carillion Energy Services staff
- the continued personal contact participants received from both NEA NI and University of Ulster, if and when queries arose about Smart metering. As indicated in the case study of Ms G. these never turned out to be problems with the Smart meter per se, but were problems with the way in which the Smart meter Trial customers were billed.

Customers described looking at their in-house display at least 2 or 3 times a day, and interrogated it at least once a week to check patterns of consumption. Two of the 5 customers placed their IHD in the living room; since this was the room most often inhabited, changes to consumption were very visible on its screen. They experienced fewer forgotten immersion heaters or ovens left on; children thought to be asleep upstairs but playing on a computer were also very occasionally discovered in this way. Some of the 5 customers also used their IHD as a budgeting tool, easing off on consumption towards the end of a month if they needed to conserve money for other bills: “Washday doesn’t HAVE to be on Monday this week”.

Credit customers, who had previously been accustomed to quarterly information on their consumption reported the biggest impact from being in the Trial. They experienced opportunities for monitoring energy use, and for deciding how to budget for consumption accurately, for the first time. However, as two of the case studies indicate, more care was needed in supporting credit customers, since the confusion generated over how they were being billed resulted in considerable distress for the 2 Northern Exposure volunteers relying on quarterly billing. For both their problems arose as a result of the meter reader not being able to interrogate the new meter in order to obtain a reading. This issue was undoubtedly an oversight on the part of University of Ulster as Trial managers. All efforts have been made to ensure the same problem does not arise in the future, including notifying the organisation that employs meter readers in Northern Ireland and writing to all credit customers to explain how to read their own meter in case of need; customers have since been contacted by telephone to ensure they are able to do this.

Northern Exposure customers were offered their “old” meter back at the end of 12 months, but none wanted this.

In the longer run, it is very likely that some modest savings might be achievable through Smart metering for some Northern Exposure clients and others like them. However, this is likely to require a somewhat more intensive engagement between adviser and resident, with an initial focus on whether savings should be expected at all. If they are, interventions in future Trials could include measures such as energy consumption diaries, setting targets for monthly saving, and carrying out additional home visits to identify effective measures for reducing electricity use. Most Smart Meter trials have concluded that the more sustained support customers can be provided with, the more likely they are to engage with Smart metering, and the more they will save on costs and carbon. The Trial
undertaken in Great Britain, for example, concluded that:

“Positive savings from Smart meters depended on providing consumers with appropriate additional intervention. However, the impact of an intervention depends on the detail of deployment: how a particular intervention is delivered and how it is combined with other interventions. Smart meters can provide key data and an RTD (real time display) can relay that information. However, further information, advice and prompts are likely to be required if the impact is to be maximised. Consumers need to know what to do; what means should be deployed to save energy. Some consumers already know (at least in part), others need further information. This information can be delivered through generic written material (on paper or online, before, during or after Smart metering installation), verbal advice as part of the installer visit and by consumers being encouraged to experiment with an RTD to see the savings that could be achieved from a particular end-use of energy. Quality matters: information needs to be clear, easily seen amongst other material sent by suppliers, and presented in an attractive way. It also needs to be relevant and timely (e.g. appropriate to the season) and kept up to date. The design of RTDs and the explanation of how to use them are similarly essential to effective customer engagement, satisfaction and savings”. AECOM/OFGEM, 2011).

What is also indicated from the Northern Exposure evaluation is the importance of what has been termed by others as “frequently iterated support” (Rockwool, 2012); that is, it is beneficial if customers can be regularly reminded of their participation in a programme of intervention, their achievements, their aspirations, and any agreed goals for the future. Between NEA NI’s regular contacts with clients before and after intervention, and University of Ulster’s before and after survey, levels of frequently iterated support were probably higher than average, but could probably be further expanded in future Trials.

12.5.2. VPhase units

Some customers were certain they had saved money after VPhase was installed. However, the VPhase mini-Trial contained too few units, installed for too short a time period, for any certainty regarding whether they saved customers money or not.

A 2010 OFGEM-approved independent trial of VPhase helps put the mini-trial in context. It was carried out, to assess whether VPhase should be included as a CERT-approved product by the Department for Energy and Climate Change (Wilson, 2011). The Trial recruited 50 customers. Based on that sample size, OFGEM’s statistical experts stipulated a requirement for 2,950 days of data, with 144 readings to be taken on each day (almost 500,000 readings). The Northern Exposure mini-trial, by contrast, relied on data from 5 VPhase units, installed for just over 1500 days, and relaying data at 48 intervals per day (44,000 readings). In other words, even with more than seven times as many customers as the Northern Exposure Trial, OFGEM required more than 10 times as much data on which they were prepared to draw conclusions.

Furthermore, while the mini-trial attempted to find matched controls for VPhase customers based on identifying customers from another trial who were similar in baseline electricity consumption, the OFGEM approved Trial was considerably tighter. It was able to manipulate VPhase functionality, so that VPhase operated only on alternate days, permitting a same-household comparison of consumption with and without the unit.

The OFGEM-approved Trial reported changes in consumption when VPhase was functioning, ranging from customers who consumed 4% more post-installation, to customers who consumed 19% less, with an average of a 5.2% saving (see Figure 12.3).

Figure 12.3: Distributions of energy saving percentages for trial sites

![Figure 12.3](source: Wilson, 2011)

Figure 12.4 is helpful in illustrating how difficult to discern changes would be if one were relying on intuition or on interrogating an in-house display’s summary data.
Given that Northern Exposure customers had VPhase units installed in the summer months of 2012, and these were then assessed until October 2012, customers would also have been estimating the somewhat variable day-to-day impact of these units in the midst of natural seasonal reductions in electricity use.

The only concrete conclusions about consumption changes must emanate from the OFGEM-approved Trial. If, as the Trial indicated, there is an average of 5.2% saving resulting from VPHASE, this would have meant an annual average saving for Northern Exposure customers of £28 per annum (if purchasing electricity from the region’s market leader, at 14.93p per kWh, with an average annual consumption of 3636 kWh). Given that the OFGEM-approved Trial estimated a lifespan of 27 years for a VPhase unit, this would amount to £756 total savings. The current purchase and installation cost in a straightforward new home is £505.40, yielding a net gain of £250.60 or £9.28 per annum.

Ideally, any customer considering purchase could usefully consider ascertaining whether they meet some of the criteria which the OFGEM-approved trial concluded boosted savings:

- mean voltage entering the home: if high, VPhase is indicated
- extent to which electricity consumption derives from products which VPhase is able to control: if extensive, VPhase is indicated
- distance from sub-station: if close, then VPhase is indicated
- amount of electricity usually consumed: VPhase will save high consumers more money over 27 years than low consumers.

For customers who meet these criteria, the savings from a VPhase unit could, the OFGEM-approved Trial suggests, be up to £100 per annum, or £2,700 over the lifetime of the product. This represents a net gain of £88 per annum.

Following the OFGEM-approved Trial, DECC awarded Vphase units CERT credits. Although the Trial had indicated that around one-third of households were unlikely to reap significant financial benefit from the product, DECC’s decision was based around the logic that several million VPhase Units averaging a 5.2% saving in electricity will yield a measurable reduction in carbon footprint for England and Wales over the next generation. This highlights the distinction evaluations always need to make between whether they are considering the impacts of fuel poverty measures on households, or on a nation, since the two are not always synonymous.

Targeted intervention, with VPhase installed in households where it can have greatest impact (with the assessment based on a few easily measured criteria) provides a more streamlined model in which both region and householders can benefit. Further exploration of this approach is highly recommended as part of a Northern Ireland strategy for jointly tackling fuel poverty and reducing carbon emissions.
Chapter 13

Conclusions and recommendations

13.1. Conclusions

Recent estimates indicate that the carbon footprint of the average UK household can be realistically reduced by 37%; this incorporates all aspects of energy consumption including transport, household goods, recreation, etc. Where estimates are confined to gas, electricity and other fuels, it is estimated that savings of 45% are possible (Druckman & Jackson, 2010). In considering the implications of this potential, the results from the Northern Exposure programme help differentiate between:

a) the savings that some households can make by actively changing their behaviours and reducing consumption
b) the savings that can be made from improving the energy efficiency of their homes, which accrue more passively from being able to heat a home for less, and to retain the heat for longer.

At least some Northern Exposure households were already very low active energy consumers, as the small sample of Smart meter customers in the present study illustrate so clearly. They were also, as both surveys and case studies made clear, experiencing considerable problems with illness and poor mental wellbeing. In this context, recruitment had been very well targeted towards the most vulnerable of households. But as a consequence of this, they were a group most in need of opportunities for passive savings through better heating and insulation, rather than through having to find elasticity in consumption patterns that were already very meagre.

This evaluation of impacts fully supports the findings from the Warm Front Evaluation carried out in England and Wales. It finds substantial mental wellbeing effects, and confirms the two routes by which these probably come about. The Warm Front team illustrate these 2 routes as follows:
The first route to improved mental wellbeing is through improved indoor temperatures which lead to better thermal comfort. The second is through improved energy affordability, which reduces the stress and anxiety associated with finding sufficient resources to pay utility bills. When these can be combined through an effective retrofit, they offer meaningful opportunities for improvements in mental health. For people like those described in the case studies reported on here, alleviating these stressors makes a measurable difference to their mood and disposition. This should not seem surprising. Collectively, they experienced bereavements, illness, unexpected repair bills, redundancy, and many more challenges during the course of the evaluation.

It is widely recognised by psychologists that adding one more stressor onto a burden of pre-existing ones has exponential rather than additive effects. In other words, having to deal with two problems at the same time is not just doubly more difficult to cope with when compared with having only one; it is quadruply more difficult. As stressors accumulate one on top of the other, so the coping resources needed to manage them rises. As indicated in Chapter 7, 92% of Northern Ireland residents view a warm home as an essential for decent living, even more so if they have children. The social and emotional significance of a cold home is now much more fully understood by researchers (e.g. Walshaw, 2010; Anderson et al., 2011), although there is a need for this understanding to reach both policymakers and the public at large. It is likely that both of these constituencies under-estimate the value which people in fuel poverty place on attaining thermal comfort, and conversely the stress associated with living without it, often for many months on end.

Removing 2 daily stressors (thermal discomfort and worry about bills), offers very substantial avenues for relief for many of the people who participated in Northern Exposure. We are grateful that they took the time to help us understand this better.

Improved mental wellbeing, however favourable, was not transformative. It did not lead to participants feeling more able to deal with everyday issues and stressors – it primarily altered their overall mood and general disposition so that issues and stressors became framed in a more positive light. How people felt about the everyday chores and responsibilities of life, such as getting up and dressed each day, shopping, and dealing with other people did not change. However, the participants recruited into the Northern Exposure trial were, in the main, problem-solvers who worked hard to find solutions to the challenges they encountered.

VPhase and Smart meters may have yielded significant savings for some customers, but not for all customers, and not to the extent where these devices produced statistically significant impacts on electricity consumption. However, these 2 mini-trials of new technology were not powered to find significant differences based on installation, and so no conclusions can be made about whether and by how much these devices might save the average customer in Northern Ireland.

Figure 7.2. is particularly helpful in this context: in order to establish that indoor temperatures were indeed increasing over time, researchers required data spanning more than 30 years – small changes in a sea of variation require very large data sets in order to establish with any degree of certainty whether changes are significant. What is clear from this very preliminary work is that Northern Exposure participants, most of them on low income and all of them low electricity consumers, provide us with excellent feedback on the palatability of these products, the non-disruptive process of installation, ease of use, unobtrusiveness, and perceived value for money. Given that the Trial’s participants were very likely to be in severe fuel poverty before retrofit, these results are a promising beginning. The learning gleaned from these 2 mini-trials has led to some specific and evidence-based recommendations (see next section).

13.2. Recommendations

- In times of austerity and distrust of Utility companies and their motives, Trials should be permitted to invest more resources and expense in recruitment, so that they can mount intensive recruitment drives in the first few months of the project.
- Additional support and resources is needed to ensure that dropout from Trials of this nature are kept to a minimum. This will help ensure that results are based on the widest possible range of experience, opinions, and outcomes.
- Further to this, staggered intervention that takes account of recruitment difficulties is not recommended because of the extent to which domestic energy consumption is confounded with season. Trial participants should, ideally, all start and end a Trial together.
- Trials should be permitted to follow up clients over at least 3 years, for the same reasons as above: winters are not all the same and wide variations in degree day demand over consecutive winters (as well as changes in lifestyle and appliance purchase over time) make trials that last only a year somewhat unreliable.
• Financial incentives may be needed to ensure that all participants originally enrolled in interventions are available for follow-up survey; this will become increasingly important if Trials take place over longer periods of time.

• Advance media coverage of Trials is probably equally as important as “good news stories” being published during or after Trials; this could further aid recruitment through getting information into the public domain, inspiring confidence in householders who are contemplating participation.

• Engaging private landlords more actively, whether through media or public events, would ensure that more interventions of this nature reached people who are experiencing the most severe fuel poverty. Funding for schemes which are specifically set up for this market audience would greatly assist learning and the development of best practice.

• The goals of Trials such as these may need to be sharpened, in the light of important evidence from Northern Exposure that illustrates the extent to which some participants are consuming abnormally low amounts of energy at baseline, despite the poor energy efficiency of their homes. Doubts arise as to whether it is ethically advisable to expect energy savings for all customers. Many could probably benefit much more from increasing, rather than decreasing consumption. In this context, focus may need to shift from concerns with restricting expenditure and carbon emissions to concerns with ensuring affordability for all.

• Trials such as these offer underutilised opportunities to identify vulnerable customers hitherto ignored by Utility companies. There are clear partnership opportunities between non-governmental organisations and Utility companies which can better accomplish duty of care responsibilities and corporate social responsibilities.

• Since Smart meters were only installed to measure electricity consumption rather than electricity and heating, they had a constrained potential for household energy saving, since electricity expenditure comprises less than half of overall domestic energy expenditure in the average NI household. There is a need for Trials to incorporate smart metering of both gas and electricity.

• The Smart meter mini-trial suggests some potential for savings among some customers, but will require a cast of hundreds in future Trials. Decisions concerning who should be targeted in terms of encouraging energy savings need to be carefully made, so that those most vulnerable are not encouraged to achieve the impossible or the unethical.

• Useful ways forward have been elucidated from the VPhase mini-trial. Streamlined targeting of VPhase towards homes that are most likely to benefit from them, and the launch of a much bigger trial, preferably using on-off methodology, are highly recommended.

• Given the extreme distress which estimated meter readings caused 2 of our 6 case studies during the course of the Trial, sending customers estimated readings should become a matter of last resort. Where-ever possible, meter readers should be given the opportunity to call again, and customers should be contacted by telephone to help ensure that a second visit finds them at home.

• A protocol for preparing customers before Warm Home installations is recommended, and would need to be adhered to by all scheme operatives. Leaving behind a clean house and satisfied customer (which is almost always the case) is not sufficient. Customers should not feel trepidation beforehand, and nor should they need to tolerate multiple visits from people who do not sufficiently explain who they are and why they need to come into their home.

• Exploring options for moving out of the house temporarily, where the level of retrofit is commensurate with that, and most especially for clients who are vulnerable and/or have family living nearby, is strongly indicated.

• The management of broader elements of customer expectations post-retrofit is also crucial in fuel poverty schemes. Although a solid-wall insulation scheme was available at the time Northern Exposure was recruiting clients, it turned out to be so limited in resources that very few of the clients who were eligible received anything from it. More minor issues relate to ensuring that clients do not expect damp to be resolved, and that they have realistic expectations regarding improvements in their physical health.

• Retrofits are seldom deep enough to deliver the maximum potential of Trials such as this. Where 90% of interventions invest under £2,000 in a home, there are very limited options for fuel poverty proofing a home. Fewer, but deeper retrofits are essential, with targeting towards those most in need seeming the only option in times of constrained budgets.
Northern Exposure

NEA NI Results, Conclusions & Recommendations

Angela Gracey and Paul Wallace
14.1. Energy Performance Certificates (EPC’s)

An EPC is a document that contains information about a property and how efficiently it uses energy. It is produced using a standard layout and standardised measures, usage patterns and performance criteria to enable properties of all shape, size and age to be compared in terms of the energy consumption and the impact on the environment. It takes into account insulation, heating, ventilation, hot water and lighting. Properties are rated on a scale of 1 - 100 and within that there are 6 bands, A - G. A property with 92 or above will be rated band A which is the most energy efficient whereas a property which sits within the 1-20 range will be rated band G. The EPC also includes recommendations on methods by which you can improve your home’s energy efficiency, which can save you money and help the environment.

EPCs are a legal requirement for any building that is to be put on the market for sale or rent regardless of whether you are selling or renting privately or using an Estate Agent. It is also a requirement for all newly built properties to have an EPC upon completion of the build. It is currently the responsibility of the building owner to ensure that an EPC is available to prospective purchasers and tenants. An EPC is valid for ten years. (Building Research Establishment, 2012).

For referrals made to the Warm Homes Scheme, an EPC is carried out automatically on a before and after basis to monitor energy ratings and improvements made. Carillion Energy Services provided this for all NISEP research referrals as part of their in-kind contribution to the project. Therefore all householders taking part in the research exercise were given the opportunity to have an EPC undertaken before and after the energy efficiency measures were installed. This meant NEA NI were able to capture the energy efficiency rating of the property before and after the works were completed indicating how much these measures improved the energy performance of a property and also their impact on the environment.

Out of the final 36 participants, NEA NI was able to collate 29 full EPC ‘before and after’ reports. There were some issues with obtaining the other 7; some householders were not at home when the surveyor came out to undertake the first EPC before measures were installed; therefore they were not approached for the second EPC as the data would have been incomplete. A further householder was not available for the second EPC to be carried out due to health reasons.
The average rating for a house in Northern Ireland is 50 which is band E. Table 14.1 shows the improvements made in the 29 households in terms of the energy rating after insulation and/or heating measures have been installed. The table also includes the percentage in regards to the improvements made.

**Table 14.1: Improvements made in the 29 households in terms of energy rating after insulation and/or heating measures have been installed**

<table>
<thead>
<tr>
<th>Property</th>
<th>Measures Installed</th>
<th>EPC Rating Before Works</th>
<th>EPC Rating After Works</th>
<th>EPC Increase %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CWI, HWTJ, CWS</td>
<td>40</td>
<td>52</td>
<td>12%</td>
</tr>
<tr>
<td>2</td>
<td>LI, CWI</td>
<td>52</td>
<td>55</td>
<td>3%</td>
</tr>
<tr>
<td>3</td>
<td>LI, CWI, HWTJ, CWS</td>
<td>35</td>
<td>49</td>
<td>14%</td>
</tr>
<tr>
<td>4</td>
<td>LI, Heating</td>
<td>40</td>
<td>65</td>
<td>25%</td>
</tr>
<tr>
<td>5</td>
<td>LI, CWS, Heating</td>
<td>47</td>
<td>74</td>
<td>27%</td>
</tr>
<tr>
<td>6</td>
<td>Heating</td>
<td>29</td>
<td>72</td>
<td>43%</td>
</tr>
<tr>
<td>7</td>
<td>LI, CWI, CWS</td>
<td>64</td>
<td>72</td>
<td>8%</td>
</tr>
<tr>
<td>8</td>
<td>LI</td>
<td>46</td>
<td>50</td>
<td>4%</td>
</tr>
<tr>
<td>9</td>
<td>LI</td>
<td>49</td>
<td>60</td>
<td>11%</td>
</tr>
<tr>
<td>10</td>
<td>LI, Heating</td>
<td>39</td>
<td>67</td>
<td>28%</td>
</tr>
<tr>
<td>11</td>
<td>LI, CWS</td>
<td>46</td>
<td>48</td>
<td>2%</td>
</tr>
<tr>
<td>12</td>
<td>LI, CWI, Heating</td>
<td>31</td>
<td>74</td>
<td>43%</td>
</tr>
<tr>
<td>13</td>
<td>LI, CWI</td>
<td>32</td>
<td>57</td>
<td>25%</td>
</tr>
<tr>
<td>14</td>
<td>LI</td>
<td>42</td>
<td>45</td>
<td>3%</td>
</tr>
<tr>
<td>15</td>
<td>LI</td>
<td>66</td>
<td>72</td>
<td>6%</td>
</tr>
<tr>
<td>16</td>
<td>LI</td>
<td>62</td>
<td>63</td>
<td>1%</td>
</tr>
<tr>
<td>17</td>
<td>CWI in extension only</td>
<td>56</td>
<td>43</td>
<td>-13%</td>
</tr>
<tr>
<td>18</td>
<td>LI, CWI</td>
<td>38</td>
<td>56</td>
<td>18%</td>
</tr>
<tr>
<td>19</td>
<td>LI</td>
<td>53</td>
<td>63</td>
<td>10%</td>
</tr>
<tr>
<td>20</td>
<td>LI, CWS, HWTJ</td>
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<td>43</td>
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</tr>
<tr>
<td>21</td>
<td>CWI</td>
<td>35</td>
<td>46</td>
<td>11%</td>
</tr>
<tr>
<td>22</td>
<td>LI, CWS</td>
<td>67</td>
<td>69</td>
<td>2%</td>
</tr>
<tr>
<td>23</td>
<td>LI</td>
<td>57</td>
<td>58</td>
<td>1%</td>
</tr>
<tr>
<td>24</td>
<td>LI</td>
<td>65</td>
<td>68</td>
<td>3%</td>
</tr>
<tr>
<td>25</td>
<td>CWI in extension of the property</td>
<td>24</td>
<td>27</td>
<td>3%</td>
</tr>
<tr>
<td>26</td>
<td>Internal Wall Insulation - dry lining, LI, Pipes &amp; Tanks lagged</td>
<td>46</td>
<td>57</td>
<td>11%</td>
</tr>
</tbody>
</table>

Note: Properties highlighted in white are discussed in the results below.

**Key:**

- CWI - Cavity Wall Insulation
- LI - Loft Insulation
- HWTJ - Hot Water Tank Jacket
- CWS - Cold Water Storage Pipe Lagging

You will see that some of the property’s ratings and percentage of increase is very small; these properties only received measures such as a top up of loft insulation through one of the schemes. One example of this is property 16 highlighted above as only gaining a 1% increase in the energy rating – an improvement from 62 to 63 points, showing that by only providing a top up of loft insulation the householder’s energy efficiency is not greatly improved and doesn’t move it up within a band. Even though it does not improve the property’s energy performance by much it is important to note that as indicated in the research results in Chapter 12, the perceptions of householders do change when small improvements like these are made to the home.

The householders’ whose rating improved greatly, such as property 10 highlighted above, had a big increase from 39 points, which is below the average of a property in NI (50), to 67 points, well above average. The property received a new gas central heating system, a conversion from a broken oil system over 15 years old plus loft insulation.

Again, taking property 6 and property 12 as two further examples of this, both of these houses received a new installation of a gas central heating; one a conversion from a broken oil system over 15 years old and the other from having no central heating previously. This change along with insulation measures has meant a substantial increase in the rating from 29 to 72, and 31 to 74 respectively.

The Warm Homes scheme does not replace broken oil central heating systems. 2 of these households were referred to the NISEP Energy Saver Homes scheme which does replace broken oil systems to natural gas central heating (if in a gas connected area, oil is installed if not). The results show the massive improvements which are made by upgrading old inefficient heating systems. The improvements are much higher than those properties that received insulation alone, highlighting the importance of ensuring that when a householder is referred for measures via a government scheme that it does receive all appropriate measures that will bring its efficiency rating up significantly.

There was an error in one EPC, property 17, in regards to the ‘total floor area’ as recorded between the 1st survey and 2nd survey. It had been recorded as a much smaller house at the first survey therefore showing a reduction in the EPC rating of minus 13% as opposed to any increase. This property did
receive cavity wall insulation but only in the extension of the property. Any increase in the rating would have therefore been small.

The average improvement made for all 29 properties is 12%. Despite being a good achievement and significant for each individual household, this is below the target of the 15% set by the Department for Social Development for the Warm Homes scheme. However approximately 40% of these properties had measures installed as part of the NISEP schemes and not via the Warm Homes scheme, therefore it is not a true reflection of Warm Homes targets; however it does draw a conclusion that by providing a top up of loft insulation on its own and leaving householders with perhaps old inefficient boilers, the home’s energy performance rating does not improve and therefore the householders would need to be referred to an alternative programme to increase the energy efficiency of the property.

14.2. Carbon Dioxide Emissions (CO$_2$)

The EPC also gives information of a property’s carbon dioxide emissions. The average household in NI produces about 6 tonnes of Carbon Dioxide per year. It is worthwhile therefore mentioning that through the project there has been a substantial reduction in the CO2 emissions based on the insulation and/or heating measures that have been installed. As part of the EPC, each property is also given a rating for its environmental impact, between A – G based on its current emissions, and through the measures installed via the schemes, the rating has improved by an average of 13% across the 29 properties.

14.3. Solid Walled Properties; Thermal Imaging & EPC’s

2 out of the 6 case study properties received Internal Solid Wall insulation via the Warm Homes Plus scheme. Carillion Energy Services took a before and after thermal image of the property to see if these reports show clear differences in what internal wall insulation can achieve.

Carillion also completed an EPC on each of these properties, before and after the internal wall insulation was installed.

The EPC ratings for these two properties are shown in Table 14.2.

<table>
<thead>
<tr>
<th>Property</th>
<th>Measures Installed</th>
<th>EPC Rating Before Works</th>
<th>EPC Rating After Works</th>
<th>EPC Increase %</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>Internal Wall Insulation - dry lining, LI, Pipes &amp; Tanks lagged</td>
<td>46</td>
<td>57</td>
<td>11%</td>
</tr>
<tr>
<td>29</td>
<td>Internal Wall Insulation - dry lining</td>
<td>68</td>
<td>72</td>
<td>4%</td>
</tr>
</tbody>
</table>

These EPC results are somewhat disappointing considering the investment made in the internal wall insulation. The first property has improved by 11% which is a very positive outcome as the property has been taken from below the average in NI to above average and has moved from a band E to a band D. This property did receive loft insulation and pipe lagging on top of the internal wall insulation.

The second property however only gained 4% in efficiency. This may raise the question of the benefits of installing internal solid wall insulation given the investment required and level of work involved in installing it; however the property’s location, size and heating system all need to be taken into account. Installing internal wall insulation does improve the efficiency of a property but this will always be dependent on other factors and also other energy efficiency improvements which may need to be made.

The case studies discussed in Chapter 12 already highlights the household’s experiences of having the solid wall insulation installed. Although there were issues surrounding the importance of communicating the level of work involved; the householders have emphasised significant thermal comfort benefits; noticed improvements in the level of heat, retention of heat and an improved overall wellbeing of living in a warmer, dryer home. This is important especially for householders with underlying health conditions which may be exacerbated by the cold.

14.4. EPC Conclusions

The results of the EPC’s indicate that, firstly it is important to assess the energy performance of the homes when installing energy efficiency measures to ensure data can be captured regarding the housing stock of Northern Ireland but also in regards to CO2 reduction. This information can help Government assess the effectiveness of installing energy efficiency measures in people’s homes. Not only do these measures improve thermal comfort and improve energy efficiency; they also highlight how NI is helping contribute to the UK’s CO2 reduction targets.

It is important to remember that at least 33% of heat is lost through un-insulated walls therefore we must not ignore the many solid walled properties which are generally harder to heat. Looking back
at Table 14.1 and Property 21 as highlighted, cavity wall insulation alone provides an improvement of 11%, therefore if solid wall insulation does the same it must also be considered. We must be able to ensure help is available for those vulnerable householders living in these conditions who may suffer some health implications discussed prior in Chapter 7.

The EPC’s do indicate savings in energy, these savings alongside the self-reported improvements discussed in Chapter 12 show that energy efficiency measures do work and do improve the lives and wellbeing of householders, helping to reduce the levels of fuel poverty for those who receive them.

14.5. BAXI Mulitfit GasSaver Unit

One of the research case study participants had a BAXI Multifit GasSaver unit installed alongside a new gas central heating system which was being installed by Warm Homes. The GasSaver unit is installed along with a BAXI Duotec 28KW boiler. This Boiler is a SEDBUK Band ‘A’ rated as it is more than 90% efficient which means lower gas bills than traditional boilers. It also won the CORGI Boiler of the Year 2008 and was awarded ‘Best Buy’ in a recent boiler report conducted by Which? (BAXI, 2012).

The GasSaver unit recycles the heat captured from the flue gases which would normally be expelled into the atmosphere and wasted. This heat is then used to heat the water going into the boiler from the cold mains supply and is projected as being able to save up to 37% of the gas needed to heat the hot water.

The householder had the gas central heating system and the GasSaver unit installed in October 2011 and as the householder was prepayment customer, NEA NI asked if they could contact her gas supplier for a breakdown of prepayment ‘Top-up’s’ made in the last 12 months, which she agreed to. The annual gas statement showed the householder topped up a total of £630 from October 2011 to September 2012.

The Sutherland Comparative Heat Cost tables (October 2011) show that a typical 3 bedroom house would pay £1099 per annum with a gas central heating system with condensing boiler on its own without the GasSaver unit. Therefore the £630 that this householder paid is significantly less, 57% less in fact, than the average cost, £1099, of a 3 bedroom house with a gas central heating system.

From reviewing the annual statement it is clear that this householder topped up around £50 per month in the summer months and on average around £75 per month during the winter months. What is significant from the case study in Chapter 11 is that this householder felt she was saving more than she actually was, possibly a reflection of the fact that she now pays for only one heat source. Also as she received loft insulation she is losing less heat through the roof of her property and so will require less heat to maintain a comfortable temperature throughout the home.

This householder’s gas statement shows an annual spend of £630 and as the BAXI Multifit GasSaver unit is suggested as reducing the gas used to heat hot water by up to 37%, we can conclude that her low annual heating bill could be attributed (at least partially) to the GasSaver unit, alongside the loft insulation and efficient boiler that was installed.

14.6. VPhase: Voltage Optimisation

The VPhase unit is a device that optimises the electricity voltage coming into a property to 215 volts, which would potentially give an annual saving of 10-12% on an electricity bill. For the Northern Exposure Project NEA NI purchased the VPhase units from FuelSaver NI who contracted Brady Electrical to undertake the installation works. Brady Electrical is a member of the National Inspection Council for Electrical Installation Contracting (NICEIC) and would use 17th Edition Regulations as per the VPhase installation instructions.

In order to find out which properties were suitable for the VPhase unit, NEA NI along with FuelSaver NI and Brady Electrical carried out site visits to establish whether the house would be suitable for the VPhase unit to be installed. 10 properties were initially identified (8 of these were part of the overall 36 final research participants and 2 additional householders who were referred for the SMART meter trial by Northern Exposure). All 10 householders were open to exploring the possibility of installing VPhase.

On first initial site visit, the following needed to be taken into consideration;

- Situation of meter box and space available for the VPhase unit within it or around it.
- Current Electrics of the house.
- Householders’ agreement to having the VPhase installed once the installation process was discussed.

Out of the 10 properties 4 were privately rented and 6 were privately owned. For those privately rented, NEA NI needed to seek landlord permission for the installation of VPhase. This was not a problem in itself as Northern Exposure was covering the cost of the unit and the installation cost, and all 4 landlords agreed, however, it was an additional step in the process and delayed the installation of the unit for some of the properties. Subsequently 2 of the private rented properties dropped out of the VPhase research.

2 of the remaining privately owned properties subsequently dropped out also, one because of aesthetic reasons due to where the VPhase unit needed to be placed, i.e. outside the meter box which was located in the living room of the property, and the other due to a death in the family which meant they could not continue within the specific timeframes of the project.

VPhase was therefore installed in a total of 6 properties. These 6 properties also had a SMART meter installed which meant that the energy usage of the household could be monitored and any reduction
in usage recorded. However, there were difficulties in obtaining the data to analyse 2 out of these 6 properties. The transmission of the SMART meter data was not always consistent so when trying to assess the effectiveness of VPhase in 2 of these properties, the data was not robust enough to include in the results in Chapter 10.

**Householders Experiences**

It has already been discussed in Chapter 11 in the case study section that householders reported that the installation of the VPhase was not disruptive to them in their daily lives and each household was pleased with the works undertaken by the contractor and the support from FuelSaver NI and NEA NI. All 6 householders reported to NEA NI that they were happy to have the VPhase installed and liked the idea that it was a ‘fit & forget’ device that could potentially save them money off their electricity bills. Most householders, on follow up visits, reported financial savings on their electricity bills including the two householders whose data is not included in the results section since the VPhase has been installed. Chapter 10 and Chapter 12 discusses the VPhase results which do indicate some savings for each household, an average of 6%; however it is important to note that the perception from most is that their bills have been reduced and their mental health and wellbeing has improved.

**Distance from Electricity Supply Point**

The proximity of a house to its electricity supply point can impact on the effectiveness of the VPhase unit. Northern Ireland Electricity (NIE) provided NEA NI with 6 maps for the properties where VPhase was being installed. These maps show the distance in meters each property is from their closest electricity supply point. Distance from electricity supply point can impact on the effectiveness of VPhase.

**Installation Process**

The process of installing VPhase as part of a retrofit project did show some complexities with the fitting process that may not be outlined in the promotional material of Voltage Optimisation. For example; if the VPhase is installed in a new build property or in social housing where it is more likely for electrics to be new or electrics to be in a similar state then the installation process would be more straightforward and the cost of installation would be less expensive. However as the Northern Exposure properties were different in type, size and age, the electrics including wiring were all in different states; some had not been repaired or rewired in a very long time which meant the install process for each VPhase unit was very different for each property; some more complex than others.

This highlights that in order to trial VPhase effectively, retrofitting the electrics does need to be taken into consideration. For example, 1 out of the 6 properties had recently been rewired; the VPhase installation was one of the most simple and took about 2 hours to complete, it was therefore the least expensive to install.

For one of the private rented properties, it was identified at first site visit that an electrical inspection needed to be undertaken as some of the electrics were very old and potentially unsafe. NEA NI agreed that as part of the overall project, the inspection could be completed to include these ‘real life’ scenarios whereby install considerations need to be highlighted as part of the research. It is important to get a realistic picture of the installation process of VPhase for future trials which may take place in NI.

**Cost**

The cost to install the VPhase unit for each property differed and was estimated based on the initial site visit and how much work the installation would entail. As discussed, some of the 6 VPhase installations were more straightforward than others. Some took about 3 hours whereas others took about 5 hours. These are longer timeframes than promotional material states; however, the real life experience of this shows again some of the challenges in installing VPhase to old houses where there can be issues with wiring.

As NEA NI were paying two individual companies; one for supply and one for install of the VPhase, the VAT rate was charged at 20%, however FuelSaver NI were able to give NEA NI a discount on purchasing the VPhase units in bulk. The units can be purchased at a 5% VAT rating when purchased as ‘unit only’ or if ‘supplied and installed’ together because they are classified as energy saving materials.

**Future Trials**

If further, larger trials are being undertaken then an arrangement on ‘supply and install’ could help reduce the overall costs of VPhase installations. For example if a Government Scheme was to bulk buy and install they would only need to pay a VAT rate of 5%; therefore the ‘payback period’ would be less which would give a better financial incentive to install VPhase.

VPhase are also looking at ways to make the installation process easier. They have reported that they have now created a new VPhase unit with attached consumer unit, which they state could make it a lot easier to install VPhase. (An additional consumer unit generally needs to be added to the existing consumer board when installing VPhase). Again, if a future large trial was being conducted, this new VPhase unit with consumer unit attached could further reduce the overall cost to supply and install each VPhase unit.
Chapter 15

Recommendations

- Tackling fuel poverty brings about improvements in mental health and wellbeing; it is therefore imperative that the Department of Health, Social Services and Public Safety (DHSSPS) and the Public Health Agency prioritise this issue and continue to take action to tackle the problem.

- The multi factorial nature of fuel poverty requires action across the Department for Social Development (DSD), the Department for Energy Trade and Investment (DETI), and the DHSSPS.

- Energy efficiency brings about improved energy affordability and mental health improvements. This preventative action can reduce inequalities in health and should be integrated into health and public health programmes.

- Schemes aiming to tackle fuel poverty should have a whole house approach. Government energy efficiency schemes are falling short as evidenced by EPCs. This should be addressed to ensure that appropriate measures are installed to provide whole house solutions.

- Schemes to address fuel poverty need to be harmonised to ensure parity for the household and efficiency in scheme management.

- Fuel poor householders are falling outside eligibility criteria for current Government energy efficiency schemes. The eligibility criteria therefore needs to be reviewed to ensure the criteria is fit for purpose.

- Clear evidence exists to highlight the lack of progress in hard to heat properties, for example the installation of solid wall insulation. Investment in this area needs to be reviewed in the light of the clear benefits to mental health and well-being that can be achieved by installing innovative measures in hard to treat properties.

- The issue of targeting is critical; we need to find those in fuel poverty and provide all the necessary measures to lift them out of fuel poverty. This will require partnership working and schemes designed to address all the fuel poverty factors; energy inefficiency, low income and energy pricing.
• As reinforced by the Northern Exposure Project, the current range of fuel poverty schemes and programmes are complex and difficult for householders to navigate. It is therefore recommended that a clear independent advocacy role is established to assist householders with information and advice.

• This research demonstrates that the most vulnerable and those most in need require significant hand-holding and sustained support in each stage of any change programme. This enables them to overcome any difficulties that may arise and maintain beneficial behaviour change. It is therefore important that more resource is put into ‘handholding’ to help people navigate their way through schemes.

• Replacing old obsolete heating systems must be part of any main Government fuel poverty grant scheme. It is clear from the EPC data that heating upgrades make greatest improvements in the energy efficiency performance of a property impacting positively on the health and wellbeing of the residents.

• In times of energy price increases, innovative solutions need to be found to help vulnerable householders who are living in fuel poverty. Smart meters, VPhase and the BAXI GasSaver unit are examples of how ‘converging technologies’ can help householders reduce their energy bills.

• A larger trial of VPhase needs to be undertaken to grasp what energy savings voltage optimisation can deliver. The Northern Exposure trial of this product indicates that savings can be made, VPhase could save fuel poor householders money; hence a trial with a larger number of householders over a longer period of time should be undertaken with vulnerable groups.

• Further trials of Smart metering should also be undertaken to measure how effective they can be in helping householders manage and reduce energy bills. As recommended by the University of Ulster, NEA NI would also suggest that any future trials should incorporate both electricity and gas.

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