Bryson Energy Retrofit Scheme – Whole House Solutions

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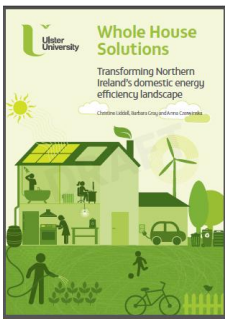
Executive Summary

This report focuses on first steps in delivering Whole House Solutions when tackling fuel poverty in Northern Ireland.

A total of 100 households were involved in the project, all residing in Omagh or Strabane, the two areas of Northern Ireland with the highest prevalence of severe fuel poverty. All of these households had already received a Warm Homes intervention some time ago, mainly consisting of loft insulation and cavity wall insulation. These households were revisited as part of this new Project, so that additional measures could be installed, thereby delivering a basic Whole House Solution; these additional items included a new boiler, new radiators, and several other energy efficiency items.

The report is an evaluation of the impacts of achieving the Whole House Solution. Impacts on energy use, energy practices, savings on bills, as well as impacts on people's physical health and mental wellbeing were assessed, based on data collected by Bryson Energy and Ulster University.

Chapter 1 provides a brief account of what Whole House Solutions entail, and some of the issues surrounding their delivery to households on the ground. A more detailed Companion Report (*Whole House Solutions: Transforming Northern Ireland's domestic energy efficiency landscape*), is being published by UU at the same time as this evaluation. The Companion Report provides more detailed information on Whole House Solutions and their implications for the region.



Chapter 2 provides a brief account of Bryson Energy's Whole House Solution Project, and how it was delivered. All households assisted in the Project were using oil as their main source of heating, and remained so after the retrofit.

Chapter 3 provides an equally brief account of the evaluation methods and how these were deployed. Greater detail on this aspect of the work is contained in the Appendices to this Report.

Chapter 4 describes the neighbourhoods and circumstances of the 100 households who took part in the Project, at the time just before the Whole House Solution was deployed. It notes their poverty status, fuel poverty status, as well as their levels of social and financial exclusion. Also noted is the prevalence of poor physical and mental health, indicating substantial levels of vulnerability. The

chapter describes in some detail the effects which living in fuel poverty has on their daily lives and energy practices, illustrating how the unitary concept of "fuel poverty" has, hidden within it, a wide variety of energy-related stressors.

Chapter 5 is the heart of the evaluation, since it compares outcomes for people at the time of the Whole House Solution being deployed, and a year later. Follow-up data was gathered from 52 of the original 100 households. Before retrofit, 62 of the homes had been below the SAP rating of the average NI house. After retrofit, only 6 remained. Comparison indicated that their energy practices had changed significantly post-retrofit, as had their consumption patterns. Households were using around 25% less electricity (based on actual energy bills, adjusted for heating degree days) and were estimated to have used 25% less oil. Reliance on supplementary sources of heating (e.g. coal and electric fires) had also reduced by more than a third. Impacts on people's self-reported *physica*l health showed significant positive outcomes. Positive *mental* health impacts were even more pronounced, with people being able to concentrate more on what they were doing, sleeping better, feeling less often under constant strain, and less unhappy or depressed. Outcomes from the Customer Satisfaction Survey (which all 100 households completed and posted back to Bryson Energy post-retrofit) demonstrated very high levels of satisfaction with the Scheme, though also brought into frame the importance of careful selection of contractors.

Chapter 6 provides information on six case studies, which UU selected independently in order to ensure lack of bias and representativeness. These case studies consistently demonstrate the extent to which a Whole House Solution offers most residents flexibility in how they heat and use individual rooms, dependent on who is in them at the time. They highlighted the extent to which a solution that involves a *Whole House* approach is also a *solution for everyone in that house too*.

Chapter 7 offers a short bullet-point set of Conclusions and Recommendations, noting that Bryson Energy has delivered what some would see as the most basic of Whole House Solutions. Despite being modest, its impacts have been substantial, not only on the energy efficiency ratings of the houses themselves, but on the lifestyles, health and wellbeing of those who live in them. As the Companion Report makes clear, this should be the beginning of increasingly deep retrofits for Northern Ireland, which can harness a wide range of new and affordable energy efficiency technologies.

Sources and Appendices conclude the report.

Chapter 1. Introduction

1.1 The current approach to retrofitting homes

The Northern Ireland House Condition Survey (2011) shows that, as a result of significant investment, there has been some progress in the energy efficiency of houses, as reflected in improved SAP ratings[1] (see Table 1.1).

Table 1.1: SAP rating and tenure 2009 and 2011

Year	SAP Rating		
	Owner Occupied	Private Rented	Social Housing
2009	56	55	63
2011	60	59	68

However, the Survey also notes that even an efficient heating system and a high standard of insulation will not automatically prevent a household from being in fuel poverty, given the cost of fuel and low incomes. Furthermore, this SAP rating falls short of SAP 78 which Morris (2014) estimates is the most cost effective SAP for NI homes.

1.2 Moving towards a 'whole house' approach

> "*We need to go beyond the single most cost-effective measure and aim to make a house fuel poverty-proof… This underscores the need for whole-house assessments and improvements... all too often the householder is offered only one or two fairly easy to install new measures.*"
>
> (Age UK, 2014)

The concept of whole house retrofit is increasingly seen as the most effective means of improving the energy efficiency of homes, with many examples from Great Britain and further afield. For example, the Community Housing Cymru Group favours the "*whole house approach, along with attempts to positively drive the behavioural aspects of energy usage by tenants*", illustrating the importance of an approach which combines more efficient systems with more informed residents.

[1] Standard Assessment Procedure (SAP) is the UK Government's method for measuring the energy rating of residential dwellings. SAP ratings are expressed on a scale of 1 to 100 – the higher the number, the better the energy efficiency of a dwelling.

Whole house solutions throughout GB have focused most often on homes which are in isolated rural locations and/or without access to mains gas. The Fife Solar Project (FESC, 2009), for example, operated with a mix of housing types in rural areas that had a high incidence of fuel poverty. One third of the properties surveyed accepted solar installations – a good uptake compared with some previous schemes, showing that "*it is feasible to promote more expensive technologies on an area basis".*

For optimum benefit, all of the energy efficiency measures in a home should work together, as stressed by Florida Energy Systems Consortium (2009): "*Changes in one or a few of these components can cause changes in how other components perform. If you recognize and take advantage of this fact, and apply appropriate advances in technology to the components, you can reduce your energy costs while improving your comfort*". Full retrofit can, however, be expensive – something which was recognised when Germany adopted Europe's largest retrofit programme based on subsidy and low interest loans, as well as information, advice and support. Given the cost of retrofit, one of the key lessons was to "a*dopt a 'whole house' approach to energy saving, even if measures are then adopted piecemeal, so people can prioritize and plan for ambitious levels of energy saving. This also makes it easier for the government, energy suppliers and builders to plan for the future*".

In the same vein, Adam-Smith (2012) advises those who "*may be wondering whether to wait until you can afford a whole-house retrofit or to take a few energy saving measures*" that it is important to "*make sure each of those pieces of work add up to a cohesive whole over time*". In that context, the Energy Saving Trust (EST, 2010) too recognises that "*A 'whole house' approach is an unrealistic option for many homeowners – it is impractical and/or unaffordable*" and suggests the use of 'trigger points' such as the redecorating or renovation of a kitchen or bathroom to persuade homeowners to tackle a problem with, for example, damp or insufficient insulation.

Private landlords on the other hand, may adopt the opposite strategy, since EST found that landlords are more likely to undertake a whole-house project in between tenancies, working on a larger budget than home owners. Customer needs, therefore, quite often vary by the type of owner.

1.3 The benefits of a 'one-stop service'

It must be recognised that the whole house concept requires a team of skilled technical surveyors, installers, designers and advisers, all of whom will be working closely with the householder. Any barriers to consumer take-up must be addressed at the outset if the whole house solution retrofit is

to be achieved. Analysis undertaken by the National Energy Foundation (NEF, 2014) identified barriers to uptake as including:

- "*lack of incentive;*
- *resistance;*
- *low levels of awareness and information;*
- *lack of trust;*
- *complexity and disruption;*
- *poor communication channels*".

NEF recommended a central information portal, seamless customer care throughout, and managing projects using a single independent service-proved. This has been endorsed by the London Borough of Sutton who found that "*having an easy, hassle free service was clearly a factor in people's decision making*" (Consumer Focus, 2012).

It is not, therefore, surprising that many of those adopting the 'whole house' approach believe that a 'one-stop service' or hub is essential. This can guide the householder through the retrofit process from start to finish, in partnership with a team of trusted advisers, surveyors and installers. Bryson Energy (in Agenda NI, 2014) supports a hub-based approach, as well as highlighting the need for a "*comprehensive framework which facilitates two-way engagement*" on a wide range of services including:

- energy brokering;
- budgeting;
- benefit entitlement checks;
- keeping houses in good repair, for example by clearing guttering and arranging regular boiler servicing; regular maintenance routines before winter can prevent problems from developing at a later stage. In this context, for example, Bryson Energy has piloted a 'Handy Person' service with vulnerable householders living in Northern Ireland.

Table 1.2 shows examples of some GB and American companies offering whole house solution services.

Table 1.2: Examples of companies and their whole house services offered

Company	Example of Services	Comments
YES Energy Solutions Ltd (A Community Interest Company) Halifax, West Yorkshire and Andover, Hampshire, England	• Home survey • Advice on energy saving upgrades • Grants information • EPC • Installation of energy saving measures	*"At YES Energy Solutions, we feel that it is our duty to support these residents and help them improve their quality of life. There are solutions, be it behavioural advice, energy saving installations or government grants*.
Better Retrofit Partnership (Founders: Aereco, Baumit UK, Natural Building Technologies, Parity Projects) Oakley, Buckinghamshire, England	• Fully integrated solution...that is proven, safe and competitive • Occupant health and comfort • Indoor air quality • Initial survey to post-occupancy feedback	*"A whole house approach which delivers better retrofit through a holistic understanding of the relationships between energy, health, fabric, ventilation and user behaviour."*
A.C. Whyte & Co Ltd Barrhead, East Renfrewshire, Scotland	• Each project designed to maximise energy efficiency • Reduce fuel bills • Tailored whole house approach • Loft, cavity wall and solid wall insulation • Draught proofing • Solar PV panels	*"By forging new partnerships with energy providers and intermediaries, we aim to ensure that homes across the UK meet green credentials."*
The Next Step Living Whole-Home Solution Massachusetts, USA	• One stop resource • In-home consultation • Informed recommendations • Guidance about incentives and rebates • Expert installation Solar power	*"A whole-home approach that makes residential energy efficiency and solar power accessible and affordable. This is a unique way to help homeowners live more comfortably and sustainably while saving money."*

In summary, experience has shown that a 'one-stop service' is essential for communication with householders, providing them with a central contact for all aspects of work undertaken, including:

- guidance through the application;
- assistance with paperwork;
- advice on how and when the work will be carried out;
- advice on using new equipment installed ;
- post-installation follow-up checks;
- further advice if required.

Chapter 2. Delivering the Whole House Solution

2.1 Recruitment

Bryson Energy contacted 240 households in the Omagh and Strabane areas which had already received energy efficiency measures through the Warm Homes scheme.

The customers were given information on the proposed Whole House Solution, through which they could receive free additional energy efficiency measures, including a new boiler, radiators, thermally controlled valves, etc. The aim of the new installations would be to achieve a fully efficient heating system. They were invited to complete an Eligibility Survey.

2.2 Specification of measures

Based on responses to this survey, 100 whole house retrofits were completed. Changes to the Renewable Heat Incentive meant that all of the homes were provided with new oil-based heating systems. Bryson Energy agreed all specification with the range of contractors needed to complete the work.

2.3 Next steps

Bryson Energy guided customers through all aspects of application, terms of agreement, supporting documents required, visits by surveyors and contractors, installation of measures, Building Control, post-installation checks and customer satisfaction forms. In addition, advice was given on energy efficiency in the home, budgeting, oil brokering, switching electricity supplier and payment methods.

Bryson Energy was the hub for communication with and between:

- Customers
- Contractors
- Surveyors
- Building Control
- Northern Ireland Housing Executive (NIHE)
- Ulster University

The process maps for Customer Journeys are shown in Appendices 1 and 2. From confirmed eligibility to the completion of installation averaged 126 days (4 months).

Chapter 3. Evaluation of the scheme

Ulster University undertook the main evaluation of the retrofit scheme.

3.1 Baseline Surveys (n = 100)

These were completed by the Bryson Energy project officer during her first home visit. A copy of the survey can be found in Appendix 3. It covered a wide variety of topics including basic household demography, energy costs, energy practices, health status, wellbeing, and daily routines.

- The 100 eligible households in Omagh and Strabane completed the baseline survey between June and October, 2014.

- During the home visit, the project officer recorded details from previous energy bills, and householders were asked to retain future ones for the post retrofit survey. They were provided with a box in which to keep them.

3.2 Post-retrofit Surveys (n = 52)

These were completed by the Bryson Energy project officer during her last home visit which took place between June and August 2015. This allowed time for residents to experience their new systems through all seasons of their first year. A copy of the survey can be found in Appendix 4. It covered the same items as the baseline survey, and in addition contained questions appropriate to the follow-up. A total of 52 were completed with the Bryson Energy project officer.

3.3 Customer Satisfaction Survey (n = 100)

The Customer Satisfaction Survey (Appendix 5) was completed by householders post-retrofit, and posted back to Bryson Energy. It asked customers three questions:

1. How was your experience with Bryson Energy regarding your initial enquiry or through any correspondence with them?
2. How would you rate the Contractor's performance/ tidiness/ standard of workmanship?
3. How satisfied were you with the overall performance of the Scheme from your initial enquiry to the completion of works?

3.4 Case studies (n = 6)

Several households were identified blind by Ulster University as being suitable case studies and were approached by the Bryson Energy project officer with an invitation to participate. They were chosen as being representative of different types of household, including:

- Age – from elderly to young children
- Single occupants
- Health issues – lack of mobility/ requirement for heating
- Location – isolated rural
- Hard to treat/ solid wall property
- Property with a back boiler.

Six households agreed to participate and were then visited by a UU researcher. In each case the procedure was fully explained by the researcher, the participants were aware that the case studies would be anonymous, but would be recorded to facilitate later transcription. All gave written consent and were given £15 Love2Shop Vouchers as a token of appreciation. While each participant was given the opportunity to elaborate on relevant issues regarding the retrofit scheme, the core questions are shown in Appendix 6.

Chapter 4. The 100 households

4.1 Area Profile

Information about the neighbourhoods in which participants lived were analysed at output area level. Output areas are small geographical units or pockets, and contain approximately 150 households. There are 5,022 of these units in Northern Ireland.

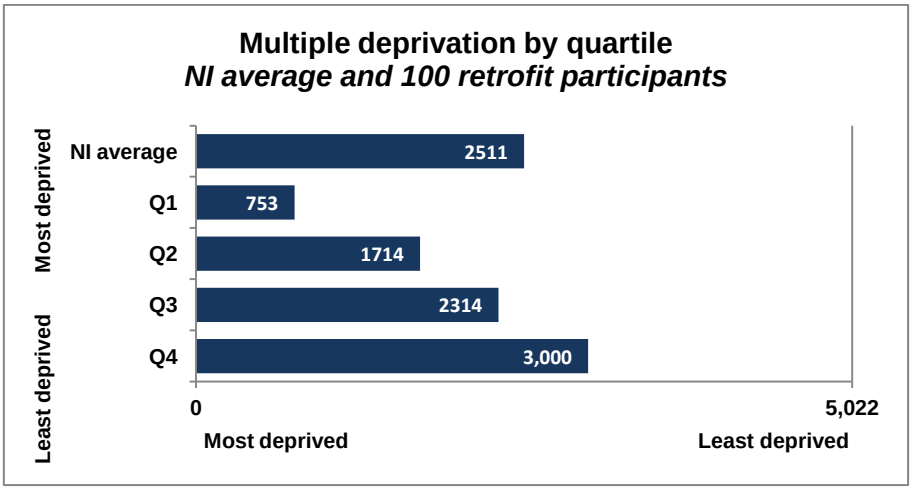
The data used for this area profiling was accessed from the Northern Ireland Neighbourhood Information Service (NINIS). Four measures were examined, namely the overall multiple deprivation measure, and then 3 components of it (income deprivation; employment deprivation, and proximity to essential services).

4.1.1 Multiple deprivation – measure of deprivation based on 7 components:

- Income Deprivation;
- Employment Deprivation;
- Proximity to Services;
- Health Deprivation and Disability;
- Education, Skills and Training Deprivation;
- Living Environment;
- Crime and Disorder.

Figure 4.1 represents multiple deprivation scores, showing first the NI average deprivation score, and then the average index for each quartile of the participant households.

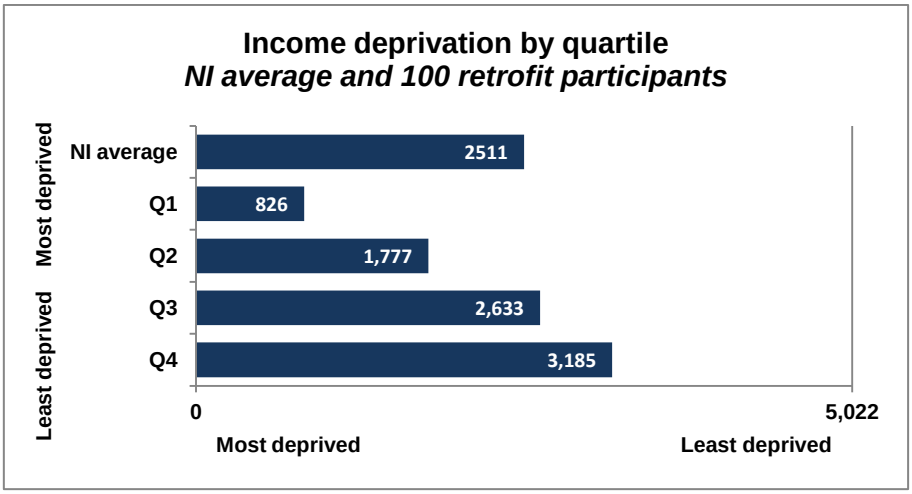
Figure 4.1: Multiple deprivation



It is evident that scores of 3 of 4 participant quartiles do not reach the NI average index of 2511. *This means that the majority of participants who took part in the Whole House Solution Project live in areas of significant multiple deprivation.*

4.1.2 Income – or more simply, poverty. Average scores for NI and each quartile can be seen in Figure 4.2.

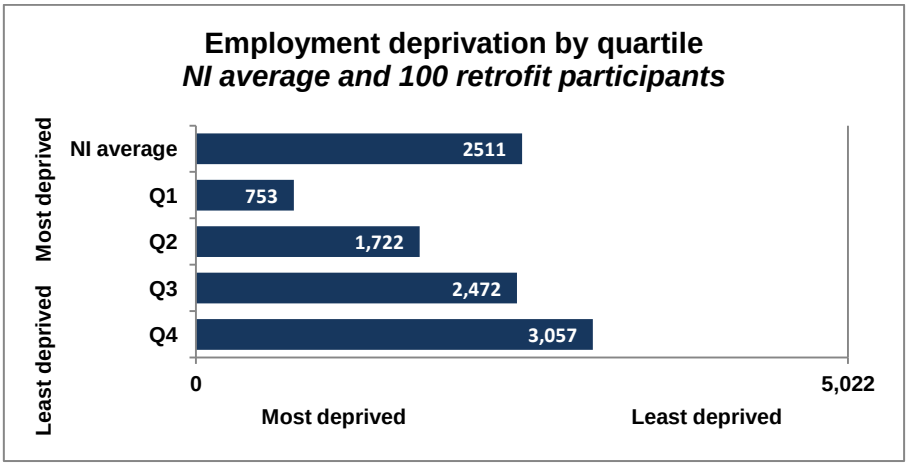
Figure 4.2: Income deprivation



From this it is evident that *most of the participants in the Project were living on lower than average incomes, with few exceeding the NI average.*

4.1.3 Employment –this component describes the proportion of adults of working age who are not in full-time employment. Results can be seen on Figure 4.3.

Figure 4.3: Employment deprivation



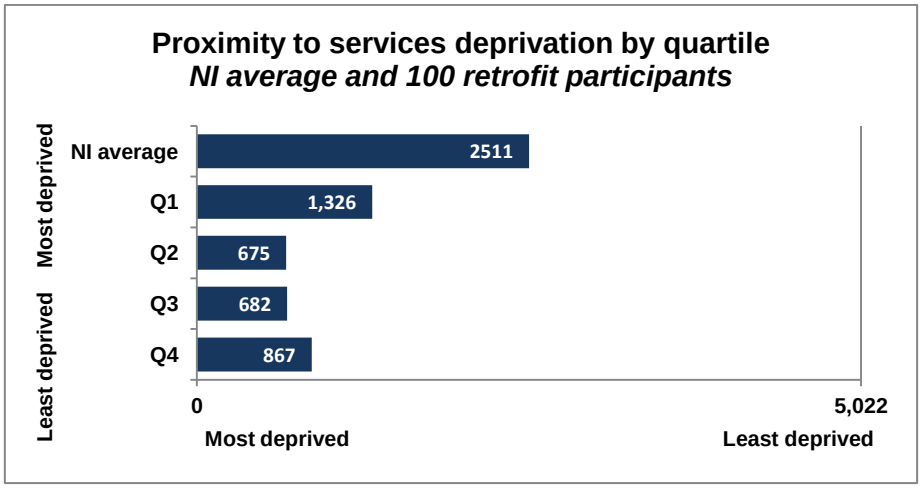
From the Figure, it is evident that *participants in the Whole House Solution Project had a significant risk of being unemployed.*

4.1.4 Proximity to services – this component describes the extent to which people have access to essential services. These include:

- GP
- Accident and emergency hospital
- Dentist
- Pharmacist
- Optician
- Post Office
- Supermarket/food store
- Financial services

Results can be seen on Figure 4.4.

Figure 4.4: Proximity to services

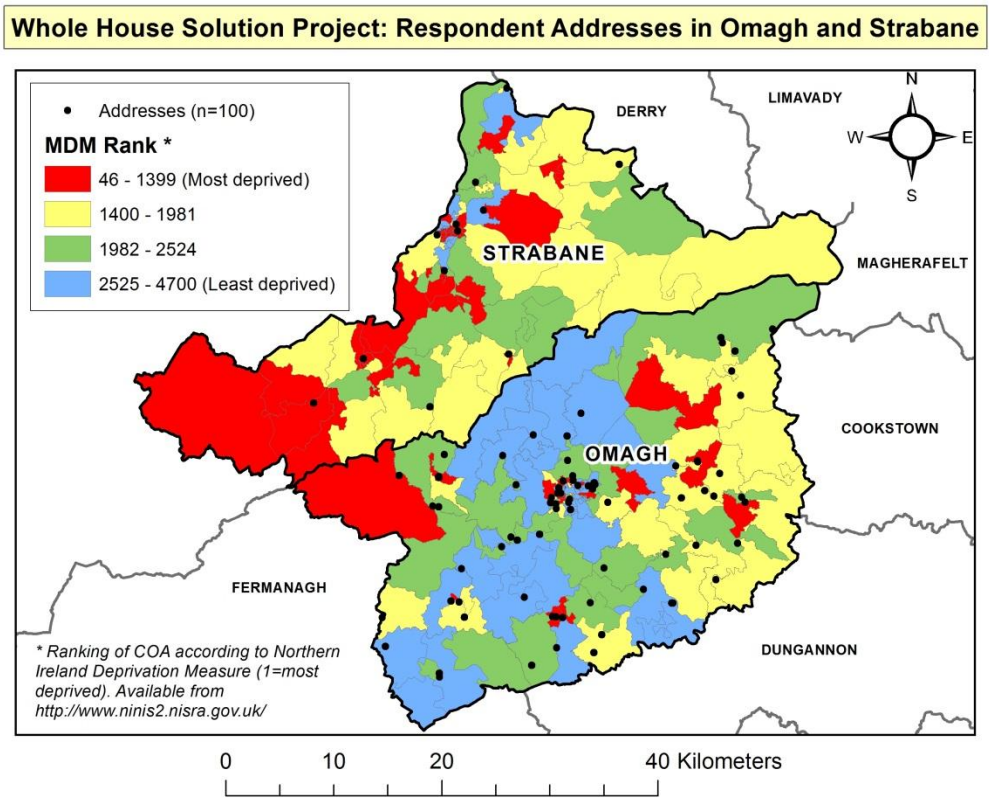


The proximity to services scores are low among participants indicating extremely poor access to services, since none of the quartiles approached the NI average. This was to be expected as Omagh and Strabane are characteristically rural areas with low spatial density, but it is nevertheless notable, since it helps account for some of the energy practices and energy purchasing patterns that emerge later in this report.

Figure 4.5 shows the locations of the 100 homes which were part of the Whole House Solution Project. Overall, the majority of the baseline survey respondents live in areas of Strabane and Omagh which have higher than average deprivation; residents have low disposable incomes and there may be fewer employment opportunities than in most other regions of NI. What is more evident is that these individuals face social and financial exclusion as a result of their rural residential

status. Furthermore, *the lack of resources and inability to pursue a hobby or leisure activity might mean that individuals spend more time at home.*

Figure 4.5: Multiple deprivation indices and locations of respondents in Omagh and Strabane



Source: Walker (2015)

4.1.5 Fuel poverty rates in the areas where participants lived

A recent survey (Walker et al., 2014) estimated that average residents in Omagh and Strabane are in severe fuel poverty. This is because they would need to spend 18% (Omagh) and 25% (Strabane) of their income on heat and other domestic fuels, in order to be able to stay warm during winter. Their fuel poverty prevalence rates are higher than any other of NI's original 26 Councils. *Households in Omagh and Strabane are, therefore at high risk of experiencing extreme fuel poverty*.

4.2 House and household

Of the 100 households surveyed, almost half (46) were living in bungalows. Table 4.1 shows the distribution by type of house, and Table 4.2 shows the number of bedrooms per house. Overall *these were relatively large properties, requiring an above average heating demand as a result of their size.*

Table 4.1: Type of house

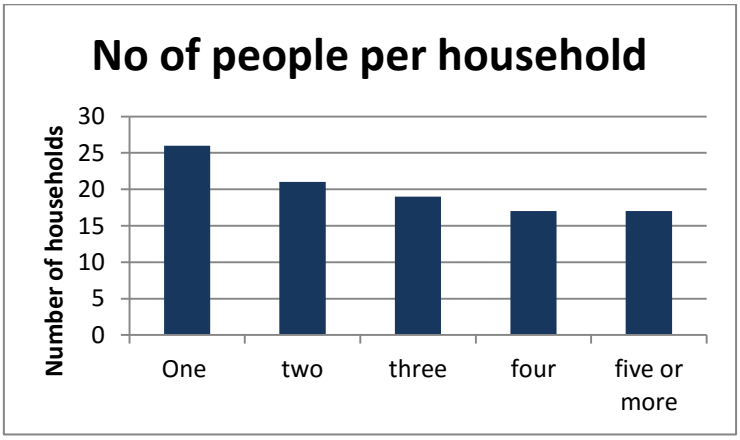
Type of house	No
Bungalow	46
Detached	19
Semi-detached	18
End-terrace	9
Mid-terrace	8
Total	**100**

Table 4.2: Number of bedrooms per house

Number of bedrooms	No of households
2	4
3	61
4	33
5	2
Total	**100**

Though homes were large, the greatest number of homes (26) had a single occupant, followed by 21 with two occupants, as can be seen on Figure 4.6.

Figure 4.6: Number of people per household



Homes were, therefore, largely under-occupied. Even so, the 100 households included a total of 288 people, meaning that any improvement to the condition of these properties could impact the lives of at least 288 people; this included vulnerable people including:

- 33 families with children up to sixteen;
- 41 households with people of retirement age
- 29 households with one or more people living with a long-term disability.

In addition, such improvement could be beneficial to friends and other family members (for example grandchildren) who may spend a considerable amount of time in these homes.

4.3 General health

Participants were asked about disabilities and illnesses at baseline survey. There were 84 different health conditions mentioned, shown in full in Appendix 7.

Furthermore, as can be seen on Table 4.3, more than half (55%) of the households with follow up data contained people living with a disability/illness which required above-average amounts of heating in the home.

Table 4.3: Illness or disability in households

Illness or disability	% of households requiring additional heating
Heart	6
Respiratory	6
Mental illness	2
Other	13

In general therefore, disability and illness were prevalent, and in many cases made particular demands on household energy bills.

4.4 Measures already installed

The energy efficiency measures already installed in the properties through the Warm Homes Scheme are shown in Table 4.4.

Table 4.4: Measures already installed in the properties

Measures already installed	No of households	Pre-retrofit SAP
Loft insulation	99	30-64
Cavity wall insulation	89	30-64
Solid wall insulation	4	44-49
Solar Panels	2	51-54

Hence, all but 1 household had loft insulation already installed, and the majority also received cavity wall insulation. This means that the more basic energy efficiency measures had been implemented before the whole house solution was deployed. *In other words, this evaluation focuses on what value can be added to the more basic energy efficiency package, through deployment of a whole house solution.*

4.5 Energy stressors and their impact on participant mental wellbeing

The mental wellbeing status of respondents was assessed at baseline a using the General Health Questionnaire (GHQ-12), a widely recognised scale developed by Goldberg and Williams (1988). Each of the 12 items has four responses ranked from "better than usual" to "much less than usual". For example:

Have you recently been able to concentrate on what you're doing:

- Better than usual
- Same as usual
- Less than usual
- Much less than usual

A low score on the GHQ-12 indicates an absence of psychiatric symptoms, and hence good mental health. Focus was placed on what predicted the mental health of participants at baseline, and stepwise regression analysis was used to determine the strongest predictors. We examined 6 potential predictors:

- physical health, since it is universally known that people living with an illness or disability experience lower levels of mental wellbeing;
- gender, for the same reasons as above, since women – on average – experience poorer mental health than men;
- purchasing oil drums, potentially a sign of low income and economic stress;
- going without treats and luxuries to keep home warm;
- worry about cost of heating and electricity;
- presence of damp, mould or condensation, indicating poor living conditions.

Four of the above predictors contributed powerfully to mental health status. In order of their importance as predictors these were:

- General health - the strongest predictor;
- Worry over the cost of heating and electricity;
- Gender;
- Purchasing oil drums.

Based on these results it can be concluded that lower levels of general health, frequent worry over the cost of heating and powering property, being female and purchasing oil drums contributed to respondents' lower GHQ-12 scores. Appendix 8 contains a summary of results, and other technical details.

What these results indicate is that worry over energy bills contributes even more to poor mental health for these participants than does gender, the latter a universally acknowledged and potent predictor of mental wellbeing. It emerges as the second strongest predictor of mental health. Gender follows in predictive power, but oil drum purchasing enters the frame as the fourth and final predictor. *This means that two aspects of energy stress (worry about bills, and buying only small amounts at a time) were exerting a significant burden on these participants' mental wellbeing at baseline.*

Table 4.5 helps explain why aspects of energy stress and fuel poverty have a negative effect on people's mental wellbeing. It contains a table of correlations between 6 different measures of energy stress, based on the responses of the 100 baseline survey respondents. The asterisks indicate cases where presence on one stressor tends to co-occur with each of the others, and a double asterisk means this co-occurrence is very likely indeed. Hence, where people are experiencing thermal discomfort (1), they are also *likely* to worry about energy bills (3), and to turn off their heating because of cost (5); they are also *very likely* to be unable to heat their home adequately in winter (2), to forgo treats and luxuries in order to stay warm (4), and to live in a home which has damp, mould or condensation (6).

Table 4.5: Fuel poverty's implications for the participating householders (n=100)

		1	2	3	4	5	6
1	Thermal discomfort						
2	Cannot afford to heat home in winter	**					
3	Worries about energy bills	*	**				
4	Foregoes treats and luxuries to keep home warm	**	*	**			
5	Turns off the heating due to cost	*	*	**	**		
6	Has damp, mould or condensation	**			*	*	

**p<.05 **p<.01*

In other words, as noted recently in Liddell & Guiney (2014), fuel poverty does not impose a single stressor on households, but multiple stressors that constrain several aspects of their lifestyles and energy practices at the same time. It is this broad range of impacts which explains why fuel poverty has such a strong potential to exert harm on mental wellbeing.

Chapter 5. Pre- and post-retrofit comparisons

5.1 Follow up sample

Of the 100 households who took part in the Project, 52 agreed to a follow-up home visit at which they completed a similar survey as they had assisted with at baseline. Results comparing before- and after-retrofit are discussed in this chapter, as well as some additional information related to living conditions post-retrofit.

5.2 What measures had been installed as part of the Whole House Solutions project

Table 5.1 shows the total measures installed. A new oil boiler and heating controls package were installed in each of the 100 households participating in the Project. Where necessary, radiators were replaced and other measures installed to ensure correct functioning. In total 19 households received additional works that were not included and costed in the original specification. Bryson Energy adapted the project to allow for the maintenance of a linked system and ensure that this was done safely. Customers were given the option of a new boiler and if they wanted to maintain the link they could do this at a small additional cost rather than receive no new boiler at all. Bryson Energy identified those in most need and paid for this additional work and in one case got an oil fill for a customer through the Bryson Hardship Fund.

Table 5.1: Total retrofit measures installed in 100 households

Retrofit measures	Number installed
Oil boiler	100
Heating controls package	100
Pipework and insulation	100
Feeding and Expansion tank	47
Cylinder jacket	15
Radiator	141
Thermostatic radiator valve (TRV)	776
Additional works	
Works to maintain a linked secondary system (Back boiler)	14
Remedial works to cylinder	3
Replacement cylinder	2
Set of replacement valves	1

5.3 Change in SAP Ratings

Before and after retrofit, 75 of the participating properties were assessed and received an Energy Performance Certificate (EPC) before and after retrofit. Table 5.2 shows the SAP points ratings for these homes. There was an average increase of 17 SAP points after retrofit. The NI average SAP for a

property is 57. Before retrofit, 62 of these 75 homes were below the NI average. After retrofit this had fallen to 6.

Table 5.2: SAP Ratings pre- and post-retrofit

SAP rating before and after retrofit (n=75)				
	Before retrofit		After retrofit	
Amount	Band	SAP	Band	SAP
Lowest	F	25	E	48
Highest	D	64	C	76
Increase after retrofit				
Range of increase		8-27 SAP points		
Average increase		17 SAP points		

5.4 Damp, mould and condensation

Table 5.3 shows that few homes experienced widespread damp or mould at baseline and almost 60% had none at all. Homes were not, therefore, likely to pose a significant health risk to participants at baseline.

Table 5.3: Presence of damp, mould or condensation

Amount of damp, mould or condensation	% Before	% After
A lot	4	4
Some	37	25
None	59	71

However, a Spearman rank-order correlation was run to determine whether levels of damp, mould and condensation (DMC) affected householders in terms of discomfort or distress. There was a strong positive correlation between these two variables ($r = 0.8$, $p < .001$). This meant that respondents' levels of discomfort about DMC were greatest where there was a higher prevalence of DMC in the home. The more was present the more distressed the householders were about it. Hence, being able to reduce DMC could readily be established as a positive outcome.

After retrofit, relatively little had changed in terms of the presence of damp, mould and condensation. This confirms a much earlier study of Hard To Treat homes which UU carried out with PowerNI (Liddell, 2011). As noted in that evaluation, damp is a structural problem which cannot be addressed directly through energy efficiency improvements. More specific treatment regimes are required. Similarly mould is caused by poor ventilation and maladaptive energy practices, as is condensation. Hence it was not expected that these conditions would alter particularly as a result of

the retrofit programme, although further energy advice focused on how these could be reduced might be effective in the months ahead.

5.5 Thermal discomfort

As seen on Table 5.4, 79% of households felt their home was too cold at times before retrofit. This reduced to 33% after retrofit.

Table 5.4: Thermal discomfort of households

How often was your home too cold?	% Before	% After
Always	0	0
Most of the time	17	2
Sometimes	62	31
Never	21	67

5.6 Supplementary heating

All but one of the 52 households used oil as the main form of home heating, with the one exception using turf. The households were also asked about supplementary heating during colder weather (see Table 5.5). Coal or logs are the households' main choice (35) of supplementary heating, with only 9 households using electric fires for this purpose. Given the location of the properties, there is access to natural materials, some of which are free to the households. There was less use of electric fires for supplementary heating, with only 3% using them very often or often. This could reduce the capacity householders will have for making savings on their electricity bills after retrofit.

Table 5.5: Type and frequency of use of supplementary heating in colder weather

Frequency of use in colder weather	Electric fire	Coal/Logs/Turf/Sticks
	% of households	% of households
Very often/ Often	3	36.7
Occasionally	19.2	34.7
Never	77.8	29.6

Overall two-thirds of the households reported that their main heating systems were not sufficiently powered to provide all-year-round warmth. As a consequence, they were burdened with two rather than one heating bill in the colder months of the year, the second bill usually being for a coal/log/peat fire, or an electric heater or heaters. Where these were not freely available to them without cost, *it is likely that this need for supplementary heat contributed*

substantively to their status as households in severe or extreme fuel poverty. Had original heating systems been fully effective, supplementary heating would not have been required.

5.7 Purchasing oil in small quantities

Buying oil in 20 litre drums had been a relatively frequent practice for 39% of the households pre retrofit, with this decreasing to 21% post retrofit (see Table 5.6). However, in some instances, the reasons given for purchasing oil drums were associated with heating oil theft, rather than issues of affordability, so in many cases oil drum purchase could not be viewed as a choice in need of remedy.

Table 5.6: Frequency of purchasing oil in 20-litre drums

Frequency of purchasing 20-litre oil drums	% Before	% After
Almost always/ Frequently	10	9
Some of the time/ Once in a while	29	12
Never	61	79

5.8 Oil payment methods

Table 5.7 shows oil payment methods. There was an increase in payment by monthly direct debit after retrofit, which may have occurred as a result of energy advice from the Bryson Energy project officer concerning this sometimes being a means of negotiating a better price from suppliers.

Table 5.7: Normal method of oil payment

Method of oil payment	% before	% After
Cash/cheque on delivery	80	83
Cash/cheque later	18	0
Monthly direct debit	2	17

As seen in Table 5.8, there had been a general lack of budgeting for oil via payment schemes pre-retrofit, with only 20% using any form of budgeting scheme before installation of Whole House measures. However, after installation, this had risen a little to 27%, although the change that was most notable was in the increase of participants joining oil buying clubs, which more than doubled. This too is likely to have occurred as a result of information passed to households on the availability of such clubs in their areas.

Table 5.8: Participation in budgeting schemes

Participation in budgeting schemes		
Budgeting Scheme	**% before**	**% After**
Fuel brokering (e.g. with family)/ Fuel brokering club	10	23
Paypoint	2	0
Oil Stamps	8	4

5.9 Affordability of heating the home

Table 5.9 shows a variety of indicators concerned with the affordability of heating the home. Before retrofit, only two-thirds of participating households had never gone without heating at some time in the past year. After retrofit, this rose to 90% after retrofit. Similarly, the number of households who could enjoy both treats and luxuries as well as heating doubled, as did the number of participants who thought that their heating costs were affordable. In terms of not worrying about energy bills, this rose from 21% before, to 33% after retrofit. *In a nutshell, the affordability of energy, and the reduction in energy stressor points, had been radically transformed as a result of retrofit.*

Table 5.9: Affordability of heating the home

Affordability of heating the home		
Gone without heating	**% Before**	**% After**
Never	63	90
Gone without treats to pay for heating		
Never	27	58
Worry about the cost of heating		
Never	21	33
Feel that the heating is affordable		
Never	8	4

5.10 Customers' thoughts on whether they had saved energy post-retrofit

Most householders felt they had saved on both heating and electricity post-retrofit. In terms of heating, Table 5.10 illustrates that a third perceived that they had saved "a lot", and another third "some" on their oil and other heating fuel bills.

Table 5.10: Householders' perception of post-retrofit saving on heating

Amount saved on heating	% of households
A lot	34
Some	36
A little	26
None	4
Total	**100**

In terms of electricity (Table 5.11), fewer respondents perceived savings. Only 25% perceived “a lot” or “some” savings.

Table 5.11: Householders’ perception of post-retrofit saving on electricity

Amount saved on electricity	% of households
A lot	2
Some	23
A little	60
None	13
Spent more post-retrofit	2
Total	**100**

5.11 Actual changes in energy usage and spend pre- and post-retrofit

Not all household who were followed up a year after retrofit had kept their energy bills. Table 5.12 shows the changes in overall energy consumption and bills for households who had done so, based on records for 12 customers, covering similar lengths of time before and after boiler installation. The methods used to estimate consumption have taken into account degree days, or heating demand, which was different in the baseline and post-retrofit years. Hence the estimates of change factor into the equation that one year required more heat because it was colder than the other, and so the estimates are unbiased by different temperatures which prevailed in the two years that household energy use was monitored.

Table 5.12: Summary of overall saving on energy usage and spend post-retrofit

Overall saving on energy usage and spend (n=12)			
Fuel Type			
Electricity	**Before**	**After**	**Overall Increase / Decrease**
No of units (kWh)	39,119	32,005	-18%
Average price per unit (pence)	17	16.6	-2%
Average spend	£554.18	£442.73	-20%
Oil			
No of litres	22,677	13,610	-40%
Average price per litre (pence)	59	45	-24%
Highest price per litre (pence)	74	67	-9%
Lowest price per litre (pence)	52	35	-33%
Average Spend	£1115.00	£510.37	-54%
Average NI household spend (Sutherland Tables , July 2014) (Sutherland Tables, July 2015)	£1430 (Conventional boiler)	£840 (Condensing boiler)	-43.35%
Other fuels			
Coal, Logs, Sticks, Turf (Paid for by householders)	£358	£202	-43.5%

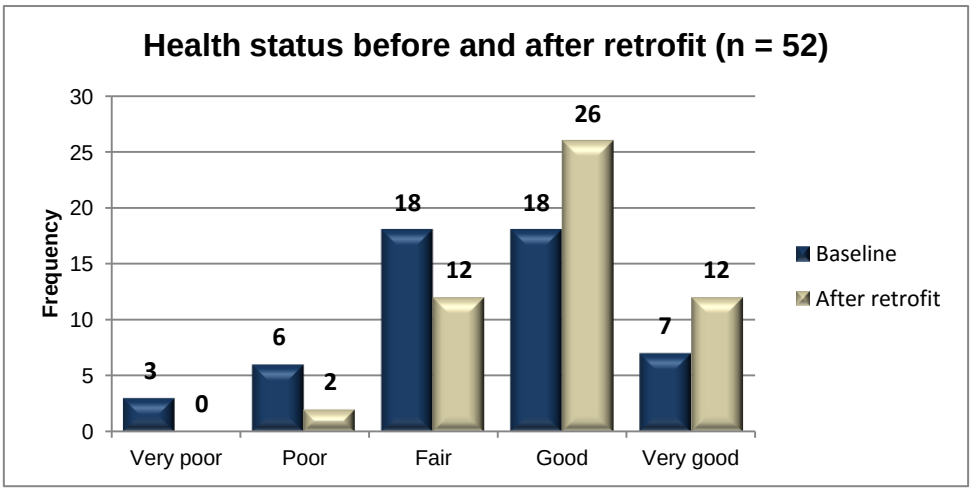
Table 5.12 lies at the heart of the evaluation and its impacts. In terms of electricity, there was an overall reduction of units consumed (18% less post-retrofit), and a corresponding saving of 20% in money terms (or £112). *These figures are based on UU inspection of actual energy bills and records from prepayment meters, not on customer estimates.* For oil consumption, estimates are less reliable, since there is no indication of how much oil was in people's tanks at system replacement, and no means of ensuring that the same time periods were covered in comparison of bills. However, all of the elements of comparison indicate substantial changes in how much oil had been purchased post-retrofit than in the baseline year. As a conservative estimate, it is likely that households had reduced their oil consumption by at least a quarter.

5.12 Physical health status

Respondents' self-reported on their general health at baseline, and then again approximately 1 year after retrofit. They rated their general health using a scale of 1 to 10, from poor (1) to excellent (10).

Figure 5.1 illustrates the distribution of overall health scores. At baseline, 52% of respondents reported their general health was very poor, poor or fair. *At follow-up, however, health status had improved. The percentage of respondents in very poor, poor or fair health had halved.*

Figure 5.1: Householders' general health and wellbeing after the retrofit

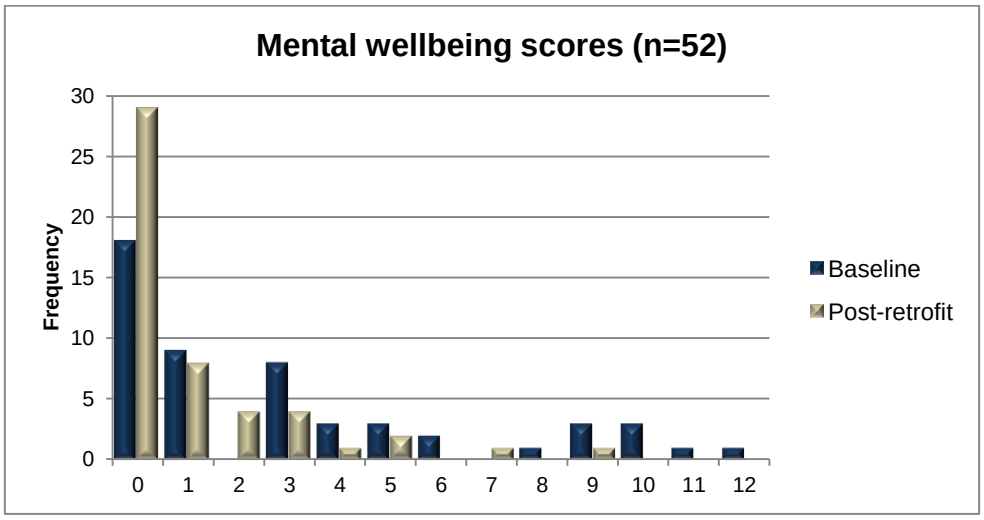


5.13 Mental wellbeing

The mental wellbeing status of respondents was assessed at baseline and follow-up too.
A low score on the GHQ-12 indicates an absence of psychiatric symptoms, and hence good mental health. Figure 5.2 illustrates the distribution of the mental health scores before and after retrofit. *Further statistical analysis of these scores (using a repeated measures t-test) indicated statistically*

significant improvements in mental health status post-retrofit. For example, the number of participants in excellent mental health had almost doubled, from 17 pre-retrofit to 29 post-retrofit.

Figure 5.2: Mental wellbeing scores at baseline and post-retrofit



Furthermore, as noted in Chapter 4, mental wellbeing was being significantly undermined by energy stressors, particularly worry about energy bills and reliance on 20 litre oil drums, the latter a possible indication of low affordability. Given that the retrofit is associated with significant improvements in wellbeing, this is likely to be as a direct result of better affordability and hence less worry, as well as a less frequent reliance on small refills.

Table 5.13 provides information on the 4 items in the GHQ-12 which showed the largest change in scores before and after retrofit. What these indicate is:

- A significant improvement in people's ability to concentrate on what they are doing;
- Significantly fewer sleepless nights as a result of worry;
- Fewer experiences of being constantly under strain;
- Significantly lower rates of unhappiness or depression.

Table 5.13: Individual GHQ-12 items where greatest change took place before and after retrofit

	Before	After
HAVE YOU BEEN ABLE TO CONCENTRATE ON WHAT YOU ARE DOING		
Better than usual	0	1
Same as usual	35	46
Less than usual	17	5
Much less than usual	0	0
HAVE YOU LOST MUCH SLEEP OVER WORRY		
Not at all	14	23
No more than usual	22	21
Rather more than usual	15	8
Much more than usual	1	0
HAVE YOU FELT CONSTANTLY UNDER STRAIN		
Not at all	8	17
No more than usual	24	25
Rather more than usual	19	10
Much more than usual	1	0
HAVE YOU BEEN FEELING UNHAPPY OR DEPRESSED		
Not at all	18	28
No more than usual	21	17
Rather more than usual	12	6
Much more than usual	1	0

5.14 Post retrofit measures

5.14.1 Co-benefits of the Project

Table 5.14 shows additional post-retrofit benefits to households, with households more confident about the thermal comfort of their homes for themselves and guests. Three quarters of the households also felt better connected to local services, as a result of the Bryson Energy advice given during the home visits. Given that the original demographic analysis of the neighbourhoods in which they were located had shown extremely poor access to services when compared with the NI average, this improvement in their sense of social inclusion is noteworthy in its own right.

Table 5.14: Additional benefits of the new heating system

Question	% of households	
	Yes	No difference
More confident about going out/socialising, and coming home to a warm house	85	15
More confident about inviting people to their home	70	30
Felt better connected to local services as a result of any of the Bryson Energy advice	77	23

5.14.2 Customer Satisfaction Survey

Every customer who took part in the Project completed their customer satisfaction survey and posted it back to Bryson Energy. This was a remarkable response rate.

Overall, customers were mostly *very satisfied* with Bryson Energy's service, the contractor's work and the overall performance of the Scheme. The results of the Customer Satisfaction Survey are shown on Table 5.15.

Table 5.15: Customer Satisfaction Survey

Question	Very Satisfied	Satisfied	Not satisfied	Total
How was your experience with Bryson Energy regarding your initial enquiry or through any correspondence with them?	89%	11%	0%	100%
How would you rate the Contractor's performance/ tidiness/ standard of workmanship?	73%	21%	7%	100%
How satisfied were you with the overall performance of the Scheme from your initial enquiry to the completion of works?	84%	15%	0%	100%

All customers were either *satisfied* or *very satisfied* with Bryson Energy. This fell to 84% for satisfaction with contractors. Additional comments were sought from participants concerning their experiences with contractors, and these included:

- *A few mistakes with contractor;*
- *It took two weeks, installed wrong boiler, no answer when phoned company;*
- *Contractor rude, did not answer phone, late evenings due to lots of callouts;*
- *Untidy work (plumbers);*
- *Position of pipes, no notice to clear stuff, untidy;*

- *Plumber put wrong valve on radiator in kitchen, leaving half the radiator warming up, impossible to bleed radiator.*

These comments, though rare, highlight the importance of ensuring that contractors are hand-picked based on a Scheme Manager's long experience of their service, and even then are also carefully monitored throughout their engagement with customers.

In general, all customers were either *satisfied* or very *satisfied* with the overall Scheme.

Chapter 6. Case Studies

6.1 Ms A

"***I think when you improve one thing, it encourages you to improve something else***."

House Type	3 bedroomed end-terrace, built in the 1920s or 1930s				
Household	Single parent, with a grown up daughter living with her				
Measures previously installed through Warm Homes	Loft insulation; solid wall insulation				
Whole House Solution measures installed	New oil boiler (dual system); replaced radiators; heating controls				
Energy Performance Certificate (EPC) rating	**Pre SAP**	NI average	**After SAP**	**Change in SAP post-retrofit**	**Potential SAP**
SAP points	49	57	67	18	70
Band	E	D	D	D	C

Ms A has lived in her home for 27 years. It is the house in which her father had grown up, so she feels an attachment to it. She described it as being "*an older house, so actually, yes, there was lots needed doing to it*".

Ms A first thought of getting loft insulation to improve her home, looked online for details, saw the Bryson website and contacted them. She found that she was eligible for loft insulation, solid wall insulation, a new oil boiler and radiators. She was apprehensive about the solid wall insulation: "*I thought, as a woman, when I started, "What am I doing?",* but post-installation felt *"really delighted".* It was much less disruptive than she had anticipated. She said, "*It all happened quite quickly. Just in a few days, they had all the re-plastering and everything done, so that wasn't that much of a disruption. It was worth it*". She added, "*Because I knew the benefits of it, I was quite happy*". Just before the work commenced, her daughter had decided to redecorate, and was advised to wait until the insulation was installed – "*it meant she had new walls to actually paint, so that was good*". In fact the re-plastering of the old and very thick walls made Ms A feel "*that I've a new home. You know the way it's an older house, I think it makes it look better because it's new walls*".

The difference in heating the home was noticed immediately: "*Massive. Before we got that insulation, at the top of our stairs when the oil was on, you never would have felt any heat at all, whereas now with the insulation in the roof and the walls, if you're at the top of the stairs and the heat's on, you actually can feel heat. Previously to that there wouldn't have been any heat*". The new system also heats the house much more quickly and to greater effect: "*We noticed the difference as soon as you put on the heat – within a matter of, like, minutes, it's working, whereas before, it never really got to the heat that it gets now*". The boiler has been in place for about a year and a half.

The dual control system meant that, for the first time, Ms A was able to heat water independently of the rooms, as she has no immersion heater. She uses quite a lot of hot water: "*Well, you know girls – quite a lot of baths and showers, and general*". The only other option had been to light an old stove, which blew out smoke through the house. Since this was unsuitable for a young family, it had not been used for years, and hence an immersion was something she might think of getting in the future.

With the new boiler and radiators, Ms A now spends half as much as she did before on oil, which she gets delivered to the house, considering oil drums to be "*kind of inefficient"*, as well as being too difficult for her to put into the tank.

Before the work was done, Ms A spent £100 a month on oil, which was not easy for her, being self-employed with a mainly seasonal income: "*If you had to save the £100 you wouldn't have had much money left for food*". Now, though spending half as much on oil, all areas and rooms of the house are comfortable. While one person might be studying in a particular room, the others can use a different room for their activities, instead of being "*under each others' feet*" in the warmest room. Ms A feels that her general wellbeing has improved, partly because of feeling less stressed about having enough money for oil: "*If I know myself now well, this month I have enough oil for next month, I'm less stressed*", and she also feels it is nicer now for other people to come to the house. She takes great pleasure in her home, and with the help of money saved on fuel, she has bought a wood burning stove for the sitting room – something she wanted for a long time – and also new bedroom furniture: "*I needed that for storage, but because* [the work] *was done and I didn't have to spend all that money on oil all the time, that it does leave you, you're happier to do it.*".

Ms A commented on how everything was handled from start to finish, including:

- **the installers**: "*You knew they were professional people were doing the job… In the end, when they left it, everything was cleaned up. They were even very helpful even moving stuff back, you know, because carpets had to be lifted*";

- **the help with the paperwork**: "*It was quite simple. They were helpful, anything was easy enough*";
- **the after-care and checks**: "*They came back to check the work. It was checked a couple of times*";
- **the energy advice given by the Bryson project officer**: "*She is very, very good, and did a wee survey, you know, on areas where I could maybe save… giving advice on even that electricity. Like, I pay by direct debit and she pointed out to me that that was the best way to do it*";
- **the Benefit Entitlement Check offered**: "*When you're in business, you're not really entitled to any benefits or anything… Possibly later on, rates – I possibly would be entitled to have it for rates, because I'm a lower income*".

She has recommended the scheme to her mother, who also got insulation installed: "*She couldn't believe they would come in and just do it so quickly and efficiently*".

Ms A has been putting her energy advice into practice in her business also, and saving on costs where she can. She is now looking into having solar panels fitted: "*That's the next plan of action. And I can see, when I do get them, it's going to cut back on my electricity bills, so then it leaves me more money for food, etc.*". She sums up the whole experience saying, "*I couldn't have afforded it, like, so it was really good... At this stage of life it's just nice to be comfortable in your home*".

6.2 Ms B

"***They couldn't have done anything more***."

House Type	3 bedroomed mid-terrace				
Household	3 adults under 60 years and a teenage son				
Measures previously installed through Warm Homes	Loft insulation				
Whole House Solution measures installed	New oil boiler (dual system)				
Energy Performance Certificate (EPC) rating	**NI average**	**Pre SAP**	**After SAP**	**Change in SAP post-retrofit**	**Potential SAP**
SAP points	57	64	76	12	79
Band	D	D	C	C	C

Ms B has been living in her home for 28 years. It already had cavity wall insulation, but Ms B described the house as "*just wild draughty and cold*", which she put down to the old heating system. As soon as the loft was insulated, Ms B "*found it a big difference*". While that immediately made the house warmer, she continued, "*it was kind of wasted until I got in the oil heating… Once the two jobs were done, it was a great job*." She said of the replacement heating system, "*It's great. It's not as cold. It's easier to heat. I don't know why, what it is, but it just seems easier*". The house now heats up within fifteen to twenty minutes. She added, "*you don't have to run it as long, leave it on as long*", as the heat is more efficient and the loft insulation reduces heat loss.

Ms B requires a lot of heat in her home. Requiring iron injections every three months, she describes herself as "*the coldest person ever*", and makes sure she always has a full supply of oil for September. Even during the summer, she says, "*There's nights the heat has to go on, like, it's just so cold*". She also suffers from a chronic back problem, so often uses a plug in heat pad instead of having the rest of the family "*sitting with the doors and the window open*" because they are too warm. Post retrofit, she says her health is "*not too bad*", but of her back problem, she says, "*I don't think there's anything makes any difference to that, only rest and the heat thing on*". During the winter, the family likes to light the fire in the living room, "*but it just heats the living room, and*

doesn't heat the water or the radiators, but it's nice if you're in the living room". Now that the home is warmer than before, they can enjoy the use of another room, as Ms B says, "*Well, we sit out here a lot now, which we never did, because it was always so cold*". Ms B remarked that she had previously had a back boiler, but said, "*They took it out years ago. You'd wonder why they would take a back boiler out… But I think it's very expensive to get it in again*". Commenting on the current price of oil, she added, "*And now everybody wants the fire back again*".

The dual control system lets Ms B heat the water independently of the rooms. This has been a change for her, having been used to having hot water when the heating was on, or otherwise switching on the immersion heater. She said, "*It's taken me a long time to get used to that – you had to put on the water heater, but a good job as well, because I think it's easier on the oil, than the electric*". She no longer uses the immersion, finding it less expensive to heat water from the oil system, but prefers to turn it on for an hour or so, rather than programme the water heating. She explained that she forgets and sometimes does not have, thinking, enough," *How have you no hot water?...the heating's on…*"and continued, "*But you get used to it*". She laughed about the amount of water used by the family having long showers, saying, "*They think it's free*", but she has saved by not having to use the immersion heater, describing it as "*A big change now*".

Ms B found no problem with the paperwork required, with support from Bryson Energy. She said, "*They seemed to have it all under control. All I had to do was sign*".

The installation went very smoothly. Ms B said, "*It was no problem at all. Nothing went wrong, everything just went, it was great, and they were clean and tidy*". She did not have to help with anything while the work was being carried out, and said of the follow-up support, "*They came out about twice after, just to make sure that everything was all right, and then when they came out then, they weren't happy with outside, the way it was left, and then somebody came out and tidied it up*". The boiler had been placed on the ground and as Ms B explained, "*He wanted it on a slab… he moved it then, and got it – it was no big deal. They had it sorted within a couple of days*".

Ms B prefers to use the same local oil supplier each time, saying, "*I ring when it's cheap*". They have a stamp scheme, but she prefers to save £10 a week, "*and maybe £5 the next week when I was a bit short*" towards her oil. She explained, "*I go down and pay it and then they deliver it*". She notices a saving post retrofit, adding, "*We wouldn't go through as much*". Previously, there would not have been treats or luxuries, in order to have the money for oil. She added, "*Well, you would have no meals out, or nothing like that… They're hard to come by*".

Overall, Ms B commented on the improvement through the scheme:

- **the installers**: "*It was no problem at all.*";
- **the help with the paperwork**: "*They seemed to have it all under control.*";
- **the after-care and checks**: "*They rang after, – they came out about twice after. "*;
- **the energy advice given by the Bryson project officer**: "*There was a girl out about the electric and everything else… She said she'd come back a year later to see what way things were, but everything was fine. "*;
- **the Benefit Entitlement Check offered**: "*I didn't get anything, but I was ok, like. I've got enough. I was happy enough with what I got*".

Describing how she felt about the improvements to her family home, Ms B said, "*Oh great, delighted. It's very good, now.*" She added, "*No complaints at all*".

6.3 Ms C

"You would hate, now, going back to the fire, when you have the oil."

House Type	3 bedroomed bungalow				
Household	3 generations of the family – mother (over 60 years old), daughter and grandchild (7 months old)				
Measures previously installed through Warm Homes	Loft insulation				
Whole House Solution measures installed	New oil boiler (dual system); 3 replaced radiators				
Energy Performance Certificate (EPC) rating	**Pre SAP**	NI average	**After SAP**	**Change in SAP post-retrofit**	**Potential SAP**
Unavailable		57 D	**Unavailable**		

Ms C shares the family home with her mother and baby. She has lived in it all her life. Before the oil heating system was installed, the house was heated by a large range cooker, which is still in place. This gave out ample heat, if filled with coal and sticks, and Ms C said, "*She put out that big a heat that you couldn't actually stay in the house with it, you know, unless it was real bad weather*". The heat came at a cost, as Ms C explained, "*It is good enough, but well, it's hard to run, too, for you couldn't carry coal to it*". The range used a lot of fuel, burning away quickly, and needing to be

refuelled. She finds the oil more convenient, "*That oil is some job*", and a lot cleaner – something which matters to her now, with a young baby. She added, "*It's great to press the button and switch the heating on and off, like. To start the fire, and red it out*[2]*, you know, red it all out, start into all that, and then you get it going. And it is dirty, like*", creating dust in the home.

Ms C is aware of being able to programme the heating system, but prefers not to, saying, "*I just put it on when I want it, and put if off when I want it off*". She finds the house, although it is a large property, heats up both quickly and well, and says, "*You'd have to put it* [the heat] *off*". Ms C tends not to need too much heat, although she "*would surely*" have felt cold in the house pre-retrofit, because of the difficulty in providing enough coal to keep the range going.

She is careful to ensure that the baby is warm enough. Having the heating controls allowed her to provide heat for his room when other rooms could be left unheated. She explained, "*I had men working at the bathroom and I had to turn [the radiator] off in the bathroom, because they would have been roasted, whereas I had to keep radiators on… for the baby. He would have been freezing, whereas they would have been roasting*". Without the heating controls, this would not have been possible. Ms C's mother also feels the cold badly, and requires a lot of heat. She says, "*Aye, sometimes… you'd be freezing*", which Ms C says puts down to bad circulation. On a holiday to Spain, she says her mother, "*sat in Spain with a big coat on her*", but since the heating was installed, Mrs C says, "*I'm comfortable now. You feel it great now*". With the family members needing different levels of thermal comfort, Ms C says of the controls, "*So it's great turning one off, if somebody's in that room that doesn't want the heat*".

Ms C has at times bought 20-litre jars of oil, but realises that it can be expensive. She said, "*But I ordered 450 litres off the lorry, and it was £170… I had it worked out that it was as cheap, and a bit cheaper actually, and getting the man out and putting it in*". She feels that the jars are useful if only a small amount is required, and continued, "*But it's all right getting jars – say you only want to top it up, say four or five jars. But, I mean, if you need a good bit of oil, you know, I think you're better getting the man out*". She is also concerned about the danger of transporting the oil, adding, "*But it's carrying them in the car, and, you know…*".

Having the water heated from the oil system is welcome. The water heats quickly and stays warm. Ms C said, "*But the water heater's a great job too – I've that on in the morning, maybe for half an hour, like, and you've warm water all day, then, for the dishes*".

[2] "red out" is a commonly heard NI expression meaning to clear or tidy up.

The installation was "*no bother*". The work was done to a good standard and everything was left clean and tidy. Of the aftercare, Ms C reported, "*We've had no problems at all*" and would know who to contact if necessary. Post-retrofit, Ms C has seen some reduction in energy costs, and needs to buy less fuel.

She received energy advice from the Bryson project officer, who "*went round the places*" in the home showing where energy could be saved.

Overall, Ms C summed up the situation by saying, "*Everything went great here. Everything went well, definitely*".

6.4 Mrs D

"It's nice to know you gave us that, that you get that help with it."

House Type	3 bedroomed bungalow – very rural location				
Household	Married couple under 60 years				
Measures previously installed through Warm Homes	Loft insulation; ventilation tiles				
Whole House Solution measures installed	New oil boiler (dual system); replaced radiators; heating controls				
Energy Performance Certificate (EPC) rating	**Pre SAP**	NI average	**After SAP**	**Change in SAP post-retrofit**	**Potential SAP**
SAP points	57	57	70	13	74
Band	D	D	C	C	C

Mrs D and her husband moved into their home in 1968, since when it has been renovated and extended. Part of the original house had stone walls, which Mrs D said were insulated by the builder, during their renovations.

The bathroom has been modified to accommodate Mrs D's current level of disability. She suffers from arthritis, is currently recuperating following a hip replacement and has trouble with her knees.

She walks with a rollator, using rails to help her manage. Their daughter, who lives nearby, spends every day with her mother, as her carer, and on a rare occasion may stay overnight.

Post-retrofit, Mrs D mentioned the relocation of the boiler outside, the original boiler having been inside, saying, "…*which is good, it's brilliant. And it's a lot safer*". She added that the boiler was larger than their previous one, adding, "*I think that made the difference*", as the heat seems to "*circulate better*".

With the dual control system, the immersion heater has not been used post retrofit. Mrs D can "*put on the water, if you want*", and her daughter commented that if the immersion was used, "*you can't go near the water, 'cause it's scalding*", whereas, "*you can put on the oil and the water's at the right temperature*". As yet, Mrs D says she is not sure that there has been any saving on the heating of water, but feels that this is included in the general reduction of oil used.

Post retrofit, Mrs D can vary the amount of heat required in different rooms, putting the heating on for about an hour before bed. Her daughter says it is good for the rare occasion when she might stay overnight, "*I have the smaller room, that I would sleep in, and because it is smaller, I am able to turn off the radiators if it is too warm, whereas I wouldn't have been able to do that before. I can turn them down, so that bit of it is good*". She also thinks it is good that other lesser used rooms do not have to be fully heated now at all times, when, "*A very odd time we have family up staying or whatever, or the odd time that I would stay up*". Post retrofit, Mrs D says they have noticed a saving of oil. She is unable to say in financial terms how much they are saving, because they "*just haven't really sat down, I suppose, and really thought about it, to be honest*", but added, "*I do know that it is easier on the oil*". As well as using the heating controls to suit individual rooms, Miss D also likes being able to adjust the temperature overall, and said, "*The thermostat is great, now, because you can turn it up or down. If it is a bit chilly, you can turn it up a wee bit, or if it's too warm, turn it down a wee bit instead of actually turning it off in the winter*". This was particularly useful during the winter, because, she explained, "*They would, after the coldest days of winter, leave the heating on, and we would be able to turn it way down low during the night. And then in the morning, they were able to turn it up that bit more*". Pre-retrofit, it would have been "*on or off – full blast or nothing at all*". The flexibility of the system has been beneficial.

Despite the fairly isolated rural location, with a very narrow access road, Mrs D says they have oil delivered by tanker, and says "*It works out cheaper that way, than them just coming with drums*", using the same supplier "*this last while now… well, they're a lot cheaper*".

Mr D pays for their oil when it is delivered. He deals with the ordering and paying for oil. Mrs D uses the Paypoint in the village to pay the electricity bills every three months, which she finds very convenient.

Mrs D tends to need heat because of her health, and lack of mobility, and finds the heating system effective. She said of the main bedroom, "*Our room used to be very, very cold, even with putting the heating on… Even before with the radiator on, it still would have been coldish*". That is no longer a problem, and the house heats more quickly, too, as her daughter remarked, "*The house is easier to heat as well – you know, you could boost it for an hour and the house is nice and warm, whereas before, with the old boiler, the heating could have been on a couple of hours and then you maybe would have felt it*". She also feels that "*it keeps warmer longer*", since the loft was also insulated. They were instructed on the use of the heating, although Mrs D prefers to leave it to either her daughter or husband, saying, "*I haven't sort of went near that, because I don't want to do anything that would…*". Her daughter laughed, "*She doesn't need to …we're here to do if for her!*". Miss D said everything was very easily explained and she felt prepared to use the heating controls, when she would be "*dealing with the heating myself*".

Neither Mrs D nor Miss D, who was present during installation, had difficulty with the process. The paperwork was "*more or less just sign, you know, whenever the work was done*", and the aftercare was good. Besides calling out to the house, Miss D said, "*they would have been on the phone a few times*", so they felt they had any support they might need.

They were given energy advice by the Bryson project officer. While Mrs D says they have not always been keeping receipts, as advised to do, her daughter said, "*Lights, I would be a lot more conscious of that now. Everything would be turned off before they would go to bed*". Her daughter has also put the energy saving tips into practice in her own house, saying, "*I think it kind of makes you think more… but even for my own house…you're thinking more on things*", so both households are benefiting from the advice. She has now incorporated the advice into her daily habits, saying, "*I've started turning off all plugs before bed, whereas earlier years you wouldn't have bothered*".

Mrs D commented on the temperature card she received from the Bryson project officer, using it frequently to check the room temperature. Mrs D said, "*You can have it sitting in the room or our bedroom, to see when it went up or down*". She is particularly conscious of the heat in these two rooms, where she spends most of her time and says that pre-retrofit, "*You would have went out from here down to our bedroom and you'd have noticed the difference in the temperature – it had*

fallen down, you know, and it was cold", whereas post- retrofit, "*you go down and you don't pass any remark because you're going from heat to heat*".

Of her home, Mrs D said, "*I like, always liked, up here, and even from moving from the village up to here, and I wouldn't move. Definitely wouldn't move, now, and that's being honest*". Of the retrofit, her daughter said, "*I think we're very happy with it*", Mrs D adding, "*And we're not just saying that. It really is, it's really good*". Summing up, she said, "*I know that we can turn up the heating in the winter time and it leaves you just…it's lovely*".

6.5 Mr E

"I can't think of anything else I would need done at the minute."

House Type	4 bedroomed end-terrace				
Household	Widowed father (over 70 years) with two adult daughters living at home				
Measures previously installed through Warm Homes	Loft insulation; ventilation tiles				
Whole House Solution measures installed	New oil boiler (dual system); one replaced radiator				
Energy Performance Certificate (EPC) rating	**Pre SAP**	NI average	**After SAP**	**Change in SAP post-retrofit**	**Potential SAP**
SAP points	51	57	69	18	74
Band	E	D	C	C	C

Mr E first rented his home around 1980, buying it later from the landlord, saying, "*Sure I got it for half of nothing*". Now widowed, he lives there with his two grown up daughters. His son also calls in frequently.

Of the original condition of the house, Mr E said, "*I suppose there was nothing wrong with it, really. There were a lot of wee faults*". He stressed, "*There were more damp spots with drains in the walls. The wee room in there in the front – the whole wall next there, the water was running off it*". This was resolved by having the cavity walls insulated, after a lot of complaints to the landlord. The house

had oil central heating and also an open fire with a back boiler. There is currently an immersion heater which is never used.

Over the years, Mr E has paid for a lot of improvements to be made to the house, including new floors in the kitchen and hallway, a new kitchen, a new bathroom, new double glazed windows and doors. The Bryson retrofit is the first grant scheme he has used. He thought his old boiler was around 16 or 17 years old, but he was not sure. He was glad to see it go, saying that the replacement is "*better than the other boiler*".

While Mr E described the warmth of the house as "*OK*" pre-retrofit, he continued, "*I don't see much difference in the warmth of the house, just I think since that new boiler went in, it's cheaper, it doesn't cost … it doesn't go through just as much oil*". Mr E has been checking how much oil is used, but because he had filled the tank some weeks pre-retrofit, he was trying to work out how much oil had been used by both the old and new boilers. He confirmed, "*That tank of oil lasted longer than the last one*", adding, "*But then it was in the middle of summer, you know, so*…". While Mr E does not feel much difference in temperature in the house, his family does. Mr E said, "*They'd be out there in the kitchen and the door open – it's… put on that heat, I'm frozen!*", whereas, "*They would think it warm*".

The house heats more quickly post-retrofit, taking "*no time at all*", and apart from times of cold weather, Mr E says, "*We hardly ever have it on up the stairs now at all, for the heat rises, anyway*", so the upstairs radiators are not always on. Having the heating controls means they can use heat as required in the house. The heating is programmed to come on in the morning. Mr E's daughter "*works it most of the time*". They also find being able to programme the separate water heating system "*very helpful, surely*", as previously the system was more complicated, as Mr E explained, "*We switched it off from going up the stairs – I'd a wee lever and I stopped it going up the stairs – just downstairs, for the water and the heating and oil, you know*". Now, because "*it comes on itself*", Mr E says, it "*keeps me from getting up… to put it on*".

Mr E has health conditions, including heart surgery, which mean he needs a considerable amount of heat and is not particularly mobile. He says he is "*killed with pains all over*", adding, "*My age, I suppose too –too many birthdays*", adding, "*Sure, I'm stuck in the corner here most of the time, anyway… And I don't move too much*". Now that less oil is being used post-retrofit, he feels that he can keep the heating on for longer.

Mr E orders oil as required, usually getting 900 litres – or 200 gallons, as he prefers to think of it. He says his son buys oil drums, adding, "*It's cheaper, I suppose*". Mr E always uses the same oil supplier.

He used to shop around for a good price, but stopped that a few years ago, because he "*began to think that some of them wasn't giving me enough oil that was paid for, you know?... Sometimes it wouldn't last for any time*". His daughter pays the electricity bills quarterly, and he would not be interested in switching to a different company. Having been given energy efficiency advice by the Bryson project officer, Mr E was unsure of how energy efficient he was, saying, "*Well, sure, I don't know – I wouldn't say that, now. I don't know*".

The retrofit work done was not any trouble. Mr E could not really remember how he went about applying to Bryson, but he said, "*There was a boy came out and checked first*". He had no complaints about the installation adding, "*Oh, they cleaned up well after them*" – praise indeed from a man who described previous builders as "*dead rough*". He made no complaint about follow-up checks that were done. An unexpected result of the Bryson installers being in his loft, Mr E said, was that they "*told me before they left that the hot water tank in the thing was about to start leaking – it was corroded*", allowing Mr E to get a plumber before any damage was done.

The only issue Mr E had with the retrofit was losing the back boiler. Mr E wanted to keep it, of which he said, "*I wasn't just dependent on it, but … it was a great help, I'll tell you*". At that stage, he said, "*I was in two minds whether to get a new boiler or not, then*"[3]. Although they never use an electric fire, his family likes to light the fire nearly every evening, and Mr E says, "*So when the back boiler was there, you'd boiling water as well, you know*". His daughter would like a back boiler put in again, but Mr E explained that with the very large stone fireplace to be removed, it would be a very difficult job.

That aside, he says, "*I'm content enough with it now… It's very good*".

[3] Mr E and the Senior Technical Manager did discuss his options for keeping the back boiler. Mr E said he would agree to disconnect if he had to, but would consider paying towards the costs of bringing the link up to current specifications. Estimates were provided. It is assumed that Mr E decided not to proceed with linking the back boiler to the new system.

6.6 Mr F

"I'm very happy with mine now, compared to what it was."

House Type	3 bedroomed detached bungalow				
Household	Sole male adult under 60 years				
Measures previously installed through Warm Homes	Loft insulation				
Whole House Solution measures installed	New oil boiler (dual system); 3 replaced radiators; heating controls				
Energy Performance Certificate (EPC) rating	**NI average**	**Pre SAP**	**After SAP**	**Change in SAP post-retrofit**	**Potential SAP**
SAP points	57	58	70	12	76
Band	D	D	C	C	C

Mr F has been living in his home for over twenty years. When he first moved in, the only heating was an open fire. Around twenty years ago, he had oil heating installed, but said, "*The heating never went right… My heating was a disaster. The house was so cold*". More recently, he installed PVC windows at his own expense. The dual control system allows Mr F to heat water independently of the rooms. Mr F had Solar PV installed a few years ago through a part-funded scheme. He said, "*If you've got sun, you go down and put on the water, you can't put your hand over it. It's first class*". He felt the outlay was worth it, saying, "*A few pounds at the time – it wasn't too much… well, you're saving too, you know*".

During the Bryson retrofit, the new boiler was repositioned nearer to the house, because, as Mr F explained, "*My boiler was outside in the shed…and it was too far to come, they were telling me. So now they've got it at the back wall, which is completely different*". The new location has made a difference, the previous one having been "*about ten meters away from the house … and it was wild hard to heat the house. You'd it on for a lot of hours even before it started to heat the house*", whereas now, he says, "*it's completely different*". The house now heats more quickly. Because of an accident, and being diagnosed a year ago with diabetes, Mr F says he "*wouldn't be too well at times… I was very bad with it there*". He feels the need for extra heat at such times.

Mr F chooses not to programme the heating, preferring to "*just press the button when I want it*". Three new radiators were installed, the old ones being "*very poorly…all rusted*". Mr F does not make much use of the radiator thermostats, stating, "*We never turn much at them, you know? Sometimes … we have to turn them down at times*".

He remarked on needing to use less oil than pre-retrofit, saying, "*We're using less, surely, it's not as sore on it*". Besides the cost of the oil, the previous system cost them for repairs. Mr F explained, "*We'd a lot of trouble, too, with the old system – it was breaking down, and we'd men here fixing it at times. It was no good. It kept breaking down*". On one occasion, he said, they paid £50 for a burner, which then "*gave a wild lot of bother*", following which, "*the boiler had packed in then 'cause it was too old… it was completely rusted, at the end of it*". Overall, Mr F knew that the system was costing more than it was worth, adding, "*And then when you pay them, like, you would be able to fill the tank with oil, a couple of times, with the money*."

He added, "*The back boiler was taken out when I got the heating put in twenty years ago*".

Mr F sometimes has oil delivered, but often uses the 20-litre drums, saying, "*It depends… It's not too bad now. It was bad there for a while, you know, it was wild dear*". He explained how it worked out to be expensive buying the oil in drums, saying, "*And some of those shops was charging nearly £20 for 20 litres".* By filling their own jars, they were "*filling the jars for 20 litres for £11*". He explained that "*they charge £2 or £3 for the jar too*", so he used his own jars when buying oil that way. He was aware of the risk involved in transporting fuel, saying, "*If anything happened, or… it is a danger*", but it was sometimes the only option, as he said, "*It's not easy getting your tank filled up when you're not working either, you know*".

Mr F budgets for oil by "*trying to leave so much away every week*" and pays when he buys it, because "*That's the way you have to do it*". He does not use oil stamps or payment cards. He has a pre-payment electricity meter, which he describes as "*a good system too… At least you've no bill coming in*". He feels that heating water using the oil and the solar panels, his electricity bill is "*not too bad, now*". Using the prepayment meter, he feels in control of how much he spends.

Mr F commented on having loft insulation installed as part of the whole house solution package, particularly as he had experienced burst pipes during cold weather – "*The weather was unbelievable here*" – which caused ceilings to come down. He felt at that stage, "*Sometimes you're better that way not owning your own house, when you have to pay for everything*", since socially renting neighbours had the repair work carried out for them . He said of the Bryson retrofit, "*We got it all lagged and all. It was very thick. It was a great job, like, the lagging*".

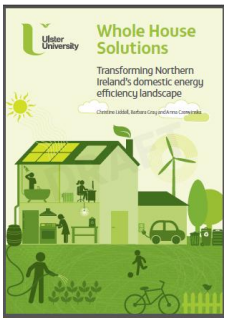
Overall, Mr F commented on the quality of the workmanship, describing the installers as "*First class at their job. Every man to their own job, like. They were class at it*", continuing, "*I tell you, it was a big job, for I used to work at fitting work myself*". He said everything was done quickly and with no mess. His mother also had energy efficiency measures installed. Mr F said, "*There were eight men*

came in one day and I never seen nothing like them. They were there at half seven in the morning and they were finished at nine o'clock at night". He described his mother as "*very tidy*", so they were pleased to report that "*the first thing they done, they came in with a roll of plastic up the stairs*", and at the end, "*two Hoovers when they were finished and hoovered up, and not a matchstick*!"

The energy advice from the Bryson project officer was "*very helpful. She went round a pile of things…It was very good*".

Mr F said the aftercare was "*Great servicing*" and he has no complaints. He sees the difference between this new Whole House Solution approach and the previous work done on parts of the heating system – for example installing a heating system without having loft insulation –ensuring that the work fully benefits the household.

Chapter 7. Conclusions



This evaluation, when read with its companion report, *Whole House Solutions: Transforming Northern Ireland's domestic energy efficiency landscape* (Liddell et al., 2015), provides a scientific evidence base for a local approach to whole house solutions in Northern Ireland. The present report in particular provides independent evidence of the positive health and wellbeing impacts which such schemes can deliver to people experiencing severe fuel poverty.

When the two reports are read together, it becomes clear that this first Whole House Solutions Project has merely skimmed the surface of the potential embedded in a Whole House Approach. As new technologies become both proven and cheaper to take to scale, so this present evaluation and its companion report can, perhaps, form a baseline for expansion and innovation.

7.1 Summary of outcomes from the surveys

- Before retrofit, the households who participated in this Project were predominantly low income households with poor access to services, and were experiencing severe fuel poverty before retrofit;
- Fuel poverty meant that they altered their lifestyles and energy practices in order to be able to achieve as reasonable a standard of warmth that money would allow;
- This caused significant worry, and often meant doing without essentials;
- Despite this households often lived with insufficient warmth during colder weather;
- Households used oil as the *main* form of heating;
- *Supplementary heating* in the form of coal, logs and turf were used by 70% of the households to top up their needs;
- A total of 100 oil boilers were installed with radiators and heating controls as required;
- The increase in SAP ratings averaged 17 points;
- Most households reduced their electricity bills by around a quarter;
- The average annual household consumption of oil (litres) decreased by about a quarter;
- The use of other fuels decreased by more than a third;
- 14 of the 19 households previously going without heating no longer do so;
- Half of the households previously going without treats to pay for heating no longer do so;
- Fewer households worry about affording heating;

- There is a statistically significant improvement in general health and wellbeing; given that many of these households had residents who were in poor *physical* health, and were also in poor *mental health,* these outcomes are particularly favourable, improving as they do the everyday lives of vulnerable people.

7.2 Summary of outcomes from the case studies:

- The case studies were not chosen by the Bryson team, but by the UU evaluation team, and this was done blind i.e. without any knowledge of the particular families that were eventually visited. Selection was based on ensuring a representative selection of case studies which covered families with children, people of retirement age, people living with disabilities etc.
- It is noteworthy in that context that case study participants were unanimous in describing the impact of the installations as positive, either in terms of impacts on their lifestyle, and/or on their thermal comfort
- A prevailing theme throughout the case studies was the value of having control of room temperatures, which participants mentioned they made use of on a regular basis throughout the day and evenings
- Wider options for heating water were appreciated, which allowed flexibility and choice as to how and when hot water was used
- The ability to have different rooms at different temperatures was frequently noted too, since this meant that – for example – a person in one bedroom could sleep without heating, whilst another person next door could have heating on all night if feeling poorly
- The case studies, more than any other element of this evaluation, highlight how a Whole House Solution can also be a *Whole Household Solution*, meeting everyone's diverse energy needs and preferences.

7.3 Customer Satisfaction Survey

- A 100% response rate was achieved for completed Customer Satisfaction Surveys.
- All customers were either *satisfied* or *very satisfied* with the overall performance of the scheme
- 7% were *not satisfied* with the Contractor's performance, whether relating to tidiness or standard of workmanship, highlighting the need for careful selection of the best contractors, and also the need for a Scheme Manager to maintain vigilance throughout contractors' contact with clients.

7.4 Recommendations and observations

Any improvement to the condition of these 100 properties may impact the lives of at least 288 residents, including many vulnerable people such as young families, over 60s, and people living with poor mental and physical health.
In addition, such improvement could be beneficial to other friends and family members, for example grandchildren, who may spend a considerable amount of time in these homes.

- All 100 participants returned their Customer Satisfaction Survey, yet only 52 accepted a home visit at follow-up. Consent to a follow-up home visit was part of the overall consent agreement, so this result was disappointing. It seems unlikely that reluctance to accept a home visit was related to participants being dissatisfied with their new systems, since the Customer Satisfaction Survey responses were largely positive. However the baseline survey had been lengthy and had taken considerable time to complete. Perhaps participants felt that this was a barrier to undertaking the same lengthy interview again a year later. In future, it is recommended that a much shorter follow-up survey is developed, and that this is posted out to participants a year later, perhaps with a modest incentive such as a £10 shopping voucher when these are completed and returned. Should participants prefer a home visit instead, this can then be arranged.
- In estimating changes in electricity use, the research team had great difficulty in making sense of the bills that participants in the scheme had stored for them; these were often impenetrable, and also varied widely across suppliers in the way they were laid out and the information they contained. All electricity suppliers should use the same form of billing for customers, and this should meet gold standards of comprehensibility. A more straightforward and clear bill would let customers see exactly how many units they have used at what price, to enable them to compare suppliers and make an informed choice about switching.
- Changes in oil consumption are much more difficult to measure accurately, since tank contents are difficult to measure pre-retrofit, and also a year later; furthermore, purchases are made sporadically and not always for the same amount of oil; few people assiduously retain receipts too, making for a great deal of guesswork. Since the cost of heating oil is the greater element of domestic energy costs in NI, investing in research which allows a more robust protocol for estimating consumption is strongly advised.

- Scheme Managers need to exercise scrutiny when appointing contractors, and be vigilant whilst works are carried out, to ensure that they all meet high standards of workmanship and timekeeping.

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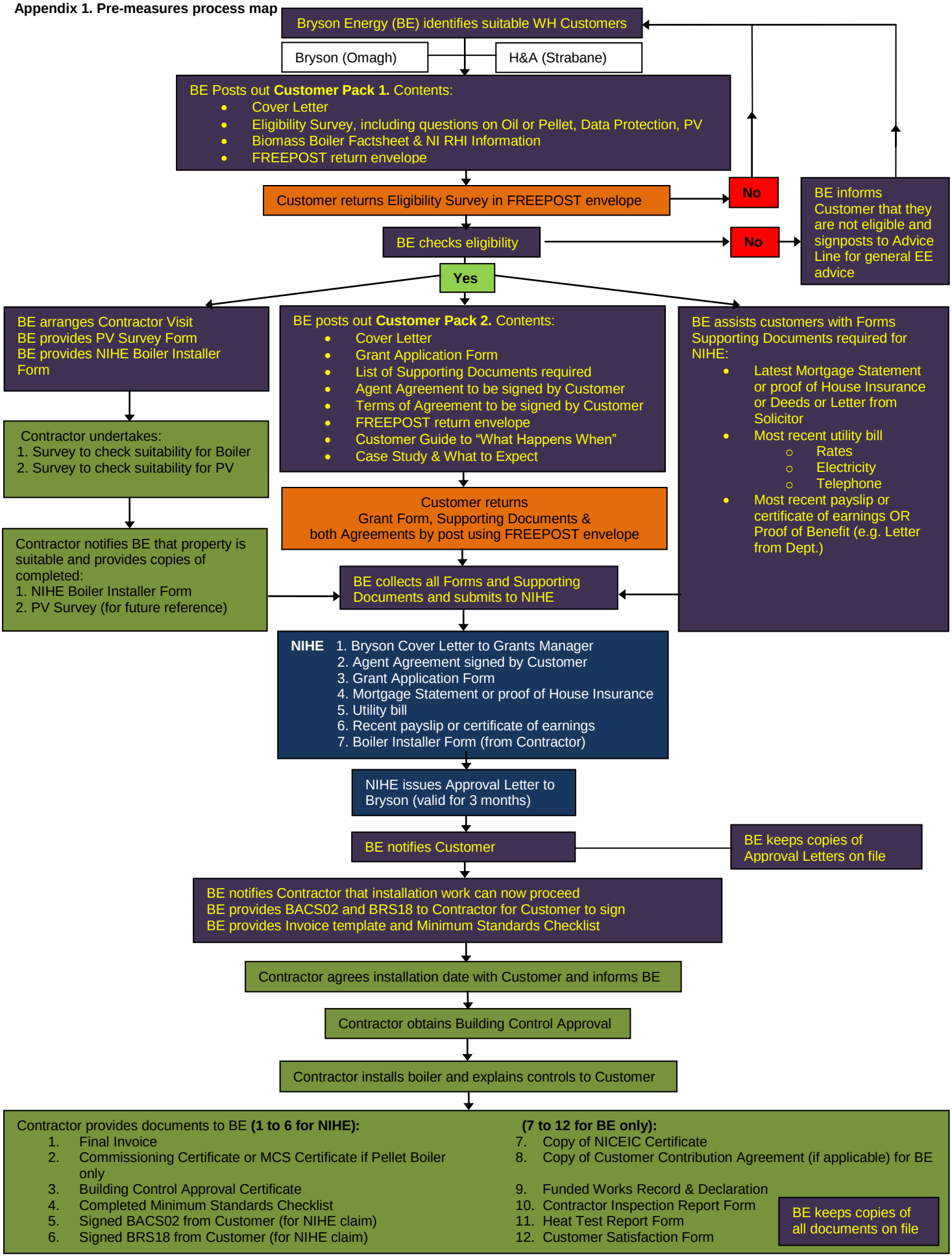
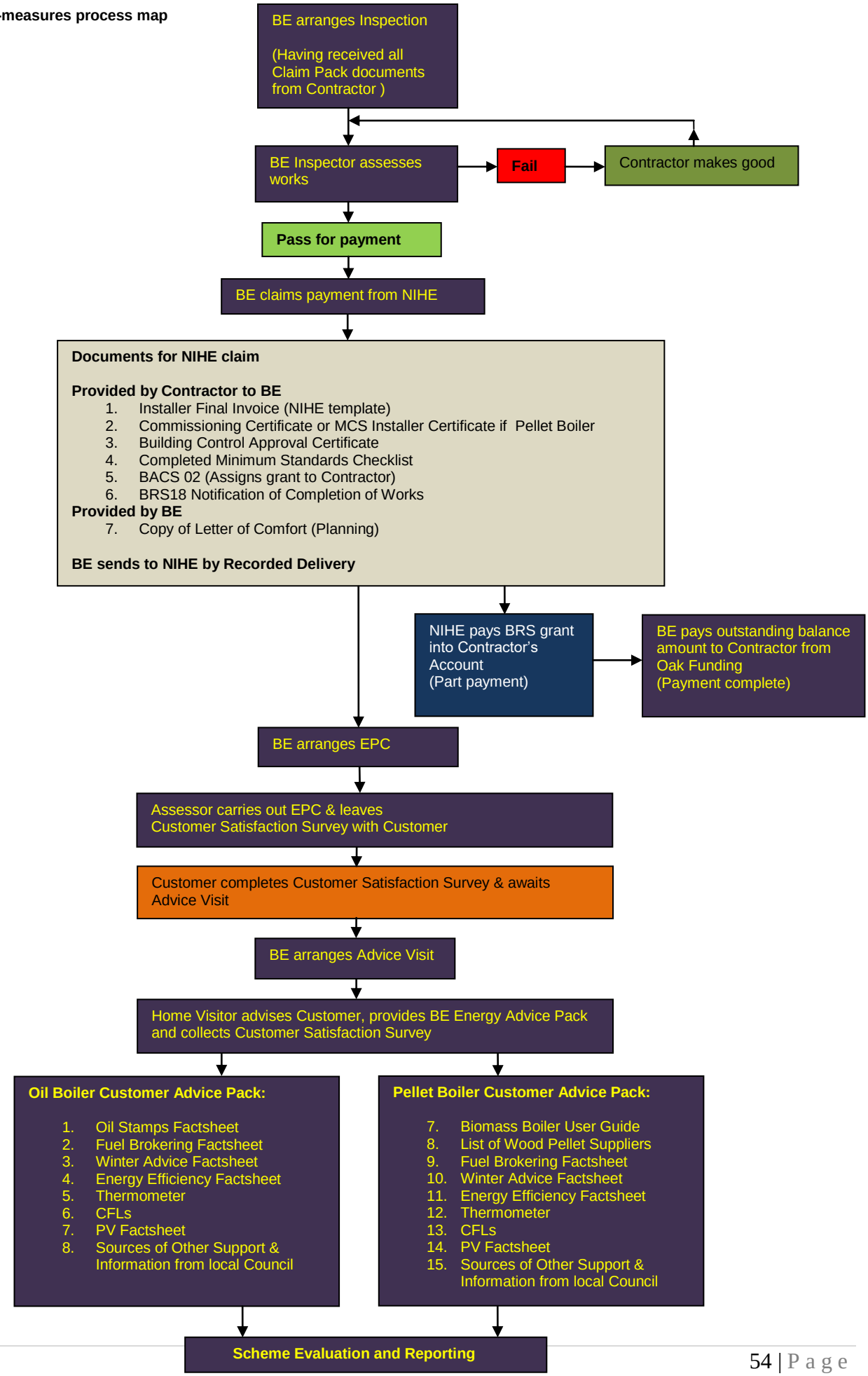
Appendix 1. Pre-measures process map



Appendix 2. Post-measures process map



Bryson Energy Retrofit Scheme - Whole House Solution

EVALUATION 2014/2015

Bryson Energy

BASELINE SURVEY (BEFORE MEASURES)

HOUSE DETAILS

What is your house type? Bungalow ☐ Detached ☐ Semi-Detached ☐ End Terrace ☐
Mid-Terrace ☐ Flat ☐ (Please tick the relevant box.)

How many bedrooms do you have?.....

How many people normally live in the house?

Children 0-5yrs	
Children 5-16yrs	
Adults	
Adults over 60 yrs	
Total	

HEATING

What is the main form of heating you regularly use in your home? Oil ☐ Coal Fire ☐
Coal Fire with back boiler ☐ Electric Fire ☐ Other ☐.....

OIL - How much oil do you order per year? Cost (£)..... Litres/gallons (Delete as appropriate) .....

How often do you order oil? Once a month ☐ Once every three months ☐
Once every six months ☐ Once every year ☐

Please provide oil bills for the past 12 to 18 months if available.

Do you use the same oil supplier every time or do you shop around for a cheaper price? Same ☐
Shop around ☐ (Please tick the relevant box.)

Do you ever purchase oil in 20 Litre plastic containers? Almost Always ☐ Frequently ☐
Some of the time ☐ Once in a while ☐ Never ☐ (Please tick the relevant box.)

How do you normally pay for oil? – Cash/Cheque on delivery ☐ Cash/Cheque later ☐ Credit Card ☐
Direct Debit ☐ Oil Cash Card ☐ Other Method ☐ ..... (Please tick the relevant box.)

Have you ever budgeted for oil using Paypoint? Almost Always ☐ Frequently ☐
Some of the time ☐ Once in a while ☐ Never ☐ (Please tick the relevant box.)

Have you ever budgeted for oil using Oil Stamps? Almost Always ☐ Frequently ☐
Some of the time ☐ Once in a while ☐ Never ☐ (Please tick the relevant box.)

How useful/beneficial have they been compared to normal payment methods?

Very useful ☐ Useful ☐ No real benefits ☐ (Please tick the relevant box.)

How often have you participated in a fuel brokering club to benefit from cheaper bulk orders?

Almost Always ☐ Frequently ☐ Some of the time ☐ Once in a while ☐ Never ☐

(Please tick the relevant box.)

If Yes, what savings have you experienced?

I saved a lot of money ☐ I saved a bit ☐ I did not save very much ☐
It made no difference to the price I paid ☐ (Please tick the relevant box.)

ELECTRIC FIRE – How often do you use an electric fire in colder weather?

Very often ☐ Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

COAL / LOGS - How often do you use coal/logs in colder weather?

Very often ☐ Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

HEALTH AND WELLBEING

On a scale of 1 to 10, where 1 is very poor and 10 is excellent, how would you rate your general health and wellbeing? .....

Please read the questions below and each of the four possible answers. Circle the response that best applies to you.

Have you recently:

1. been able to concentrate on what you're doing?

better than usual (0) same as usual (1) less than usual (2) much less than usual (3)

2. lost much sleep over worry?

not at all (0) no more than usual (1) rather more than usual (2) much more than usual (3)

3. felt that you are playing a useful part in things?

more so than usual (0) same as usual (1) less so than usual (2) much less than usual (3)

4. felt capable of making decisions about things?

more so than usual (0) same as usual (1) less than usual (2) much less than usual (3)

5. felt constantly under strain?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

6. felt you couldn't overcome your difficulties?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

7. been able to enjoy your normal day to day activities?

more so than usual (0) | same as usual (1) | less so than usual (2) | much less than usual (3)

8. been able to face up to your problems?

more so than usual (0) | same as usual (1) | less than usual (2) | much less than usual (3)

9. been feeling unhappy or depressed?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

10. been losing confidence in yourself?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

11. been thinking of yourself as a worthless person?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

12. been feeling reasonably happy, all things considered?

more so than usual (0) | same as usual (1) | less so than usual (2) | much less than usual (3)

ELECTRICITY

How much electricity do you use per year? Cost (£)…….. Units (kWh)……..

Please provide electricity bills for the past 12 to 18 months if available. ☐

Please give your consent as below:
I give my consent for the Advisor/Surveyor to access my prepayment meter. Please tick ☐ or N/A☐
I give my consent for Bryson Energy to obtain consumption history from my supplier or NIE and I have completed the separate Consent Form. Please tick ☐

Please indicate your electricity supplier; Airtricity ☐ Power NI ☐ Budget Energy ☐
(Please tick the relevant box.)

How long have you been with them?……

How do you normally pay for electricity? – Pay As You Go☐ Monthly Direct Debit ☐ Quarterly Bill☐
Standing Order ☐ Paypoint Savers Card ☐ Other Method ☐ (Please tick the relevant box.)

PATTERNS OF ENERGY USAGE

Last winter, how often did your household go without heating because of the cost?
Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

Last winter, did you go without other things such as treats or luxuries so that you could keep your home warm? Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

Do you worry about the cost of heating and powering your home?
Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

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?
Always ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

Are you a member of a credit union? Yes ☐ No ☐ (Please tick the relevant box.)

If Yes, which one……

Is there any illness or disability which requires the heating to be on more than most households?

……

……

……

……

COMFORT LEVELS

During Winter when heating needs are greatest, how often would you say your home is:

(Please circle for **each**.)

	All of the time	Most of the time	Sometimes	Never
Too hot	1	2	3	4
Too Cold	1	2	3	4
Fine	1	2	3	4

DAMP, MOULD or CONDENSATION

Is there any damp, mould growth or condensation anywhere in your home?

Yes a lot ☐ **Quite a lot** ☐ **A little bit** ☐ **None** ☐

If present, how does damp, mould or condensation affect your household in general?

	No trouble	Live with it	Some inconvenience	Some discomfort	Distressing
	1	2	3	4	5

MEASURES INSTALLED

(Before Retrofit Scheme) What previous measures have been installed?

Loft Insulation ☐ Cavity Wall Insulation ☐ Solid Wall Insulation ☐ (Please tick the relevant box.)

Other ☐..... (Please provide details.)

PERSONAL DETAILS

Name: .....

Address: .....

Postcode: .....

Daytime Tel: ..... Mobile: .....

Email Address: .....

SIGNATURE and DATE

Signed: ..... **Date:** .....

Field Notes:

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Date of Baseline Survey: .....
BERS Ref. No. .....
Advisor Name.....
EPC Energy Efficiency Rating (Before).....
Referred for Benefit Entitlement Check? Yes ☐ No ☐ BEC Outcome
.....

Annual electricity usage:	.....kWh	£.....	Bills provided	Yes ☐ No ☐
Annual oil usage:	.....Litres	£.....	Bills provided	Yes ☐ No ☐
Other fuel: (.....)	..... ( )	£.....	Bills provided	Yes ☐ No ☐
Other fuel: (.....)	..... ( )	£.....	Bills provided	Yes ☐ No ☐

Total Annual Energy Spend (Before) **£.....**

Unit cost of electricity during the period .....pence per kWh
Unit cost of oil during the period..... pence per litre

Appendix 4. Post-retrofit Survey

Bryson Energy Retrofit Scheme - Whole House Solution

EVALUATION 2014/2015

ENERGY USAGE SURVEY (AFTER MEASURES)

Bryson Energy is the Data Controller and is collecting information from you today as part of the Bryson Energy Retrofit Scheme. We wish to evaluate the outcomes of the scheme following the installation of your new boiler. We are working with the University of Ulster who will undertake an evaluation of the scheme. Your responses to this survey will be recorded and shared with the University, grant providers and other relevant stakeholders for the purposes of the evaluation. Do you consent to this?

Yes ☐ No ☐

HOUSE DETAILS

What is your house type? Bungalow ☐ Detached ☐ Semi-Detached ☐ End Terrace ☐ Mid-Terrace ☐ Flat ☐ (Please tick the relevant box.)

How many bedrooms do you have?.....

How many people normally live in the house?

Children 0-5yrs	
Children 5-16yrs	
Adults	
Adults over 60 yrs	
Total	

HEATING

What is the main form of heating you regularly use in your home? Oil ☐ Coal Fire ☐ Coal Fire with back boiler ☐ Electric Fire ☐ Wood Pellet Boiler ☐ Other ☐ .....

OIL - How much oil do you order per year? Cost (£)..... Litres/gallons (Delete as appropriate) .....

How often do you order oil? Once a month ☐ Once every three months ☐ Once every six months ☐ Once every year ☐ (Please tick the relevant box.)

Do you think you have saved money on heating post-Retrofit? (e.g. since the new boiler was installed.)

A lot ☐ Some ☐ A little ☐ None ☐ Spent more Post-Retrofit ☐ (Please tick the relevant box.)

Please provide oil bills for the past 12 to 18 months if available.

Do you use the same oil supplier every time or do you shop around for a cheaper price? Same ☐ Shop around ☐ (Please tick the relevant box.)

Do you ever purchase oil in 20 Litre plastic containers? Almost Always ☐ Frequently ☐ Some of the time ☐ Once in a while ☐ Never ☐ (Please tick the relevant box.)

How do you normally pay for oil? – Cash/Cheque on delivery ☐ Cash/Cheque later ☐ Credit Card ☐ Direct Debit ☐ Oil Cash Card ☐ Other Method ☐ ..... (Please tick the relevant box.)

Have you ever budgeted for oil using Paypoint? Almost Always ☐ Frequently ☐
Some of the time ☐ Once in a while ☐ Never ☐ (Please tick the relevant box.)

Have you ever budgeted for oil using Oil Stamps? Almost Always ☐ Frequently ☐
Some of the time ☐ Once in a while ☐ Never ☐ (Please tick the relevant box.)

How useful/beneficial have they been compared to normal payment methods?

Very useful ☐ Useful ☐ No real benefits ☐ (Please tick the relevant box.)

How often have you participated in a fuel brokering club to benefit from cheaper bulk orders?

Almost Always ☐ Frequently ☐ Some of the time ☐ Once in a while ☐ Never ☐

(Please tick the relevant box.)

If Yes, what savings have you experienced?

I saved a lot of money ☐ I saved a bit ☐ I did not save very much ☐
It made no difference to the price I paid ☐ (Please tick the relevant box.)

ELECTRIC FIRE – How often do you use an electric fire in colder weather?

Very often ☐ Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

COAL / LOGS - How often do you use coal/logs in colder weather?

Very often ☐ Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

WOOD PELLETS - How much wood pellet fuel do you order per year? Cost (£)**.....**
Number of 10kg Bags..... Bulk Order/Tonnes.....

Please provide wood pellet bills for the past 12 months if available.

HEALTH AND WELLBEING

On a scale of 1 to 10, where 1 is very poor and 10 is excellent, how would you rate your general health and wellbeing? .....

Please read the questions below and each of the four possible answers. Circle the response that best applies to you.

Have you recently:
1. been able to concentrate on what you're doing?

better than usual	same as usual	less than usual	much less than usual
(0)	(1)	(2)	(3)

2. lost much sleep over worry?

not at all	no more than usual	rather more than usual	much more than usual
(0)	(1)	(2)	(3)

3. felt that you are playing a useful part in things?

more so than usual (0) | same as usual (1) | less so than usual (2) | much less than usual (3)

4. felt capable of making decisions about things?

more so than usual (0) | same as usual (1) | less than usual (2) | much less than usual (3)

5. felt constantly under strain?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

6. felt you couldn't overcome your difficulties?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

7. been able to enjoy your normal day to day activities?

more so than usual (0) | same as usual (1) | less so than usual (2) | much less than usual (3)

8. been able to face up to your problems?

more so than usual (0) | same as usual (1) | less than usual (2) | much less than usual (3)

9. been feeling unhappy or depressed?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

10. been losing confidence in yourself?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

11. been thinking of yourself as a worthless person?

not at all (0) | no more than usual (1) | rather more than usual (2) | much more than usual (3)

12. been feeling reasonably happy, all things considered?

more so than usual (0) | same as usual (1) | less so than usual (2) | much less than usual (3)

ELECTRICITY

How much electricity do you use per year? Cost (£)…….. Units (kWh)……..

Do you think you have saved money on electricity post-Retrofit? (e.g. following the advice on efficiency, switching, payment method.)

A lot ☐ Some ☐ A little ☐ None ☐ Spent more Post-Retrofit ☐ (Please tick the relevant box.)

Please provide electricity bills for the past 12 to 18 months if available. ☐

Please give your consent as below:
I give my consent for the Advisor/Surveyor to access my prepayment meter. Please tick ☐ or N/A☐

Please indicate your electricity supplier; Airtricity ☐ Power NI ☐ Budget Energy ☐
(Please tick the relevant box.)

How long have you been with them?……

How do you normally pay for electricity? – Pay As You Go☐ Monthly Direct Debit ☐ Quarterly Bill☐
Standing Order ☐ Paypoint Savers Card ☐ Other Method ☐ (Please tick the relevant box.)

PATTERNS OF ENERGY USAGE

Last winter, how often did your household go without heating because of the cost?
Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

Last winter, did you go without other things such as treats or luxuries so that you could keep your home warm? Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

Do you worry about the cost of heating and powering your home?
Often ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

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?
Always ☐ Occasionally ☐ Never ☐ (Please tick the relevant box.)

As a result of the new heating system do you feel:

More confident about going out / socialising knowing that you could come home to a warm house?

Yes ☐ No ☐ No difference ☐

More confident about inviting people around to your house?

Yes ☐ No ☐ No difference ☐

Do you feel any better connected to local services as a result of any of the advice we gave?

Yes ☐ No ☐ No difference ☐

Are you a member of a credit union? Yes ☐ No ☐ (Please tick the relevant box.)

If Yes, which one……

Is there any illness or disability which requires the heating to be on more than most households?

……

……

……

……

COMFORT LEVELS

During winter when heating needs are greatest, how often would you say your home is:

(Please circle for **each**.)

	All of the time	Most of the time	Sometimes	Never
Too hot	1	2	3	4
Too Cold	1	2	3	4
Fine	1	2	3	4

DAMP, MOULD or CONDENSATION

Is there any damp, mould growth or condensation anywhere in your home?

Yes a lot ☐ **Quite a lot** ☐ **A little bit** ☐ **None** ☐

If present, how does damp, mould or condensation affect your household in general?

	No trouble	Live with it	Some inconvenience	Some discomfort	Distressing
	1	2	3	4	5

MEASURES INSTALLED

Under the Retrofit Scheme, which measures were installed?

Oil Boiler ☐ **Biomass Boiler** ☐ **Solar PV** ☐ **Draught Proofing** ☐(Please tick the relevant box.)

Other ☐.....

..... (Please provide details.)

PERSONAL DETAILS

Name: .....

Address: .....

Postcode: .....

Daytime Tel: ..... Mobile: .....

Email Address: .....

SIGNATURE and DATE

Signed: ..... **Date:** .....

Field Notes:

For Office Use Only
Date of Energy Usage Survey (After): .....
BERS Ref. No. .....
Surveyor Name.....
EPC Energy Efficiency Rating (After)..... Improvement of ..... from Baseline scenario
Referred for Benefit Entitlement Check? Yes ☐ No ☐ BEC
Outcome.....
Comments .....
.....

Energy Usage (After)

Annual electricity usage:	.....kWh	£.....	Bills provided	Yes ☐ No ☐
Annual oil usage:	.....Litres	£.....	Bills provided	Yes ☐ No ☐
Other fuel: (.....)	..... ( )	£.....	Bills provided	Yes ☐ No ☐
Other fuel: (.....)	..... ( )	£.....	Bills provided	Yes ☐ No ☐

Total Annual Energy Spend (After) **£.....**

Unit cost of electricity during the period .....pence per kWh
Unit cost of oil during the period..... pence per litre
Cost of other fuel e.g. wood pellets, coal .....

Cross reference with Baseline Survey to ascertain if the householder has:
Switched Supplier? Yes ☐ No ☐
Changed payment method? Yes ☐ No ☐
Availed of budgeting advice? Yes ☐ No ☐
Availed of fuel brokering? Yes ☐ No ☐

Annual Savings of £ ..... compared to Baseline scenario

OAK FOUNDATION	**Bryson Energy Retrofit Scheme**	Bryson Energy

Customer Satisfaction Survey

Customer Details	
Name:	
Address:	
Postcode:	
Daytime Tel:	
Email Address:	

You recently received heating measures through the Bryson Energy Retrofit Scheme. As part of the Scheme we endeavour to give the best service to our customers at all times. In accordance with our customer promise, please complete the Customer Satisfaction Survey below.

Customer Satisfaction Survey	**Very Satisfied**	**Satisfied**	**Not Satisfied**
How was your experience with Bryson Energy regarding your initial enquiry or through any correspondence with them?			
How would you rate the Contractor's performance / tidiness / standard of workmanship?			
How satisfied were you with the overall performance of the Scheme from your initial enquiry to the completion of works?			

Additional Comments:

Signature and Date
Signed: ..... **Date:** .....

Bryson Energy, Unit 1, Rivers Edge, 13 – 15 Ravenhill Road, Belfast BT6 8DN

For Office Use Only
Date Received:
Ref:

Appendix 6. Case Studies Core Questions

1. How long have you been living in your home?
2. What was it like before the measures were installed?
    a. Type of heating?
    b. Insulation?
    c. Thermal comfort?
    d. Damp, mould, condensation?
3. How did you find the installation process?
    a. Application?
    b. Having the work done?
    c. Aftercare and follow-up checks?
4. What difference have the energy measures made?
    a. Thermal comfort?
    b. Water heating?
    c. Energy costs?
    d. Health & wellbeing?
5. What way do you order oil?
    a. Payment methods?
    b. Same supplier or shop around?
    c. Use of oil drums?
6. How do you pay for electricity?
    a. Switching supplier?
7. How useful did you find the energy advice given by the project officer?
8. Is there anything else you feel would make you home more energy efficient or comfortable?

Appendix 7. Illness and disability in households

Illness or disability requiring heating to be on more than most households			
	Total instances of illness/disability requiring more heating than most households: 84		
Illnesses by group	**Illness reported by households**	**No of households affected**	**Further detail**
Musculo-skeletal	Arthritis	21	
	Rheumatism	1	Rheumatism in knees
	Back problems	3	
	Knee problems	2	Includes 1 operation
	Hip problems	1	Includes 1 operation
	Ankle problems	1	
	Osteoporosis	1	
	Pain in bones	1	
	Disc osteophyte	1	Degenerative wear of upper spine vertebrae
	Fibromyalgia	1	
	Total	**33**	
Organs /Brain	Kidney problems	4	Includes 1 having dialysis and 1 on transplant list
	Bowel problems	1	
	Heart problems	7	Includes 1 using defibrilator
	Angina	1	
	Brain tumour	1	
	Liver problems	1	
	Chronic Kidney Disease (CKD)	1	Stage 3
	Cerebral palsy with epilepsy	1	Requires 24 hour care
	Thyroid	2	
	Total	**19**	
Respiratory	Bronchitis	1	
	Asthma	6	In one family, all members are affected
	Chronic Obstructive Pulmonary Disease (COPD)	3	Including 1 who has had a triple bypass
	Total	**10**	
Mental illness	Depression	4	
	Dementia	1	
	Total	**5**	
Other	Cancer	3	
	Leukaemia	1	
	MS	1	
	Diabetes	3	
	Parkinson's Disease	1	
	Blood pressure	4	
	Amputations	1	
	Learning difficulties	1	
	Low in iron	1	
	Child has heating needs	1	
	Total	**17**	

Appendix 7. General Health Questionnaire statistical analyses

Stepwise regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Zero-order Correlations
		B	Std. Error	Beta			
4	(Constant)	1.596	0.057		28.239	0.000	
	General Health	**-0.054**	**0.005**	**-0.655**	**-9.791**	**0.000**	**-0.687**
	Worry about cost of heating	**-0.054**	**0.017**	**-0.212**	**-3.111**	**0.002**	**-0.341**
	Gender	**0.083**	**0.025**	**0.222**	**3.325**	**0.001**	**0.216**
	Oil drums	**-0.020**	**0.009**	**-0.140**	**-2.073**	**0.041**	**-0.208**

Note. N=96, criterion variable=GHQ transformed, t=t-test, R^2=0.600

Reliability

Reliability, in simple terms, describes the repeatability and consistency of a test. It is important that a measure is stable over time and later application attempts provide accurate results. One method of analysing reliability is calculating Cronbach's alpha.

The scale of 12 items had a high level of internal consistency with alpha = 0.939. The value of each item was investigated and it was concluded that deletion of any would not improve the overall score. General recommendation for a good reliability score is 0.7, which the GHQ-12 exceeds.

Exploratory factor analysis

This statistical method was used to assess the underlying structure of the GHQ-12. Kaiser-Meyer-Olkin (KMO = 0.918) measure of sampling adequacy as well as Bartlett's Test of Sphericity X^2= 750.659, df=66, p<0.001) indicated that the data was suitable for factor analysis. Multiple approaches were used to identify the factors of the GHQ-12.

The analysis revealed that one factor was underlying respondents' mental wellbeing. All values of item loadings were greater than 0.3 and were considered meaningful (see Table XX). Initial Eigenvalues indicated that one factor explained 53% of the total variance.

Factor Matrix of the GHQ-12

Item description	Item loading
Able to concentrate	0.756
Lost much sleep over worry	0.651
Play useful part in things	0.725
Capable of making decisions	0.677
Constantly under strain	0.720
Couldn't overcome difficulties	0.742
Able to enjoy day to day activities	0.762
Able to face problems	0.831
Feeling unhappy or depressed	0.820
Lost confidence	0.805
Thinking of self as a worthless person	0.639
Feeling reasonably happy	0.578