

Talysarn and Nantlle Community Energy Survey

Summary and Key Findings

1. Project Objectives

- i) By means of a representative survey of the properties and householders in Talysarn and Nantlle, make a determination of the levels of fuel poverty in the villages, the opportunities for energy improvements to properties and the installation of renewable technologies.
- ii) Make recommendations for a strategy to carry out the energy improvements, maximising the opportunities for local employment. Make proposals to secure the implementation of the strategy as a long term energy project, including identifying the resources needed.
- iii) To carry out the necessary work on a local community building (the Canolfan) leading to recommendations for energy improvements and appropriate renewable technologies and funding to take these forward.

2. Method

To discover the potential improvements that are appropriate and estimate the benefits, both the financial savings people may make and reduced environmental impact from energy use, a comprehensive survey has been conducted. External surveys of 551 of the properties have been carried to determine age, wall construction, glazing types and, where possible, heating type. Detailed surveys of 52 households has provided more filled in details not visible from outside the properties and information collected on heating use, costs and incomes.

3. Outcomes

Although it was not possible to recruit a truly randomised sample for detailed surveys, the support from volunteers has resulted in a reliable representative model for the properties found in Talysarn and Nantlle, though the under representation of working families in the samples means that costs and incomes data can only be regarded as indicative. As a result of this a number of opportunities for energy improvements and renewable energy generation have been identified. The current cost of providing adequate heating and the financial and carbon savings that result from improvements have been worked out.

From the age and appearance of most of the properties it was anticipated that the majority would be a solid stone walled construction. It was expected that most lofts and cavity walls, where they existed would be fully insulated, that full double glazing would be nearly universal and that, where available, most homes would have mains gas fired central heating. Heating costs were expected to be much higher than the national average, mostly due to high heat losses through the walls.

From the detailed surveys:

- 15% of households were found to be spending more than 10% of income on heating and hot water. In almost all of these cases the

heating was on for all of the day, either through choice for comfort or because of reduced mobility.

- ❑ 40% of households were spending significantly less than required for adequate heating and hot water.
- ❑ 30% of households would have needed to spend more than 10% of income to achieve adequate heating and hot water.
- ❑ If all the measures proposed in this report were adopted no households would need to spend more than 10% of their income to achieve adequate heating and hot water.

For the whole area covered by the surveys (excluding some of the outlying Properties):

- ❑ 71% have solid walls
- ❑ 16% an uninsulated room in the roof space
- ❑ 37% have insufficiently insulated loft spaces
- ❑ 21% have at least some cavity walls which require insulation.
- ❑ Many of the solid walled properties have some degree of dampness due to cold walls, especially around windows,
- ❑ Some solid wall properties suffer occurrences of penetrating damp where there are faults in the external render.
- ❑ 70% of properties are fully double glazed and a further 10% partially so.
- ❑ Single glazed properties, especially those in Nantlle which cannot be double glazed for planning reasons, are difficult to heat and comfort is reduced because of draughts.
- ❑ Mains gas is available to 79% of the houses but only 82% of these have mains gas heating (58% of the total).
- ❑ In houses that do not use a mains gas connection roughly equal numbers use open coal fires, oil central heating, peak electric heating, wood/coal stoves or electric storage heaters. A very small number use tank or bottled propane.

4. Canolfan Talysarn

The heating cost is much higher than should be experienced for a building of this construction. The heating in the main hall is particularly ineffective because of the position of the radiators high up on the wall and without the air circulation fans that were part of the original design. Lack of controls, heating of all areas when only part is needed, the inefficient boiler in the older part and thermal inefficiency of the older part all contribute to costs.

The main areas to be addressed are:

- ❑ solid wall insulation of the older parts and replacement of the boiler there
- ❑ zoning of the heating to restrict the heat to areas in use
- ❑ lowering the radiators in the main hall and ensuring good circulation of the air, probably with a heat recovery ventilation system.

5. Opportunities

The analysis of the survey indicates that there many opportunities for improving the energy efficiency of houses and for the installation of renewable energy.

a. Loft insulation & Heating Systems

- ❑ Around 200 properties still require improved loft insulation and about 100 have some cavity walls that should be insulated, mostly in extensions.
- ❑ 43% of the homes are suitable for heating upgrades, mostly either by taking up a gas connection with central heating or replacing very old gas boilers or back boilers behind gas fires.
- ❑ Significant reductions in heating costs and carbon emissions would result from these simple improvements, some of which supported by grants or other subsidies.

b. Solid Walls & Un-insulated Rooms

- ❑ Almost 80% of the properties have solid walls, including the outlying properties, and a further 16% have an un-insulated room in the loft. While bringing these up to the standard expected of a modern home involves more serious work and is more costly the benefits in terms of financial savings and increased comfort are similarly greater. These measures will also reduce dampness caused by condensation.
- ❑ Currently such improvements are not supported by general grant schemes, but certain programmes may help and the cost of remedial measures may be reduced by training and using local contractors.

c. Installation of Renewable Energy

- ❑ The orientation of most of the roofs in the village make them suitable for roof mounted solar panels, for producing both hot water and electricity. These are expensive, though prices should fall as a result of anticipated increased demand.
- ❑ Although there is little in the way of grants towards the cost on installation, the recently introduced *Feed in Tariffs* (FIT's) for producing electricity and future *Renewable Heat Incentives* (RHI)'s for producing heat will pay a substantial income to homes with these installed. The challenge is to find ways to finance the upfront costs so that everyone can benefit. Local contractors would be able to install these after suitable training and accreditation.

d. Other Energy Related Problems

A number of simple, mostly very low cost, options are available that would deal with some of the problems experienced in homes.

- ❑ Sempatap, a thin latex foamed product that is put up like a wall paper, would reduce condensation around window openings.
- ❑ Plastic film attached to window frames would act as temporary double glazing where other solutions are unsuitable.
- ❑ Excessive moisture can be reduced without making properties colder by using extractors with heat recovery *systems*.
- ❑ All of these measures could be organised locally.
- ❑ In most of the homes visited additional advice was provided for a

range of issues and this would be valuable part of any future project.

e. Savings to Households

The summary of the benefits these measures bring to households is provided in table 2 (Page 6). The average household savings are shown in table 4 (Page 7). With the incomes provided by solar panels, the average costs of providing adequate heating and electricity can be reduced from £1,442 to under £100 per year.

f. Indicative Cost of Improvements

Currently the cost for the major measures identified are approximately £4k for external solid wall insulation, £3k for solar thermal panels and £7.5k for solar PV. Cavity wall and loft insulation upgrades will be in the range of £200 to £500, but grants are available for much of this. Boiler upgrades will cost around £1.5k, but could be reduced through the boiler scrappage scheme. It is expected that the cost of all major items could be reduced by around a third by the adoption of the follow on project and alternative ways to subsidise the upfront costs should be pursued.

6. Carbon footprint

Reduction in carbon dioxide emissions due to energy use are one of the main incentives for support for energy saving and is a way that individuals can contribute to combating man made climate change. Table 3 (page 6) summarises the potential that the suggested measures can make towards reducing emissions. The current average household emissions amount to 7.4 tonnes of carbon dioxide each year and taking up all the measures will reduce this to 3.7 tonnes.

7. Other Factors

Adoption of the proposals made below will result in lower heating costs and households will be better placed as energy costs rise. It will be more affordable for currently under heated households to become warmer. Further benefits include;

- ❑ **Reduction in use of primary health care needs through people living in properly heated, ventilated and damp free homes**
- ❑ **Creation of employment and training opportunities for local people in building, heating and renewable energy businesses.**

8. Next Steps for Talysarn & Nantlle Energy Project

The survey findings have demonstrated the opportunities and the benefits of adopting a programme of substantial improvements in energy efficiency and renewable energy in a rural Welsh village with large numbers of older properties.

If the recommendations are to be implemented a development officer will be needed with responsibility for:

- ❑ helping householders access the existing measures and grants that address improving insulation
- ❑ helping householders access existing measures and grants for renewable energy

- ❑ encouraging local businesses to provide relevant goods and services
- ❑ the development of financial mechanisms to ensure that private & social tenants and those with limited financial resources can benefit from the grants and payments available
- ❑ working in conjunction with other agencies to ensure that maximum advantage is taken of all opportunities for improving energy efficiency and renewable energy in the locality.

8. Project Evaluation

This project has demonstrated that a detailed appraisal of the energy performance, opportunities for improvements and benefits for a small community can be carried out with a high level of confidence in the outcomes. It has been established that the method can be used more generally.

The sampling problems are encountered in all surveys, questionnaires and activities related to energy consumption. Here, as is usually experienced, the majority of respondents are more mature, leaving young families under represented. As a result the information collected regarding incomes and amount spent on heating does not have the same level of confidence as the property data. The main conclusions concerning Fuel Poverty are broadly correct if not numerically robust.

The timescale for carrying out this project was short, leaving no time to prepare the community before starting data collection. During the course of the data collection it was clear that as local people became more familiar with the project, so did their interest and confidence. To be most effective community support should be garnered in advance.

The amount of usable, representative data collected offered the opportunity for very detailed analysis but this was time consuming and lead to further delays in producing the outcomes.

Table 1. Income and cost of heating, before and after improvements

Currently spend more than 10% of income	Spending significantly less than needed to heat home	Spending significantly more than needed to heat home	Would currently need to spend more than 10% of income to sufficiently heat home	Would need to spend more than 10% of income on heating after improvements
15%	40%	12%	30%	0%

Table 2. Improvements that can be made and savings that result

	Insulate Solid Wall	Insulate room in roof	Insulate cavity walls	Improve loft insulation	Heating upgrades	* Temp double glazing	** Solar Thermal panels	** Solar PV panels
Number needing measures	393	88	118	206	236	59	551	551
Average household saving	£319	£186	£138	£182	£229	£30	£295	£817

* In Nantlle only, saving calculated from draught-proofing provided

** Includes the income from producing heat and electricity from renewable sources (FIT and RHI)

Table 3. Carbon emissions savings that result from improvement

	Current values	With Energy Efficiency Improvements	With Energy Efficiency Improvements and Heating Upgrades	With Energy Efficiency Improvements, Heating Upgrades and Solar Thermal	With Energy Efficiency Improvements, Heating Upgrades, Solar Thermal and Solar PV
Total CO ₂ emission tonnes/year	4082.7	2920.2	2589.0	2396.2	2037.9
% Saving Carbon emissions		28%	37%	42%	50%

Table 4. Total savings made by improvements to homes

	Average Annual Household Heating and Hot Water Costs	Average Annual Household Heating, Hot Water and Electricity Costs	Average Household Annual Energy Costs (inc income from Solar Thermal and PV)	% Average Saving in energy costs (inc income from Solar Thermal and PV)
Current values	£856	£1442	£1442	0%
With Energy Efficiency Improvements	£454	£1039	£1039	28%
With Energy Efficiency Improvements and Heating Upgrades	£406	£992	£992	31%
With Energy Efficiency Improvements, Heating Upgrades and Solar Thermal	£331	£916	£696	52%
With Energy Efficiency Improvements, Heating Upgrades, Solar Thermal and Solar PV	£331	£840	£99	93%

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The survey consists of two levels, a “walk by” survey, making use of satellite images, to identify the types and age of properties and other features visible externally and detailed internal surveys of 10% of the properties to make a more detailed determination of energy performance as well as collecting data on income and energy use and costs. Comparisons between the two levels establishes how representative the data is and the level confidence in extrapolating this to the whole area.

The detailed surveys are to be of sufficient depth to perform a SAP (Standard Assessment Procedure, for further explanation see page 16) calculation, providing not only the calculated cost for maintaining the property at an adequate temperature and the carbon emissions that result, but also be used to calculate the benefits of improvements. From these levels of fuel poverty and the degree to which homes are adequately heating is determined.

A detailed survey of the Canolfan in Talysarn is used to identify heat losses and to recommend energy efficiency improvements, renewable energy technologies and funding sources to provide these with the aim of reducing the running costs and environmental impact.

Determine opportunities for local tradesmen to carry out energy efficiency improvements and renewable energy installations. Assess the interest in moving into this area and, where appropriate provide introductory ‘training’. Provide support through the follow up proposals.

Working with the local energy group and community first partnership carry out activities, including events, to communicate the results of this project and the opportunities they open up to the community as a whole. Communicate the benefits to the individuals and to the area as a whole.

2. Other Aims

As a result of the detailed surveys carried out on homes, the residents will receive a detailed report, based on the SAP method, of their energy use and ways in which improvements, both behavioural and structural, can be made. Advice will be provided as part of the survey on energy use, improvements and related issues such as the presence and causes of dampness. Advice will also be provided on full benefit

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entitlement and accessing existing grants for heating and energy efficiency improvements.

3. Defining the Area

Following reorganisation of electoral wards, Talysarn/Nantlle is split between 2 electoral wards and 2 Lower Level Super Output Areas (LSOA's), the basic division used by the Office of National Statistics (ONS). These cover much larger areas than required for this project. LSOA's are further divided into output areas, four of which contain all properties of interest.



Fig.1 Wards around Nantlle/Talysarn

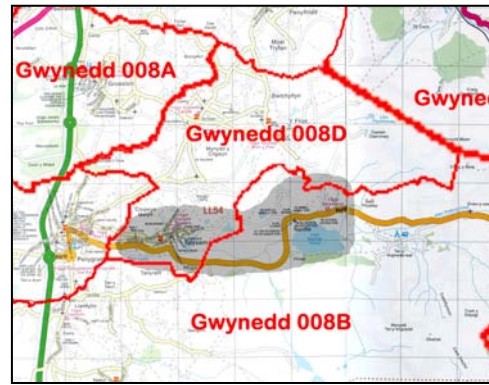


Fig.2 Lower Level Super Output Areas around Nantlle/Talysarn

The Office of National Statistics (ONS) provides statistics down to LSOA and output area level. This includes data about housing tenancy, age distribution and benefits uptake. These are based on the last national census in 2001 with more up to date information provided by the Pension Service and other benefits agencies. Data is only available to a level of detail that does not allow individuals to be identified. As Nantlle and Talysarn are only part of 2 larger LSOA's data at this level can only at best be indicative.

Output areas used by ONS typically contain 100 to 200 dwellings in Wales. As shown in figure 3, three of the output areas are almost entirely within the areas of interest. Although Nantlle is only part of a much larger area, most of the dwellings are within the area of interest.

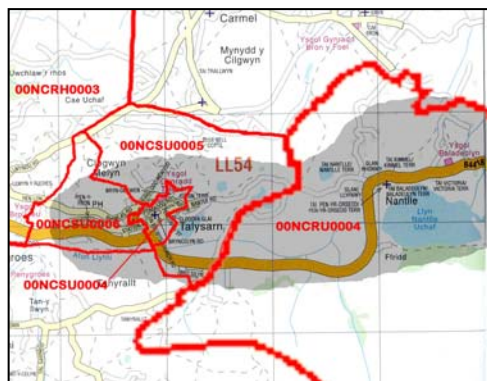


Fig.3 Output Areas around Nantlle/Talysarn

Initially 624 domestic properties were identified from Council Tax lists as having Talysarn or Nantlle in the address. 21 were well away from the main area of interest.

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Of the remainder, 475 are in Talysarn ward and 128 in Llanllyfni ward. In both cases they only represent a proportion of each ward.

4. Pre-project profiles

Information on tenure and household composition is based on 2001 census. Benefits information is supplied by the pension service and for 2008. This is based on a much larger area than Talysarn/Nantlle. The prevalence of solid walls and use of mains gas is derived from the HEED (Home Energy Efficiency Database, mostly derived from Home Energy questionnaires). Although this is available down to output area level, because of the small sample size and poor quality of the data collected any conclusions based on this should be treated with caution.

Tenure

All households	Owned	Social rented	Private rented
%, all households	72%	19%	9%
Pensioner households (34% of all)	Owned	Social rented	Private rented or Living rent free
%, pensioner households	73%	19%	8%
Non pensioner households (66% of all)	Owned	Social rented	Private rented or rent free
%, non pensioner households	72%	19%	9%

The distribution between tenure types is similar for both pensioner and non-pensioner household, around 70% owner occupier, 20% social rented and 10% privately rented.

Age Distribution

Age profiles (post 20)	20-59	60-69	70-79	80
For all areas (post 20)	68%	14%	11%	7%

The ages within the population corresponds reasonably closely to the ages of the heads of households. This has implications for the types and levels of grants for household improvements.

Benefits

Benefits	Under 16 (DLA)	Working age	Pensionable age	Total % benefits
Gwynedd 008B	0%	3%	11%	15%
Gwynedd 008D	1%	5%	12%	18%

Indicates a relatively low numbers in receipt of benefits, though the area here is much bigger Talysarn/Nantlle.

Hard to Treat Homes

Homes are regarded as hard to treat where they have no cavity wall that can be insulated and do not have the option of a mains gas connection that could provide efficient, low cost heating. These are older properties, usually in rural locations.

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Output Area Code	% Off Gas households	% Solid Walled Households
00NCRU0004 (Nantlle)	88%	82%
00NCSU0004 (Middle of Talysarn)	0%	36%
00NCSU0005 (East Talysarn)	50%	20%
00NCSU0006 (West Talysarn)	67%	79%
For all areas	49%	55%

This information would not appear to represent the area accurately, with fewer solid walls and a lower use of mains gas than expected. This is because of the small sample sizes used for the HEED database.

5. Outline of Methodology

SAP calculation method: The Standard Assessment Procedure is a method worked out by the Building Research Establishment to calculate the heating requirement and carbon emissions generated by heating of buildings. This is the method used for the Energy Performance Certificate (EPC) required when properties are rented or sold and rates the property with a numerical level and a grade between G and A. By altering the input data the resulting savings from energy efficiency measures can be estimated.

The hot water requirement calculated by the SAP method is based on the size of the property, based on an average for different property types, and not the actual occupation. While this is a reasonable way to assess the potential impact of the property, it is less useful in the context of this project. When examining Fuel Poverty and issues around overheating/underheating an assumption that 20% of the energy is used to heat water has been used.

Walk by Surveys: External surveys of properties (“Walk by Surveys”) were carried from the street. From these it is possible to determine from construction details the build type and build form, inferring the age of the property and wall construction. The type of heating fuel used in the property can be determined where storage tanks, meters and heating exhausts are visible, but in around a third of properties there is no evidence. Glazing types at the front of properties are visible. Further information as to the size of the property can be determined from readily available satellite image.

Provided that the selected detailed sample can be shown to be representative of the whole, especially with regard to property types, then the survey data for the whole area can be corrected to allow for actual heating types and use, roof insulation, partial glazing and details such as room-in roof construction. With this level of detail an assessment can be made using the SAP calculation method of heating needs and costs and the benefits of improvements for the whole area.

Selected detailed surveys: In order to refine the data from the whole area survey and collect information about household occupants, heating costs and incomes a detailed survey of 10% of properties was proposed. For this to be representative 15% of properties were selected randomly from the entire address list, with the expectation that at least a third would be for some reason unsuitable or the householders unwilling to take part.

As well as detailed determination of the heating types and the way it is used, the property details, including internal size and glazing/door sizes was measured. Information about heating costs, income and benefits was also collected. Once collected, the properties range was checked to ensure that it remained a representative sample of the whole.

Information to householders: Two letters went out to householders, one to those selected for a detailed survey asking them to make contact to organise a convenient time for a visit; the other to the rest of the households explaining the project and its objectives and inviting them to take part. Letters to the selected group were sent out with a sample questionnaire, the other were hand delivered.

Community building improvement: A detailed survey was conducted of a selected community building (the Canolfan in Talysarn), including the physical structure, Using the SAP method, anticipated heating costs were calculated along with the values of suggested improvements. The reasons for the current high running costs above those expected from calculations were proposed. Suggestions were made of further ways that the energy use can be improved and the suitability for installing renewable technologies along with potential income derived and possible funding sources.

Local employment: Identify and contact a range of local tradesmen. Using questionnaire assess their current awareness of the opportunities for energy improvements and renewable energy. Canvas them on their needs for improved information and training courses. Propose (as part of follow on project) a way to deliver these needs and/or increase awareness.

6. Survey Outcomes

Walk by surveys: 551 of the properties on the initial list were surveyed from the ground. Most of the remainder were either unidentified (either on the satellite images or on the ground) or further out than the area covered in this survey. Most of these properties appear to be older, solid walled types and are outside of the region where mains gas is available and, where appropriate, have been treated statistically as such.

Of all of the properties examined, 75% were judged to have been built before 1930, when cavity walls started to become common and only 3% dated from after 1992, the date from which reasonably effective cavity wall and loft insulation became requirements for new properties. 81% of all properties have solid walls (as compared to the 55% indicated from the pre-project profile).

Only 8% of properties are detached, a further 26% semi detached, the remainder being terraced in 51 terraces. 95% of the properties fall into council tax bands A to C (value less than £91,000), with 86% coming from band A or band B (value under £65,000).

Double Glazing (mostly PVC), at least on the front, is present in 84% of homes, though slightly less, 74%, have modern PVC/double glazed doors. From the outside 58% appeared to have a mains gas connection, though in many more homes this was probably present but not visible. Both the number of homes with a gas connection and heating method used is re-assessed using detailed data from the selected homes. 42% of properties have no external evidence of heating fuel/method used.

The roof orientation of most homes is in the ideal range for Solar Thermal or Solar Photo-Voltaic panels. 84% of roofs are angled within the desired 45° of South.

A complete summary of this data is presented in **Appendix 1**.

Making detailed surveys: From the initial list of properties 91 (about 1 in 7) were selected for full, detailed surveys and letters sent out explaining the project and the surveys and asking them to contact to make appointment for the visit. Of these around half a dozen called to make appointments.

Further attempts to make contact with householders were made by calling round to the houses, especially over weekends when it was felt most likely that people would be in at willing to give up a little time. Some of the properties proved to be unoccupied, a few were not interested or had other commitments but from the majority there was no reply despite at least three attempts to make contact at different times and on different days. A local volunteer was recruited to try and make contact and appointments. In the end a third of the sample was contacted and had surveys carried out rather than the initial target of 60.

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Responses from the original random sample of 90:

Surveys carried out	30	33%
Not convenient (often illness at home, visiting hospital)	5	6%
Unoccupied property	6	7%
Not interested, see no benefit to themselves	5	6%
No reply to calls/.property not located/not there for pre-booked appointment	43	47%

Eventually 53 surveys were carried out, the numbers made up from those who requested a survey and a number of people who were either approached directly or recruited at the Friday market. (Further requests for surveys are still coming forward and will be dealt with in due course but are too late for inclusion in these conclusions.)

This difficulty of collecting data from the initial randomised selection presents difficulties as to how representative the eventual detailed surveys are of the area as a whole. Tests are applied to determine if this is a reasonable assumption as regards the property, but such a group is inherently likely to be biased to some degree in respect of age, employment during the day, receipt of benefits and sense of civic duty. In this respect the results of the survey should be regarded as indicative rather than conclusive.

Testing the validity of sample survey: For the detailed survey to be useful in informing the whole area survey it is essential that the properties chosen be representative of whole. Random sampling goes some way towards achieving this but even if it had been possible to carry out detailed surveys of all the randomly chosen properties it would still be important to verify this. Given the difficulties in reaching all the selected properties, it is all the more important to demonstrate that the data collected can be taken as representative.

Comparisons were made between the data collected from the Walk by Surveys for the whole with the selected properties. The results of this are displayed as charts in **Appendix 2**.

The overall conclusion is that, although there are slight differences, these are well within those which might be expected from a normally randomised sample. Possibly the most significant difference is the proportionally greater number of properties in council tax bands C and above, and detached properties. This is of little concern since modifications of the whole area data is applied selectively for different types of property.

Personal details from sample surveys: the personal data for the occupants of homes where a detailed survey was carried out and shown in chart form in **Appendix 3**.

The only means of determining the degree to which the personal details collected during the sample surveys is representative of the whole community is by comparison to the data collected for the pre-project profile (ppf). The sample over represents those

over 60 (51% of sample and only 34% of ppf.) Within the over 60 group the owner occupier sector is over represented, but within the under 60 group social housing is under represented. A similar trend is seen when looking at the ages of all of the occupants of the homes in the selected sample group. Privately rented properties, expected to represent 9%, only form 2% of the sample

This is not altogether unexpected as such a heavy reliance had to be placed on volunteers in order to carry out the required number of surveys. The elderly are more likely to be available to carry out such surveys and also tend to be more financially concerned about the cost of energy use. This was however inevitable given the difficulty in contacting those under 60 and at work, who in general tend to be less concerned about the cost of energy use. Privately rented properties will also include many which are only occupied for part of the time.

This will have further consequences, since the occupiers of the homes visited are likely to have a lower income, are more likely to be in receipt of benefits and may have higher heating costs because they are at home for much of the day. This needs to be borne in mind when looking at these aspects, which should be regarded only as indicative and not truly representative of the area as a whole.

Income: just over half of the sample had incomes of less than £12,000. A large number of these are pensioners but there are also a number of single occupants or single parents, most of whom are in employment. A large number of these are in receipt of benefits, or entitled to benefits but not claiming. Benefits uptake as a proportion of the sample is highest among the over 60's with a number receiving both pension credits and some form of disability premium (as well as the council tax benefits which goes with pension credit.) Most of the remaining benefits recipients are low income families who are entitled to child/working tax credits. Quite a large number have incomes greater than £20,000, a mixture of one person working away during the week and household with two sources of income.

Heating Costs are relatively high (average £732.64) given that such a high proportion of the properties are mid terraced, with no end gables, or semi detached/end terraced with only one gable end and despite the high uptake of mains gas for heating and high incidence of double glazing. The main causes are the near universal solid wall construction and the use of alternative heating to gas central heating, in the mistaken belief that they are saving money. Some homes have astonishingly high heating costs, but a larger number spend very little, either because they are using a cheap fuel such as free wood or are very frugal (and potentially living in a cold house.)

Other issues raised by home visits: A majority of the homes visited, whether volunteers or from the original list, had other issues to be addressed. A number of the pensioner homes visited were not claiming some or all of the benefits to which they were entitled. Several had insufficient or broken heating and were signposted towards the relevant grant assistance. A number needed sign posting to help for adaptations for disabilities.

Although a number of the volunteers specifically wanted advice and help over planned improvements, there was quite a high prevalence of damp in the sample properties, especially around window reveals. This is partly due to relatively small

properties now under ventilated after the introduction of double glazing and partly caused by cold solid walls. There is also some incidence of rising or penetrating damp and it would seem that the wall constructions used for many of the properties is particularly porous if the outside render is in any way defective.

7. Affordable Warmth and Fuel Poverty

Each winter in England and Wales, over 20,000 additional people die as a result of living in cold homes. 90% of these deaths are people over 60, the most vulnerable to living in cold conditions and the dampness that results. That this is the result of living under these conditions is confirmed by evidence from colder countries where, because insulation levels are of necessity higher, and excess winter mortality is much lower.

Ambrose¹ examines a number of comparative studies which show that improving housing, particularly the thermal efficiency, to make heating affordable reduces costs of primary health care by over 85%, from £515 per household to £72. There was a similar reduction in days of illness experienced and further economic benefits such as fewer days off from work due to illness. There was a significant improvement in children doing well in school, attributed by parents to more quiet space in warmer homes where children could study.

Fuel Poverty is defined as adequate heating, 19°C in main living space and 17°C in the rest of the house, and hot water costs requiring more than 10% of household income. This may be due to inefficient or over expensive heating, living in a home which is not energy efficient, low income or, most commonly a combination of all of these. Low income combined with high heating costs leads householders to making choices about spending, often resulting in insufficient being spent on heating to provide comfortable warmth.

In this study, fuel poverty levels have been assessed in two ways, based on the actual amount spent on heating and on the amount that needs to be spend (based on the SAP calculation) to achieve an adequately warm home. When using the SAP calculation, an allowance of 20% is made for hot water costs and only homes where the cost of adequate heating exceeds the amount spend on fuel by more than 25% are included.

Because the cost of using wood for heating is difficult to assess and homes where wood burning contributes significantly to the heating often have access to cheap or free wood to burn, these types of homes have been excluded from the analysis of affordable warmth.

Overheating occurs when the householder spends more than would normally be considered necessary to adequately heat the home. This usually occurs where the householder, for reasons of comfort or through necessity because of medical conditions such as reduced mobility, keeps the heating on for longer or at a higher than usual temperature. It occasionally happens because the heating is either difficult to control or the controls are not properly used.

Underheating, where the householder spends less than needed to heat the home, is much more common and may happen because of concern over the cost of heating, because the home has less than average use or because the householder does not feel the need for as much heat as the average home. For the purposes of this study, overheating or underheating is only considered to be occurring where the heating spend is 50% more or less than that required, as indicated by the SAP calculation.

¹Peter Ambrose, 2002, "The costs of poor housing", www.york.ac/inst/chp/hsa/papers/ambrose.pdf

Six homes (12% of the sample) visited for the detailed surveys are **overheated**. All of these are spending substantially more than would be expected, between 75% and 180% extra. Three of these have (older) gas central heating, two use storage heaters and one uses electric heaters. All either have heating on most of the time or are knowingly using expensive heating until an alternative can be installed. All of these homes fall under the heading of fuel poverty.

Twenty homes (40% of the sample) are being significantly underheated, spending between 22% and 66% of what would be needed to provide sufficient warmth. Half of these have gas central heating, five rely on coal fires, three use heating oil, one uses LPG and one storage heaters. Coal fires, like electric heaters, frequently lead to under heating because only part of the property is being adequately heated. Where central heating is available this is usually down to the choice of the householder. The majority of these would not be regarded as in fuel poverty.

A summary of the data is presented in Appendix 5.

Fuel Poverty levels, based on what householders actually spend, is surprisingly low given the low incomes and large heating bills, with around two thirds of households spending 3% - 5% of income on heating and 10% spending less than this. All the examples that technically fall into the category of fuel poor are homes where the heating is on all day, either by choice or through necessity, for instance because of reduced mobility. 15% can technically be described as living in fuel poverty based on current fuel consumption.

When homes which are underheated are taken into account, the level of fuel poverty rises to 30% of the sample. Four of these have more expensive heating, LPG or electric storage heaters but nearly half have gas central heating. Five either use electric heaters or coal fires as the main source of heat, which can adequately heat a single room but often result in the rest of the house being too cold.

The proposed energy improvement programme would reduce the cost of heating to 10% or below for all of these households.

8. Detailed Surveys and generalising to the whole area

Although the bias in the detailed sample means that it can only be indicative regarding financial and social information, the closeness of the match in respect of property types allows this to be used with confidence to amend and add detail to whole area survey, and assess what energy improvement opportunities exist. The detailed surveys have revealed important details not visible externally, have raised issues, such as dampness, that need to be addressed and provided data on heating use, particularly useful for properties not using mains gas.

Superimposing the detailed data onto the whole area survey produces the following conclusions for the 551 properties covered

Property age, wall types:

Talysarn			*Nantlle		
Properties built post 1992, adequate insulation should be installed at build					
	House	Bungalow	House	Bungalow	
Detached	2	4			Detached
Semi-detached					Semi-detached
End terraced		4			End terraced
Mid terraced		7			Mid terraced
Properties built 1930 – 1991, should have cavities that can be insulated					
	House	Bungalow	House	Bungalow	
Detached	3	8		1	Detached
Semi-detached	70	8	6	6	Semi-detached
End terraced	3		4		End terraced
Mid terraced	5		3		Mid terraced
Properties built pre 1930, mostly solid walls					
	House	Bungalow	House	Bungalow	
Detached	21	2	2		Detached
Semi-detached	11	37	6		Semi-detached
End terraced	71	2	14		End terraced
Mid terraced	182	4	54		Mid terraced

* Most recently built properties do not yet appear on the council tax lists used to identify properties

As anticipated, the most common wall type (around 75%) are solid walls, mostly built from stone. Almost all of these are rendered externally. Of those properties which have cavity walls, a large number are social housing which has been insulated, some with external wall insulation. Quite a number of solid walled properties have old extensions which may have cavity walls.

Besides the problems with heat loss there are also issues of dampness related to the solid walls. The construction used would appear to be fairly porous and, where the render on the outside is poor quality or damaged there is evidence of penetrating damp. Because of the small size of many of the properties most with modern PVC double glazing, ventilation can be poor and this is leading to condensation on cold walls, especially around windows where exposed walls are coldest.

Roof insulation:

	Room in roof (assume no insulation present)	Levels of loft insulation present (recommended 270mm, minimum should be 150mm)					
		None present	50mm	100mm	150mm	200mm	250mm
Number of properties	94	197	9	50	9	9	165
% of whole area	17%	36%	1.5%	9%	1.5%	1.5%	30%

Despite the opportunity for free insulation in lofts when Gwynedd Council carried out the trial for the “Here to Help” programme several years ago, there are still a substantial number of properties which still have insufficient. Although there are no grants where more than 60mm is already present, it is still worth doing if there is less than 150mm present. Most of the properties not covered by the survey also have solid walls.

A surprising number of properties have a room in the loft accessed by a (very steep) staircase, part of the original build. Although the roof lights have in most cases been replaced with modern “Velux” type units (probably because the originals leaked), none show any evidence of having been insulated and occupants descriptions indicate that this is unlikely.

Heating:

Main fuel type	Mains gas Central Heating	Oil central heating	LPG central heating	Coal Fires	Electric off-peak (storage heaters)	Wood/Coal stoves	Electric peak (room heaters)
Off gas area Talysarn		7	0	5	7	3	
Off gas area Nantlle		29	1	21	29	14	
Mains gas available Talysarn	354			23		13	45
Totals across whole area	354	36	1	49	36	30	45

Over 80% of the properties surveyed are in parts of the village where mains gas is available (75% when the properties not covered in the survey are allowed for). Surprisingly, quite a large number (22%) of properties where a gas connection is available do not have one. In this respect both the whole area survey and detailed surveys are in very close agreement. A number of home that do have gas central heating do not use it as their main source of heating believing, incorrectly, that it is an

expensive way to heat homes. (This may be because it is easier to limit the heating to one room with alternative forms of heating.) Quite a number of homes in the on-gas area are using peak electricity for heating, the most expensive way.

People living in the off-gas areas use a variety of heating types, with a variety of financial and environmental consequences. Low cost/low carbon options are available but for these to be effective high levels of insulation are essential.

Suitability for solar panels:

Roof orientation (from south)	>75°	60° to 74°	45° to 59°	30° to 44°	15° to 29°	0° to 14°
Number of properties in range	18	25	45	115	215	132
Percentage of properties in range	3%	5%	8%	21%	39%	24%
Expected output as % of maximum (roof pitch 50°)	78 - 84	84 - 88	88 - 92	92 - 95	95 - 96	96 - 97

Although solar panels, thermal and PV are sensitive to orientation, this is a complex combination of angle to south, pitch of roof and height of the sun at different times of the year. They can work effectively over a wide range of angles, even beyond the recommended range of +/- 45° from South. Fortunately, because most of the roads in the village are roughly east/west, only 16% of properties lie outside of this ideal orientation. Even for those that are outside of this range a substantial benefit would be achieved, especially with oversized panels. Many of the older properties would previously have had cylinders for storing hot water which could be restored for use with solar thermal panels.

(The orientation of the properties also means that they maximise solar gain to supplement heating, especially in the winter.)

9. Carbon footprint and potential for energy improvements

More details used to inform the following summaries, in particular the separation of data for Talysarn, where most houses have access to mains gas, and Nantlle, which does not, are presented in Appendix 6.

Current Carbon Footprint

The total carbon footprint and average running costs are based on the SAP values determined for the selected sample and extrapolated to cover the 551 properties (all the main housing areas in Talysarn and Nantlle) which formed the larger survey group. These **baseline values** are for the properties, factoring in the details discovered and heating types available in each home, and are for a predetermined “average” use. This has the advantage that the same basis can be used anywhere, but it does not include details of occupation or personal use, in particular the use of hot water and over or under heating.

Electricity consumption is based on a Welsh average of about 4,400 Units (kWh) per year. Carbon emissions values are, for consistency, those used for the SAP calculation. These are slightly lower than the latest values for electricity due to more recent changes to the mix of fuels used to generate electricity. More details for how the summary below is derived are available in Appendix 6.

	Total CO ₂ emission tonnes/year	Calculated Average Annual Costs	SAP 2005 rating / grade
Heating and Hot Water	2842.9	£856.63	39.3 / E
Electricity use (except for heating/hot water)	1239.8	£585.60	
Total for all energy use	4082.7	£1442.23	

A small correction can be made for the overheating and underheating discovered as a result of the surveys. According to this, on average, only 89% of the heat is used as compared to the requirement calculated from the SAP. This cannot be shown to be truly of the area as a whole, but if this were the case then both the carbon emissions and average costs would be 93% of those forecast above.

Value of Potential Improvements to Houses and Heating

Improvements to the properties have three benefits, they reduce the running cost of the property, while making it warmer and reducing the impact of energy use in the property on the environment. All possible appropriate improvements which result in quantifiable carbon and cost savings are tabulated below.

Improved loft insulation: while a majority properties have some or sufficient loft insulation there are a number that would benefit from adding this or topping up what is already there. There are also a significant number of properties that have a small area of loft space that needs to be addressed. Loft insulation is a low cost measure which pays for itself quickly. Where only part of the loft needs doing grants would

not apply, though it is still worth doing, but for a substantial part of the loft needing a deep fill it would be subsidised or free.

Room in roof: a surprising number of properties of all types and sizes have a room directly under the roof, built as part of the original house and accessed by a steep built in staircase. As these rooms are open to the rest of the house considerable amounts of heat are being lost through the roof. Although the ceilings are boarded, in most cases there appears to be no insulation in place. Also, there is a small amount of roof space at the sides of these rooms that needs to be insulated.

These rooms need to be insulated using a foamed board type of insulation (not a loose material or filling) leaving an adequate ventilated air space above to prevent condensation occurring inside the roof. The easiest method would be to line the inside of the present ceiling with an insulation backed plasterboard (Kingspan board) but a better result would be achieved if the ceiling were removed and foam board pushed up into the space before relining with insulation backed board. The sides also need to be opened up in order to insulate here too.

There are no grants for this and the materials required are fairly expensive, but the result is a large saving in heating and a warmer, more usable space.

Insulating solid walls is a disruptive and fairly expensive procedure but with very large benefits in terms of financial savings, comfort and reduction in condensation on internal walls. It can either be done internally or externally and is especially beneficial on end properties that have a large exposed gable end. Though technically grants can be provided for this and there is the possibility of loans, in practice these could only be obtained where an organised programme of sufficient size is taking place.

Cavity wall insulation: there are few properties that are built with cavity walls that can be easily and cheaply insulated. However there are a number which have extensions that are modern enough for this to be done. Although there are no grants for partial jobs like this, the cost would not be great and in most cases this would be equivalent to insulating half of the rear external wall.

Draught-proofing windows using flexible plastic sheet stick on “double glazing”. Most of the homes in Talysarn have modern PVC double glazing and for the few that don't have this or only have partial double glazing it would not be cost effective to organise a programme to provide this. However there are quite a number of properties in Nantlle which are unable to have double glazing and have old, very draughty windows. In these cases temporary plastic sheet internal glazing would be worth putting up during the winter. The savings provided have only been calculated on the basis of the draught-proofing it provides but there is in addition a small, but unquantifiable insulation benefit. This results in a much greater improvement in comfort than the simple savings would suggest. Care would have to be taken to ensure sufficient ventilation for the open fires and stoves that are present in many of these homes.

Heating upgrades are not worth doing for the majority of gas boilers, which are modern combi boilers, many of the condensing type. However there are quite a number of the older, inefficient types of gas back-boiler and some properties that do

not have gas central heating where there is gas available. It is possible that some of these can be dealt with under the Welsh Assembly boiler scrappage scheme or through other grant schemes such as HEES. Householders need to be made aware of the possibilities and options and have expert advice available to guide them towards the most appropriate choices.

Where no mains gas is available a programme to look at alternative heating, including heat pumps, would be appropriate but insulation should take priority and heat pumps are only effective in well insulated properties.

The financial and carbon savings from these measures is summarised below.

	CO2 emission savings tonnes/year			Heating costs savings /year		
	Total	Number receiving measure	Average	Total	Number receiving measure	Average
improved loft insulation	210.39	206	1.02	£37,558.87	206	£182.00
Improved room in roof insulation	91.39	88	1.03	£16,528.72	88	£186.89
Insulate solid walls	687.88	393	1.75	£125,557.14	393	£319.42
Cavity wall insulation	118.91	118	1.01	£16,321.00	118	£138.40
Draught-proofing	10.81	59	0.18	£1,768.36	59	£29.99
Heating upgrade	554.24	236	2.35	£54,033.09	236	£229.10

Value of Savings for Hot Water from Thermal Solar Panels

Solar thermal panels have then potential to make a small saving to running costs, replacing 60% to 70% of the annual hot water requirement and requiring little or no “top-up” during the summer months. More significantly such panels will attract an income from April 2010 which immediately make them a cost effective item.

As broad rules of thumb $\frac{3}{4}$ to one square metre of panel should be provided for each occupier and 45 litres of storage capacity. Panel size should ideally be chosen to match the size of the property and potential number of occupants rather than the number living there at present.

For the purposes of this study it has been assumed that 2m² panels are installed. Although there is a large uncertainty about the actual use of hot water in the study area, the savings that can be made from a 2m² panel can be forecast with much more confidence.

	CO2 emission savings tonnes/year			Heating costs savings /year		
	Total	Number receiving measure	Average	Total	Number receiving measure	Average
Solar Thermal Panel (2m²)	192.83	551	0.35	£41569.98	551	£75.44

In addition to the savings an income of around £220 can be expected. All of these values will increase proportionately with larger panel sizes. Evacuated tube arrays will result in similar figures for panels that are $\frac{3}{4}$ the size of these quoted for flat panels.

Savings Resulting from Solar PV Panel

Across the UK, most homes spend similar amounts on electricity and heating, resulting in similar carbon emissions from each. (Producing electricity costs between 3 and 4 times as much as heat from gas and 3 to 4 times the carbon emissions but most homes use 3 to 4 times as much gas as they do electricity, balancing out.) In Talysarn and Nantlle more than the average is spent on heating because of the types of older, colder houses, so that around 50% more is spent on heating than electricity and emissions from heating are around twice that from electricity use. Nevertheless, it is still attractive to produce electricity for the home and worthwhile in terms of the reduced carbon footprint that results.

The figures below are for a modest 1.5kW peak rated panel. Based on average Welsh electricity consumption, this would replace 29% of electricity.

	CO2 emission savings tonnes/year			Electricity costs savings /year		
	Total	Number receiving measure	Average	Total (from use and export)	Number receiving measure	Average (from use and export)
Solar PV Panel (1.5kWp)	358.25	551	0.65	£41,765.80	551	£75.80

In addition a panel of this size would be expected to generate an income of £522 per year. In this example, the savings produced and income derived is more than the current cost of electricity to a home.

Costs of Proposed Improvements

Although these proposals have the potential to make very big financial savings and reductions in carbon dioxide emissions there are currently large upfront costs to be met. Some of the high prices are due to the current small numbers of installations carried out and should fall as demand increases, especially for projects where a lot of work is carried out in a small area. It is possible that some of the cost is due to larger installers maintaining higher than necessary prices to achieve higher profit margins.

One of the objectives of a follow on programme should be to find ways to reduce these costs, some of this through local partnerships of tradesmen and contractors, and to investigate alternative sources of support through subsidises and grants. Indicative

values for current and likely future prices are shown in the table that follows, along with likely reasons for price reductions.

Improvement measure	Indicative current cost	indicative cost for local improvement programme	Reasons for cost reduction
Solar Thermal Panels	£3,000	£2,000	Expect economies of scale as demand increases and installations are carried out by local installer partnerships
Solar PV Panels	£7,500	£5,000	Expect economies of scale as demand increases and installations are carried out by local installer partnerships
Solid Wall insulation	£4,000	£2,500	Using local tradesmen and installers and moving away from expensive “system” methods
Room in Roof Insulation	£1,500	£1,000	In larger programmes this would be eligible for utility grants under CERT provided the specification meets ofgem requirements
Cavity Wall and Loft Insulation	£200 - £500	£0 - £200	For “whole house” installations grants reduce prices to £149 to £199 (free to benefits recipients and over 60’s). Costs of customised work eg extensions and small roofs reduced by negotiating with installers
Boiler upgrades	£1,500	£1,000	Using local installer reduces costs. Boiler scrappage for over 60’s reduces costs by £500. “Fuel switching” discounts possible from utilities under CERT for new connections.

Other programmes, such as ARBED, and sources of additional support that could be used in a follow on project are detailed in Appendix 7.

Carbon Footprint from all Improvements

The summary of all of the improvements is tabulated below. Together these result in a 50% saving in carbon emissions, 42% reduction in energy costs which rises to 93% when the income from FIT’s and RHI’s are taken into account. This would result in total energy bills of just over £100 per year.

Talysarn and Nantlle Community Energy Survey

	Current values	With Energy Efficiency Improvements	With Energy Efficiency Improvements and Heating Upgrades	With Energy Efficiency Improvements, Heating Upgrades and Solar Thermal	With Energy Efficiency Improvements, Heating Upgrades, Solar Thermal and Solar PV
Average household CO ₂ emission tonnes/ year	7.71	5.55	4.85	4.50	3.85
Total CO ₂ emission tonnes/year	4082.7	2920.2	2589.0	2396.2	2037.9
Average CO ₂ emission savings tonnes/year		2.16	2.86	3.21	3.86
Calculated Average Annual Heating and Hot Water Costs	£856.63	£454.27	£406.44	£331.00	£331.00
Calculated Average Annual Heating and Hot Water Savings		£400.29	£450.19	£525.63	£525.63
Calculated Average Annual Electricity Costs	£585.60	£585.60	£585.60	£585.60	£509.80
Calculated Average Annual Energy Savings		£400.29	£450.19	£525.63	£601.43
Estimated Income from Solar Thermal and PV				£220	£742
SAP 2005 rating / grade	39.3 / E	57.7/D	67.2/D	C	C
% Saving Carbon emissions		28%	37%	42%	50%
% average household saving		28%	31%	36%	42%
% average saving (inc income)				52%	93%

10. Community Building, Canolfan Talysarn

Heating requirement calculations have been carried out based on the survey conducted on 24th March 2010 and the benefits for a number of improvements have been calculated.

While the new part of the building is intrinsically fairly efficient, the way the heating is used, the lack of necessary controls and the siting of the radiators in the main hall are resulting in very high costs. The older part of the building, with thermally poor solid walls and an older gas boiler is a significant contributor to the high running costs.

These calculations have been carried out assuming a heating pattern the same as for a domestic dwelling, which should lead to more pessimistic forecasts of heating requirements, but they show that in its current state the cost of heating the building, including electricity used by boilers, pumps etc, should be just under £3,000. This is less than half the current excessive costs due to a combination of factors.

Quick hits: The boiler in the old, partnership part of the building, which is any way relatively inefficient (replacing with a modern condensing boiler should result in savings of £500), appears to be burning inefficiently, possibly dangerously and has a faulty boiler thermostat, meaning it is either on or off but without further control. This may also be causing rooms to overheat despite the setting of the radiator thermostats.

Once this boiler is replaced it should be possible to use the radiator thermostats to regulate the temperature in the various areas. In the meeting room it would make sense turn them down to a very low setting when the room is not in use and recommend a max setting (probably around 2) when the room is occupied.

Given the use made of the main hall it seems pointless to have the radiators mounted high on the walls. Bringing these down should produce acceptable heat at less cost. I would not, at this stage use radiator thermostats but investigate **zoning** (see below). Apparently there was at one time the intention of using fans to produce a more even temperature but these were never installed.

It should be possible to get lockable radiator thermostats to prevent them being turned up and left on a higher setting. As it would be good practice to turn the radiators down when rooms are not in use, at least until zoning is introduced it would be best if the maximum setting only could be locked.

Zoning: The system at present lacks the control to only heat the parts of the building in use. Zoning would introduce motorised valves which would allow the selection of where heating is applied. It would also allow different maximum temperatures to be set for different general areas. The savings made by this are difficult to calculate but the benefits are obvious.

Main Recommendations: For convenience the building has been treated in three parts. From the table of results (page 35) it is clear that the largest heat losses are due

to the old walls in the partnership office, meeting room and computer suite. Internal insulation of the older, solid walled parts, without changing heating use by zoning, has the potential to save around £900 per year. If radiator thermostats are set sensibly, it should also help with the variations in temperature that now occur.

In the main hall, installing double glazing high up on the south facing wall to provide more natural light is broadly neutral in terms of energy consumption, the increased solar heat gain compensating for the reduced insulation. This means that natural light can be introduced without penalty in terms of heating costs and there is potential for savings from reduced use of artificial light.

The ventilation in the roof is apparently rarely used and not working at present. Although it is not supposed to let any air in, it is reported that wind is felt under the inlets. The position of the vents would be suitable for a heat recovery ventilation system. This would not only give a degree of comfort but would aid the circulation of the hottest air, near the roof, back to the ground where it is wanted. By recovering what would otherwise be wasted heat, a small saving is achieved.

Other Savings: The wooden fire doors through the building are a small addition source of heat loss, but more significantly result in uncomfortable draughts. Ideally these would be replaced by secure and better fitting PVC units but should be looked at to see if draught proofing can be improved.

It is noticeable that, even in areas with a reasonable amount of natural light, artificial lights are all on. An ideal solution would be to fit sensors which turned off lights in unoccupied areas and switched lights on progressively to achieve acceptable illumination with the minimum of lamps lit. Until this is installed encourage users to use only as much light as necessary and switch off in all unoccupied areas.

Most electrical equipment continues to use electricity when it is shut down, unless switched off at the wall. Computers, including screens and peripherals can be particularly expensive. It should be policy to switch off any items not in use at the wall switch (after properly identifying items that do need to be left switched on.) It would be a good educational exercise to identify where all the electricity used is going too. An individual appliance meter can be used to confirm how much energy is being used by appliances, both in use and when apparently off. It may be possible to install a **currentcost** meter to measure consumption at different times, a valuable way to identify waste (since consumption at night should be practically zero).

Heating requirement calculations and potential financial and carbon savings for Canolfan Talysarn

Detail	change	Heating requirement (GJ/year)	pump/ventilation (GJ/year)	SAP grading (2005)	SAP rating (2005)	tonnes CO2/year	Energy Costs (gas plus electric)
old building	as is	200.7	0.47	17	G	10.9	
new less hall	as is	40.79	0.63	81	B	2.29	
hall	as is	64.41	3.36	65	D	3.91	
old building	replace boiler	147.5	0.47	26	F	8.03	
old building	replace boiler plus insulate walls and improve roof insulation	46	0.47	74	C	2.55	
hall	Install 14 m ² of double glazing, south wall main hall	63.63	3.36	65	D	3.89	
hall	double glazed plus heat recovery ventilation	46.5	3.36	72	C	2.96	
Whole buildings totals (heating improvements only)							
	as is	305.9	4.46			17.1	£2,959.55
	replace boiler in older part	252.7	4.46			14.23	£2,485.86
	plus double glazing in hall	251.92	4.46			14.21	£2,478.91
	plus double glazing and heat recovery in hall	234.79	4.46			13.28	£2,326.39
Whole buildings totals (including insulation of solid walls)							
	as is	305.9	4.46			17.1	£2,959.55
	replace boiler and improve insulation in older part	151.2	4.46			8.75	£1,582.10
	plus double glazing in hall	150.42	4.46			8.73	£1,575.16
	plus double glazing and heat recovery in hall	133.29	4.46			7.8	£1,422.63

11. Opportunities to benefit Talysarn and Nantlle

a. Insulation for Hard to Treat Properties, Solid Wall and Room in Roof

Hard to Treat properties are so called because they are not suitable for the easy to apply, low cost cavity wall and loft insulation currently supported by grants from the utility company. Methods to carry out improvements for such properties are available and used very successfully but they are currently expensive, involve major alterations and not significantly supported by grants. They are however very effective, making much bigger savings than cavity wall or loft insulation (because hard to treat properties typically have much greater heat losses) and are very significant in improving comfort where used. It will also be necessary at some point in the future to apply such techniques to all homes if we are to achieve the sort of energy savings we are committed to.

External wall insulation consists of panel of high performance insulation attached to the outside of the property which is covered by mesh and render coats, then finished off with a waterproof polymeric coating. Thicknesses are typically one to two inches. This is more expensive than internal insulation, partly due to the need for scaffolding and delays due to the weather. There is also a need to cope with increasing the depth of window sills, dealing with wires coming through the walls, such as for satellite dishes and replacing or moving gutter downspouts and soil stack. With older properties there are also issues to address where the roof has only a small overhang. None of these are insurmountable.

Internal wall insulation is usually cheaper to do, consisting of replacing existing plaster with a proprietary product, insulation board with a foam insulation product attached. Typically this is also between one and two inches thick, but the impact is reduced somewhat as the original plaster is removed. The main disadvantages are the mess created in clearing the wall, replacing items such as skirting boards and picture rails and possible need to partially rewire as sockets are brought forward.

Both of these methods are very effective, eliminate condensation and will greatly reduce or eliminate any naturally penetrating dampness. A greater benefit will be experienced for semi detached and end terraced properties where very high heat losses are experienced at the gable ends.

Where no loft is present, or it is used as a room, the roof can be lined with insulation boards, ideally to a depth of at least 4 inches. It is important to ensure that there is sufficient ventilation behind the insulation as a cold space will be created where condensation will occur if precautions are not taken. This is very effective, greatly reducing the overheating and coldness such spaces are prone to, depending on the time of the year, and making a large contribution to retaining heat within the home. A partial solution is to simply line the inside of the present loft lining and this can be also be done where the roof forms part of the ceiling to upstairs rooms.

b. Renewable Energy, Heat Pumps, Solar Thermal and Solar Photovoltaic panels

The introduction of **Feed in Tariffs** (FIT's) for renewable electricity from April 2010 and the proposed **Renewable Heat Incentive** (RHI's) for renewable heat that will come in from April 2011 has massively changed the benefits and market for installing renewable technologies. Both of these will lead householders (and other

organisations) with renewable technologies on their buildings receiving a payment for all of the energy generated, even if that energy is used on the premises. The level at which these tariffs are set is high enough for the cost of equipment installed being recovered within a realistic timescale. The value will be reviewed annually for new installations but, once installed, it will only change by increasing with inflation and continue until the end of the programme (2035 for PV).

This has already begun to effect the market as it has opened up the opportunities to many more people to install equipment. Prices for the equipment are falling and, because this makes it beneficial for installers to be properly accredited, many more approved installers are entering the market. Shortages of panels and inverters is happening, partly as a result of stock being bought up in bulk.

The values for the tariffs for the type and scale of equipment most likely to be used in a domestic situation are shown below.

		Tariff level for new installations in period (p/kWh) [NB tariffs will be inflated annually]			
Technology	Scale	Year 1: 1.04.10- 31.03.11	Year 2: 1.04.11- 31.02.12	Year 3: 1.04.12- 31.03.12	lifetime (years)
PV	≤4 kW (new build)	36.1	36.1	33.0	25
PV	≤4 kW (retrofit)	41.3	41.3	37.8	25
PV	>4-10kW	36.1	36.1	33.0	25
Wind	≤1.5kW	34.5	34.5	32.6	20
Wind	>1.5 - 15kW	26.7	26.7	25.5	20

The income that will be received is shown below. Current system prices are quoted but are likely to fall, even in the short term.

Income from FIT for small scale PV

Supplier	System Size	Estimated Cost (inc VAT)	Anticipated Output/year	Value of FIT /year	Value of sales /year	Payback years
Segen [*]	1.8kWpeak	£9450	1518 kWh	£627	£45	14 years
Allbrite ^{**}	1.5kWpeak	£7350	1265kWh	£522	£38	13 years
Dulas ^{***}	1.7kWpeak	£7350	1417kWh	£585	£42	12 years

^{*} Segen Ltd, Wesley Hall, Barrack Road, Aldershot, Hants, GU11 3NP

^{**} Allbrite UK Ltd, 30 Chester Street, Mold, Flintshire, North Wales, CH7 1EG

^{***} Dulas, Unit 1, Dyfi Eco Park, Machynlleth, Powys, SY20 8AX

Similar benefits will be achieved from the installation of a solar thermal technology, but the proposed financial value is expected to be even greater than for generating electricity. It also has the benefit that the heat generated is used in the home, unlike PV which generates most energy during the day when there is usually little domestic consumption. Proposed financial support is shown below

Small installations			
Technology	Scale	Tariffs (pence/kWh)	Tariff lifetime (years)
Solid biomass	Up to 45kW	9	15
Ground source heat pumps	Up to 45kW	7	23
Air source heat pumps	Up to 45kW	7.5	18
Solar thermal	Up to 20kW	18	20

The chart below shows how this converts to a financial return for practical systems that could be installed. Heat pumps are included as well as solar thermal system but properties need to be well insulated for heat pumps to be effective at providing comfortable room temperatures.

RHI estimated value

	Semi *	Detached *
Space heat requirement (from SAP)	6,000 kW-hr	9,250 kW-hr
Hot water requirement (from SAP)	3,686 kW-hr	4,700 kW-hr
60 % Hot water requirement provided by Solar Hot Water	2211 kW-hr	2820 kW-hr
RHI value per year for Solar Hot Water	£400	£500
RHI lifetime for Solar Hot Water (years)	20	20
RHI value per year for Air Sourced Heat Pump	£450 for space heating + £280 for hot water	£690 for space heating + £350 for hot water
RHI lifetime for Air Sourced Heat Pump (years)	18	18
RHI value per year for Bio-Mass Boiler	£540 for space heating + £330 for hot water	£830 for space heating + £420 for hot water
RHI lifetime for Bio-Mass Boiler (years)	15	15
Estimated RHI value per year for 2 m² Solar Hot Water **	£220	£220

* Energy requirement (SAP) based on typical sizes for existing homes retrofitted with cavity wall insulation and loft insulation but no under floor insulation with PVC double glazing/ half glazed PVC doors and no chimneys or open flues.

** Assuming 1,000kW-hr/m² incident radiation, system efficiency 60%.

One of the main criticisms of FIT's and RHI's as a way to encouraging the take up of renewable technologies is that it offers an investment opportunity for the better off, but will lead to increased electricity prices which will fall on everyone, since it is the utility companies that are required to make the FIT and future RHI payments. As it

stands this could lead to lower income households subsidising those who can afford the initial costs.

This is big challenge, to ensure that everyone can enjoy the reduced energy costs and income derived from renewable technologies, especially those on low incomes who would benefit the most. Using the value of the guaranteed income that the FIT provides, it should be possible to organise loans to cover the installation costs. Although grants under the **Low Carbon Building Programme** have ended for all renewables other programmes like **ARBED**, a Welsh Assembly Government economic development initiative for Strategic Regeneration Areas funding home energy improvements, could be explored if objective of creating employment opportunities was met.

There is a proposal that in future loans will be made available to everyone based on the value of the FIT income, tied to the property and passed on to the new occupiers when the property is sold. These are unlikely to be available until 2013. There are also companies exploring the possibility of carrying out the work and retaining the income until the initial cost is covered. Meanwhile the householder benefits from the reduced energy bills and then receives the income once the initial cost has been paid off. Effectively the roof would be rented out for a period.

The opportunities for an energy project, such as Talysarn/Nantlle energy group are

- i. **Developing local employment opportunities and networks.** By informing local electricians and heating engineers of the potential, providing guidance to become accredited and investigating ways in which groups can work together to minimise costs and share marketing efforts. Help them to gain experience under guidance of established and experienced installers.
- ii. **Promoting the benefits locally.** Make it easy for those who could potentially invest in these technologies to learn about the opportunity, be sufficiently well informed to make decisions and introduce to reliable, trusted and hopefully local installers.
- iii. **Investigate all of the options for financial support.** Investigate and help implement ways in which low income households and those that already have financial commitments can install equipment. This may involve loans against the guaranteed income, grants, ARBED or even ideas like “rent a roof”.

c. Ventilation with heat recovery

Older, smaller properties are particularly prone to problems cause by condensation. The introduction of double glazing, deliberate attempts to reduce draughts and the closing up of open fires have increased comfort but reduced the original (excessive) ventilation. This is made much worse by activities such as regular baths and showers and large amounts of clothes washing that did not happen when these houses were first built.

Wall insulation will go a long way to reducing this but the most common solution is to increase ventilation, either by air vents or fans, usually in kitchens and bathrooms where most water vapour is produced. The problem with this is that any damp air leaving the property is replaced by cold air from outside. The same is true there is an open flued fire, be it a coal fire, gas fire or a multi fuel stove.

The solution to this is to add heat recovery to ventilation. Ideally this should be a whole house system but current systems are not suitable for small homes. However there are low cost, heat recovery ventilation units for individual room that take up no more space than a conventional ventilator but which extract the heat from the damp air leaving the house and control the air coming back in, putting the collected heat into the dry air from outside.

d. Smaller improvements, Sempatap Internal Wall Insulation, Temporary plastic film double glazing and Insulation Top Up

A number of low cost measures have been identified that can help with problems identified during the course of the surveys.

Condensation is particularly bad around windows, where the walls are coldest because they are near to the cold exposed exterior surface. There is also little depth here to use a product such as insulated board because of the narrowness of window frames. A product that can be used in this situation is **Sempatap**. This is a 10mm thick latex foam sheet that is fixed like wall paper. This is intended as a whole wall insulation material, but because of its thinness and far from ideal insulation properties it is greatly inferior to proper solid wall insulation (it may still be used where the disturbance of other solutions is too great) but is the best solution where only a thin material can be used. Although relatively expensive, only small quantities would be needed for the reveals around windows.

A number of houses only have partial double glazing and for others there are restrictions that prevent double glazing from being installed. Secondary glazing can be unsightly and may be restrict the opening of windows in the summer. A solution is temporary thin film plastic glazing. This is a sheet which is cut to size and attached to the outside of the window frame with double sided tape and made tight by heating with a hair dryer. It can then be removed for the summer and reused if desired. It is very effective, partially by creating an insulated layer and partly by eliminating draughts. It also greatly reduces noise from outside.

A number of the properties have lofts with insufficient depths of loft insulation. Grants exist for everyone if a top up is required from under 60mm (or 100mm for those over 60). People in this situation need to be informed about this and facilitated in making the arrangements. For those with less than 150mm of insulation but who have too much to qualify for grants, the materials are cheap to buy, subsidised by utility companies. These people need help sourcing and fitting the extra insulation. There is also a need to help clear lofts prior to insulating, especially the elderly

e. Advice in the home

In the course of carrying out the surveys a lot of help and advice was provided to those visited. This covered a very wide range of things, from benefits advice to setting up heating to run more efficiently and identifying causes of damp. Although agencies exist that provide this help, usually over the telephone, in most cases people would not have used these services, often weren't aware that they existed and often did not know they could be helped. One particular lesson from this project is that there is a very tangible benefit to providing help and advice face to face in the home

12. Follow on project development

A follow on project to implement a major programme of energy improvements and renewable energy installations, resulting in very large reductions in energy and CO₂ emissions and increased local employment by ;

- i) **Insulation of Hard to Treat properties** by insulating solid walls and rooms-in-roofs. Though these are larger jobs and more expensive than cavity wall and loft insulation, the benefits are also greater, bringing older properties up to the same energy performance level of the newest homes. Most of the work involved can be done by local tradesmen with additional training and, initially, led by experienced installers.
- ii) **Installing renewable energy technologies** , for most houses these would consist of roof mounted Solar Thermal or Solar Photo-Voltaic panels, though there is also some potential for using Heat Pumps where there is no mains gas once insulation has been carried out. These will replace some of the energy used in homes and generate a considerable income to householders and could be fitted by a partnership of local installers following training and accreditation.
- iii) **A smaller measures and advice service** to carry on the activities begun in this project, facilitate the range of smaller and more conventional measures that still need completing and will contribute to overall savings, build on contacts with the community and promote the benefits of the programme.
- iv) **An initial demonstration of installations** using existing grant funding to demonstrate the practicality of the measures, act as a catalyst for further interest and create a demand for the larger project.
- v) **Bringing together the various financial options** to allow everyone to be able to benefit by taking up the measures by investigating loan options, grants and other ways to meet the initial costs

These have been demonstrated by this study to result in up to 59% reduction in energy consumption, 50% reduction in CO₂ emissions and 93% reduction in the cost of energy.

i) Insulation for Hard to Treat Properties

Widespread uptake of measures for older solid walled properties is hindered by the high cost, perceived specialist nature of the work and lack of appreciation of the benefits. Although most of the work is being done by certified installers, usually working for large national companies and using a “certified system” (meeting ISO standards and registered with the British Board of Agreement), the skills required are well within those of plasterers and general builders and the materials required are readily available.

As well as increasing local employment, the use of local tradesmen has the potential to greatly reduce the cost. The materials required are readily available. This project will bring together local tradesmen with the required skills and introduce them to the techniques, initially bringing in experience from outside of the area to supervise the first installations.

ii) Renewable Energy, Heat Pumps, Solar Thermal and Solar Photovoltaic panels

There is already a lot of interest in the village in the possibility of installing solar panel for both hot water and generating electricity. With the introduction of the FIT and the coming RHI there is a real opportunity for this. There is some interest shown by heating engineers considering moving into this field.

Electrical installers and heating engineers need help in obtaining appropriate accreditation. The possibility need to be explored of forming some form of co-operative to reduce accreditation costs, share experience and work together to inform the public of the new opportunities and market the products.

Sustainable Gwynedd is looking at some of these issues and it would make sense to work in partnership, possibly using Talysarn as a “test bed” to take these options further.

iii) Smaller measures and advice

This project has already demonstrated the value of combining advice with home visits, not only to provide help with energy related issues but other issues including damp and condensation, planning cost effective improvements and benefits entitlement. The value of working within the community has been demonstrated.

A number of properties still require small, low cost measures which contribute to the savings that can be made and help is needed to enable this and advise where existing grants can be obtained. A lot of the work, including loft clearance and loft insulation top up could be done with a local volunteer or handyman service or in co-operation with the Care and Repair service. Volunteers could also promote a home energy monitoring of consumption.

Additional measures that could be provided include small scale ventilation with heat recovery, fitting Sempatap thin foam insulation around windows openings and fitting temporary plastic film double glazing.

iv) Initial demonstration

Arbed funding exists to carry out a small scale project, probably on one terrace of properties in a prominent position.

v) Developing financial options

In order that everyone can take advantage of the measures proposed, particularly those on lower incomes who will feel a greater benefit from the reduction in energy costs it will be necessary to bring together a whole range of options. A combination of grants, especially those aimed at economic development, small subsidises from utility companies for larger projects and loans can be combined to make installations more affordable.

Development Resources

A project development officer, working in the community, is recommended to link together the initiatives that are taking place, identify ways that funding sources can be used to subsidise the cost, especially for low earning households, and generate the levels of local interest and acceptance needed to make a larger scale, lower cost programme feasible. The initial phase of this will take at least two years, with visible

Talysarn and Nantlle Community Energy Survey

progress in the form of installed equipment going in towards the end of the first year, particularly solar panels, with a larger programme beginning in the second year.

The development officer will need to work with other groups who are working towards wider uptake of measures in Gwynedd, especially Gwynedd Council, Sustainable Gwynedd and Tai Eryri, and a range of potential funding providers. A number of smaller scale measures can be introduced immediately and, along with expanding the detailed surveys and home advice begun in this work, these will produce acceptance and confidence in then community as well as working with volunteers to provide home electricity audits. The officer should assist the Canolfan in introducing measures there as visible demonstration of the feasibility and the benefits.

In areas with older, traditionally built homes, like Talysarn and Nantlle, the problems presented by each home may be complex and a high level of experience and knowledge is essential if properties are to be improved effectively. The officer should be working with, or as part of, a larger organisation that can bring in further resources and help provide the simple measures.

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Appendix 1. Initial data summary from external surveys of whole

	pre 1900	1900-1929	1930-1949	1950-1966	1967-1975	1976-1982	1983-1990	1991-1995	1996-2002	2003-2006	post 2006
Approx Age	362	52	32	71	10	6	1	14		2	
	66%	9%	6%	13%	2%	1%	0%	3%	0%	0%	0%

	Bungalow detached	Bungalow end terrace	Bungalow mid terrace	bungalow semi detached	flat	House detached	house end terrace	house mid terrace	house semi detached
Build Type/Form	15	8	11	18	8	28	94	242	128
	3%	1%	2%	3%	1%	5%	17%	44%	23%

	A	B	C	D	E	F	not recorded
Council Tax Band	251	219	47	12	4	1	16
	46%	40%	9%	2%	1%	0%	3%

	cavity	solid	solid inc all
Wall Type	113	437	
	21%	79%	81%

	wood single	wood single/ wood double	wood double	wood single/ PVC double	Aluminium double	PVC double
Glazing	90	2	3	2	2	452
	16%	0%	1%	0%	0%	82%

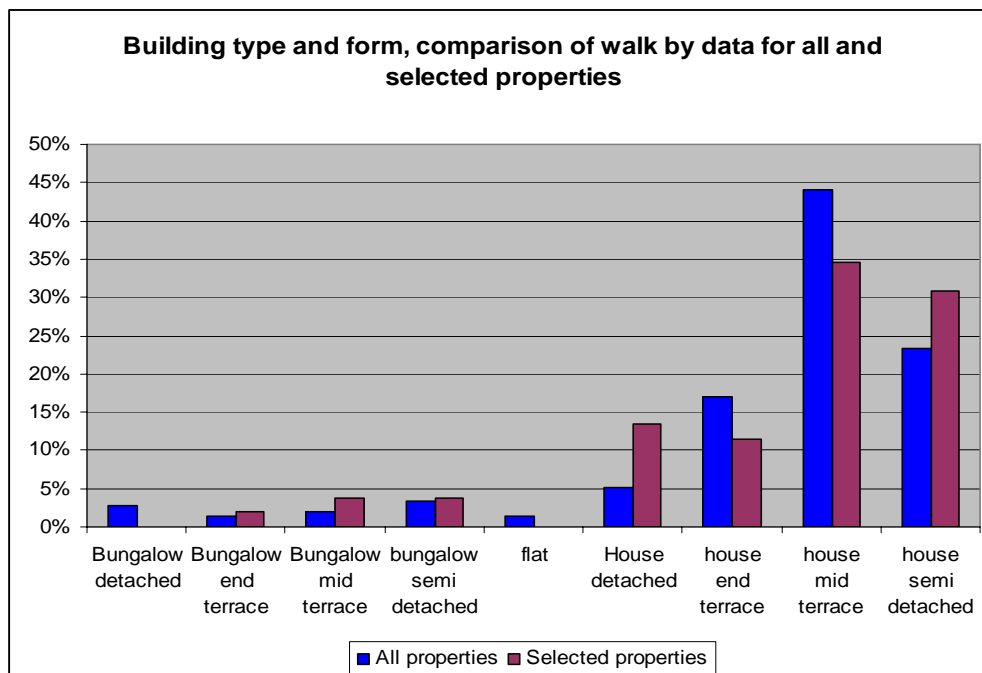
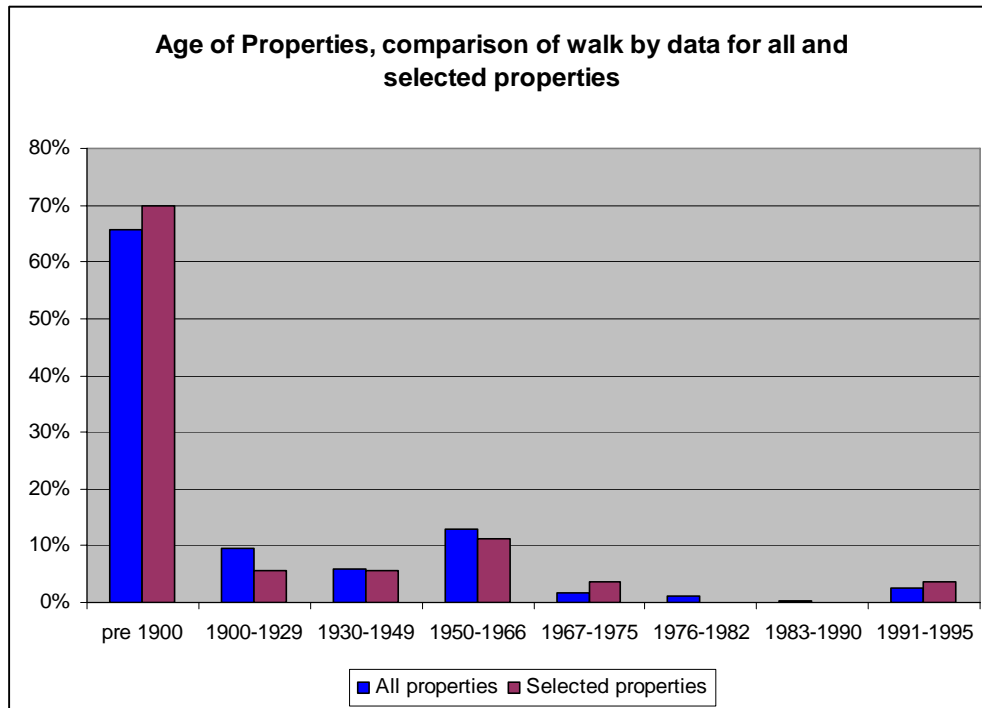
	unglazed wood	1/2 glazed wood	fully glazed wood	Fully glazed Aluminium	unglazed PVC	1/2 glazed PVC	fully glazed PVC
Doors	40	93	10	2	22	302	81
	7%	17%	2%	0%	4%	55%	15%

	mains gas	oil	LPG	no evidence	gas inc all	n e inc all
Heating Type	346	4	1	199		
	63%	1%	0%	36%	58%	42%

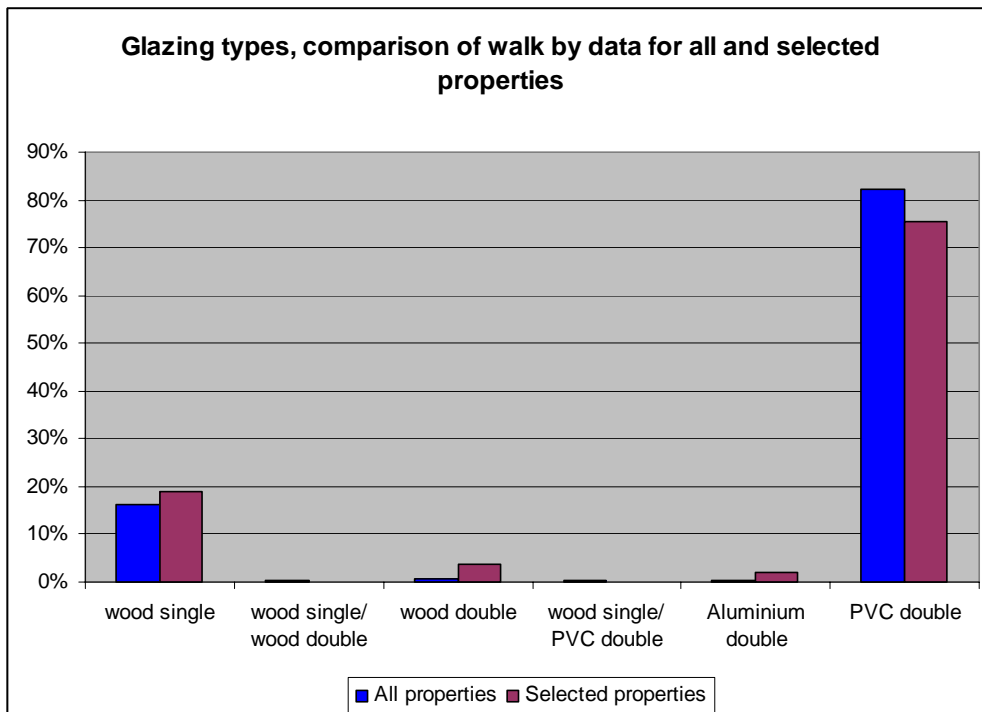
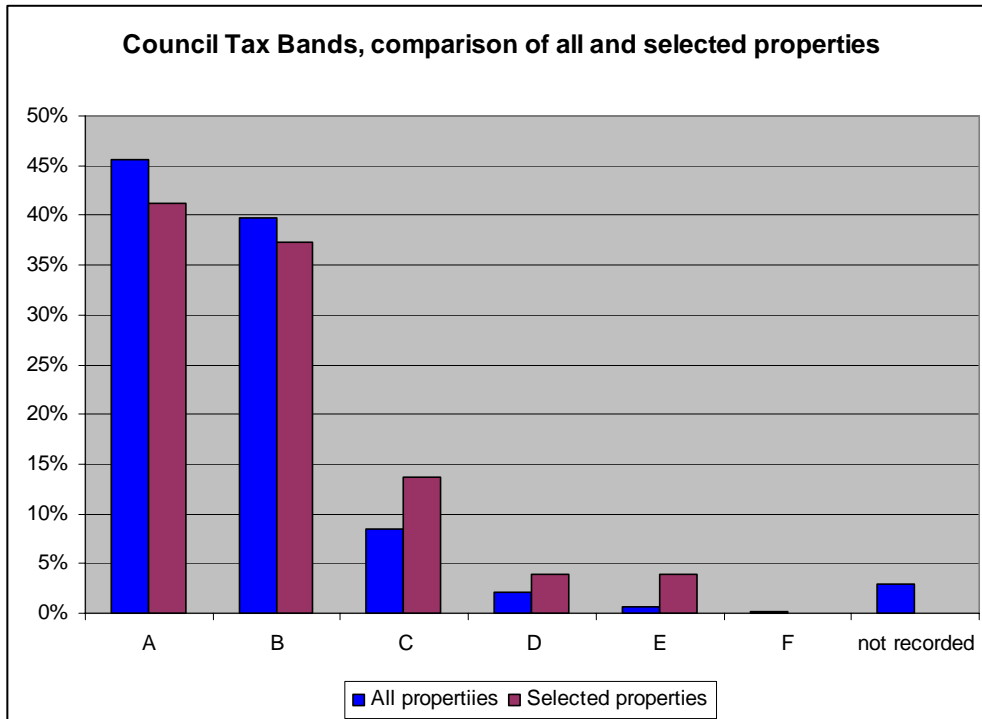
	>75	60 to 74	45 to 59	30 to 44	15 to 29	0 to 14
Roof orientation (degs from south)	18	25	45	115	215	132
	3%	5%	8%	21%	39%	24%

Appendix 2

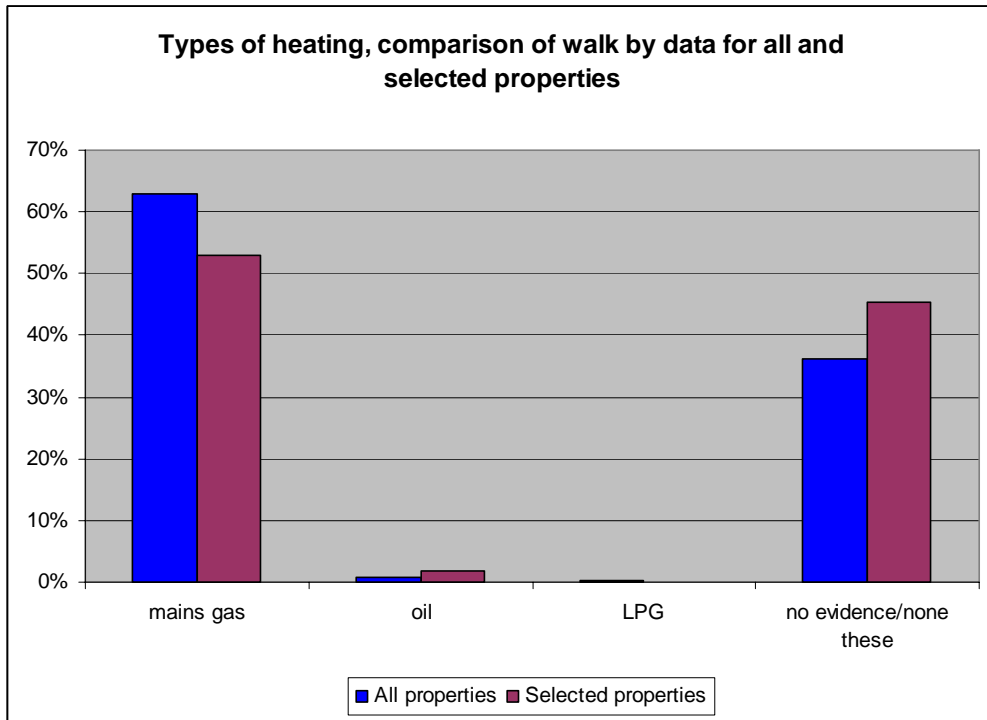
Comparison of the walk by survey data for all properties and the properties selected for detailed surveys. The fairly close correlation between the two sets of data gives confidence that these are representative and that details revealed by the detailed surveys can be applied across all properties in the area.



Talysarn and Nantlle Community Energy Survey

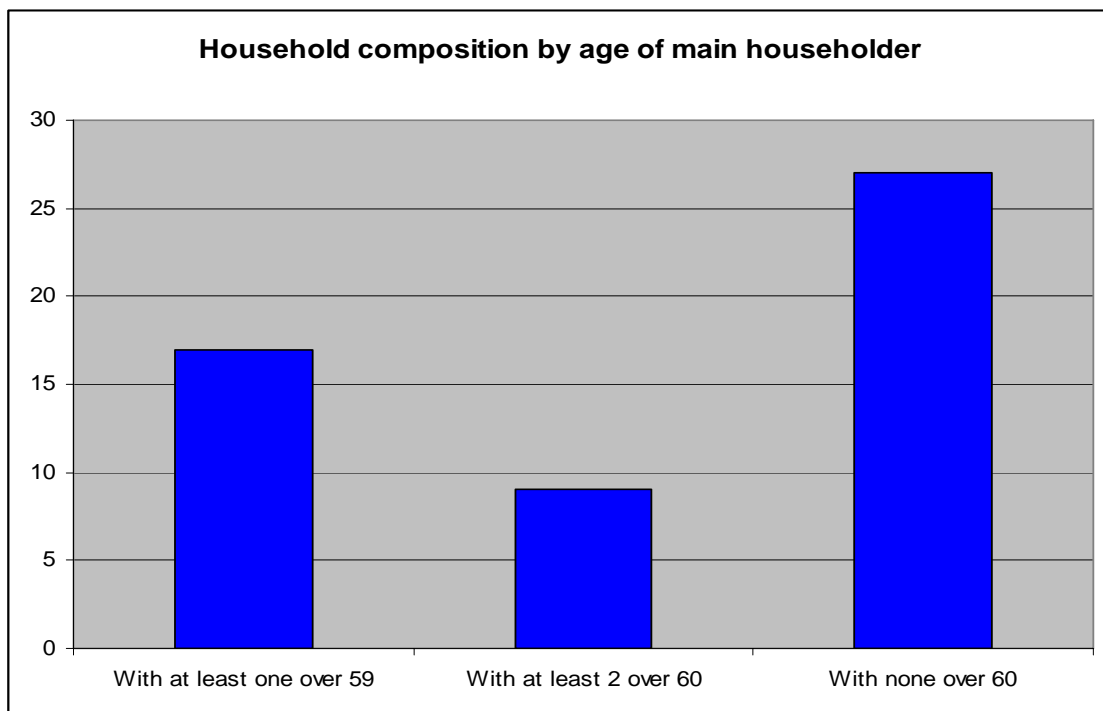
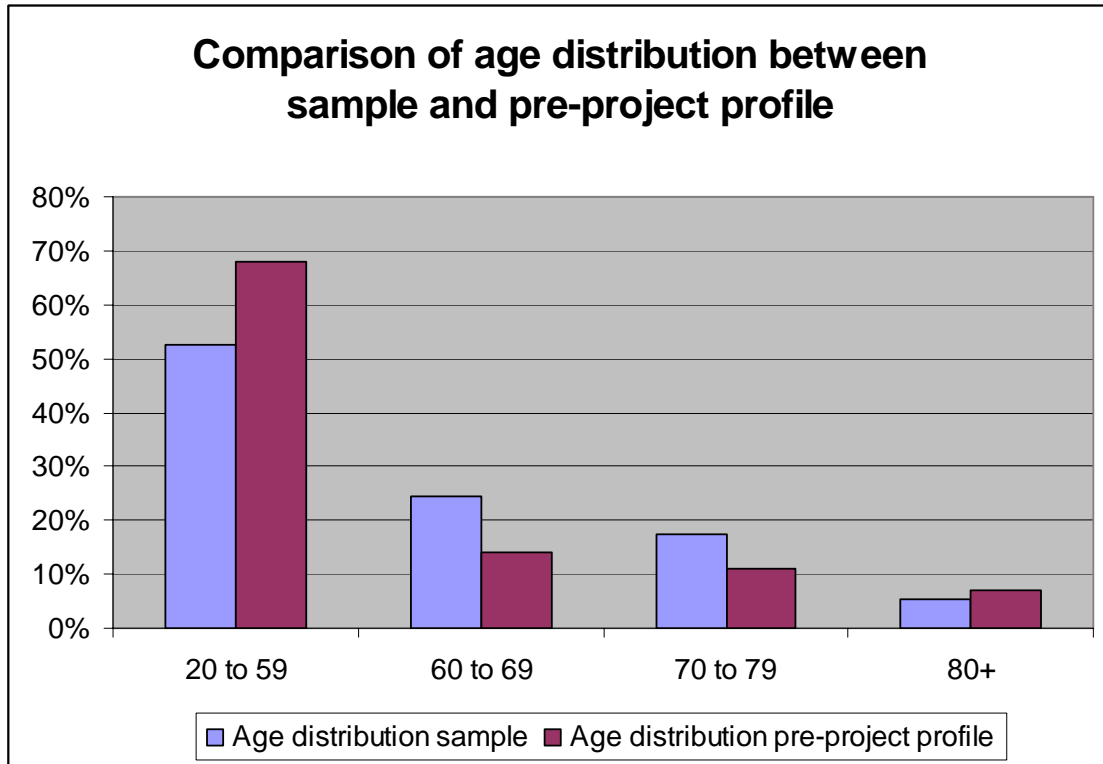


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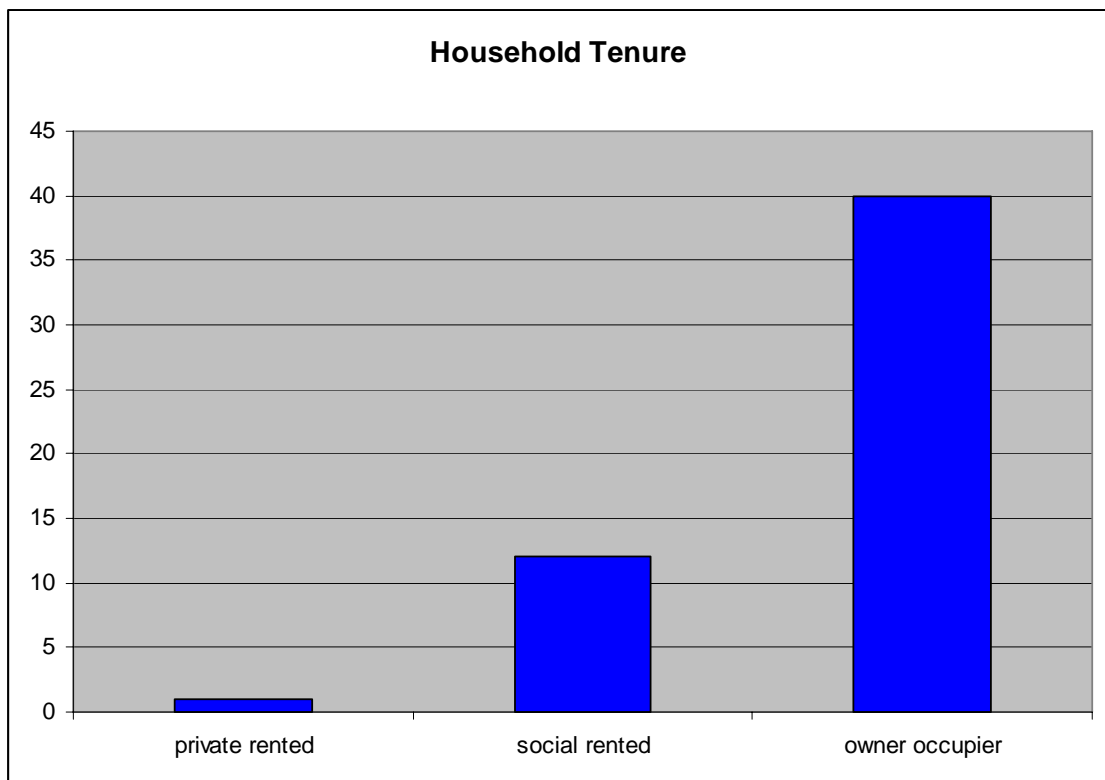
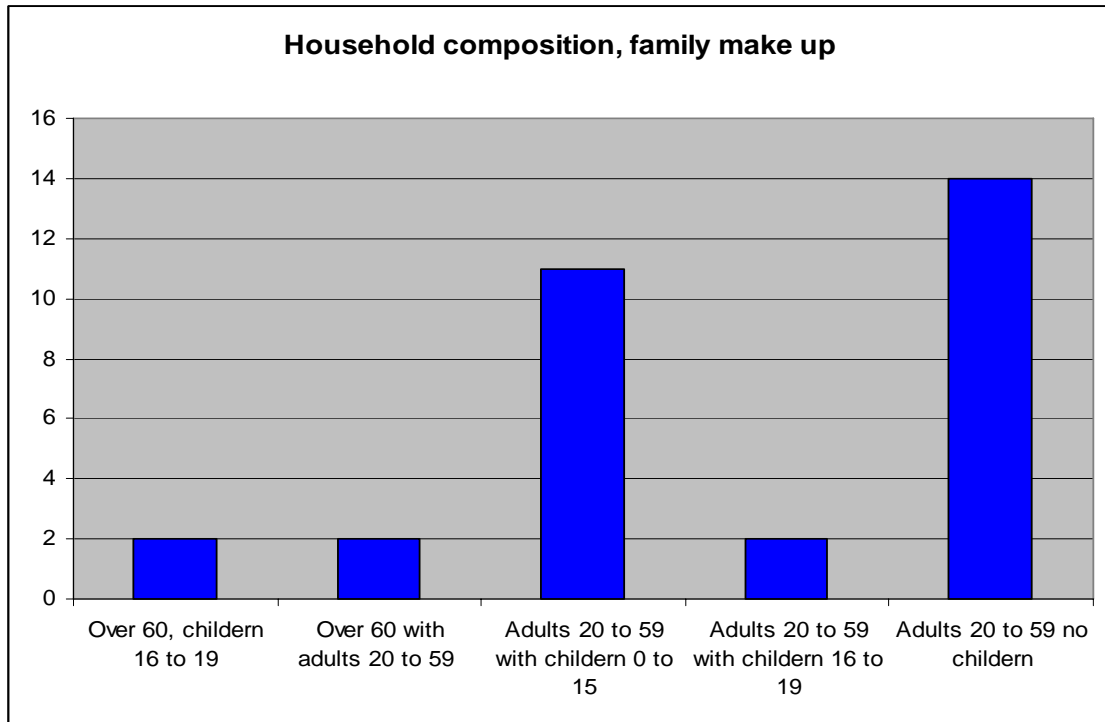


Appendix 3

Sample Households and Occupiers

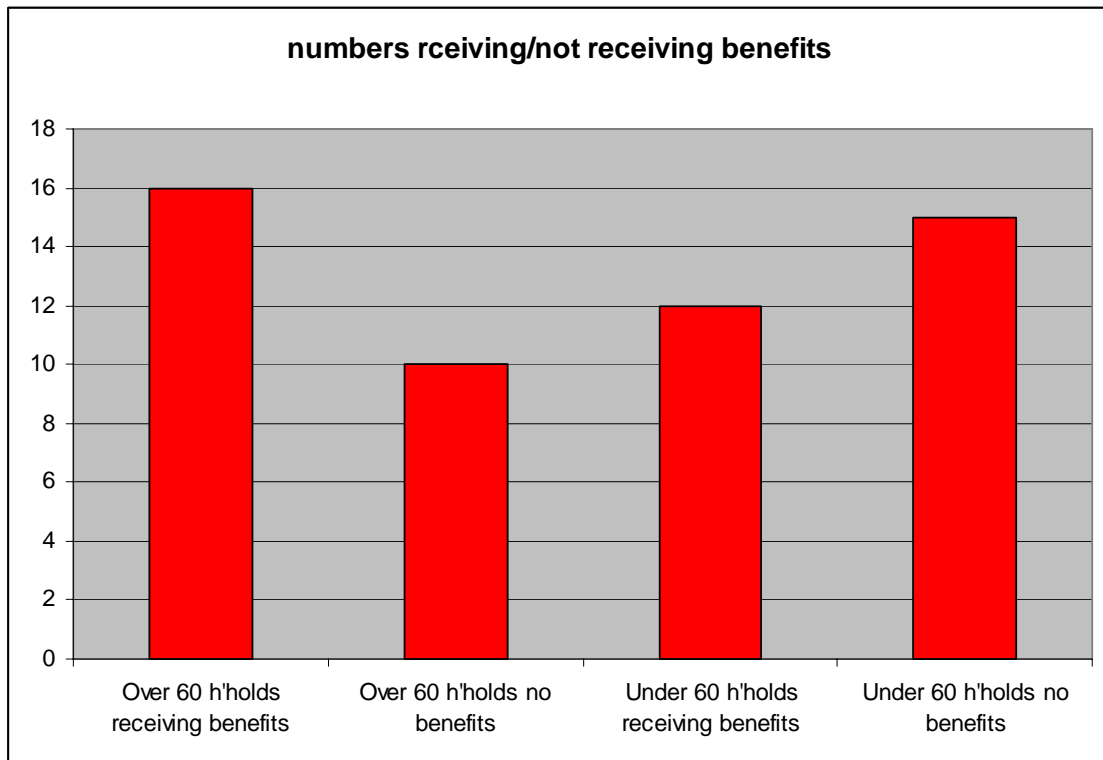
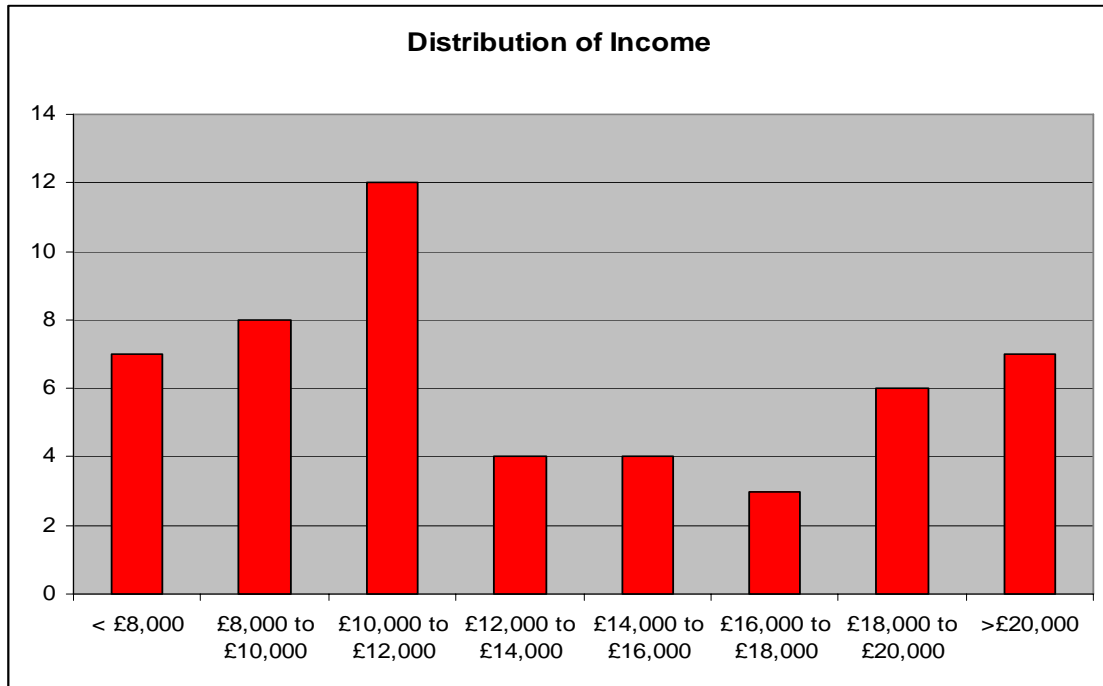


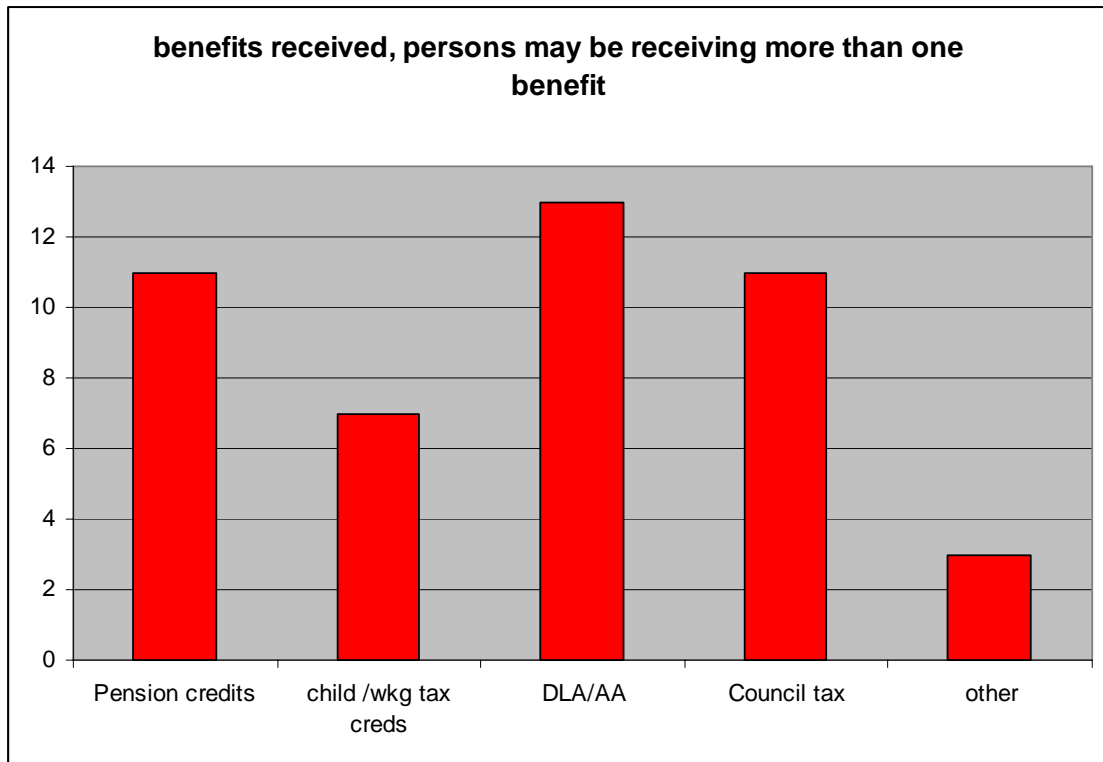
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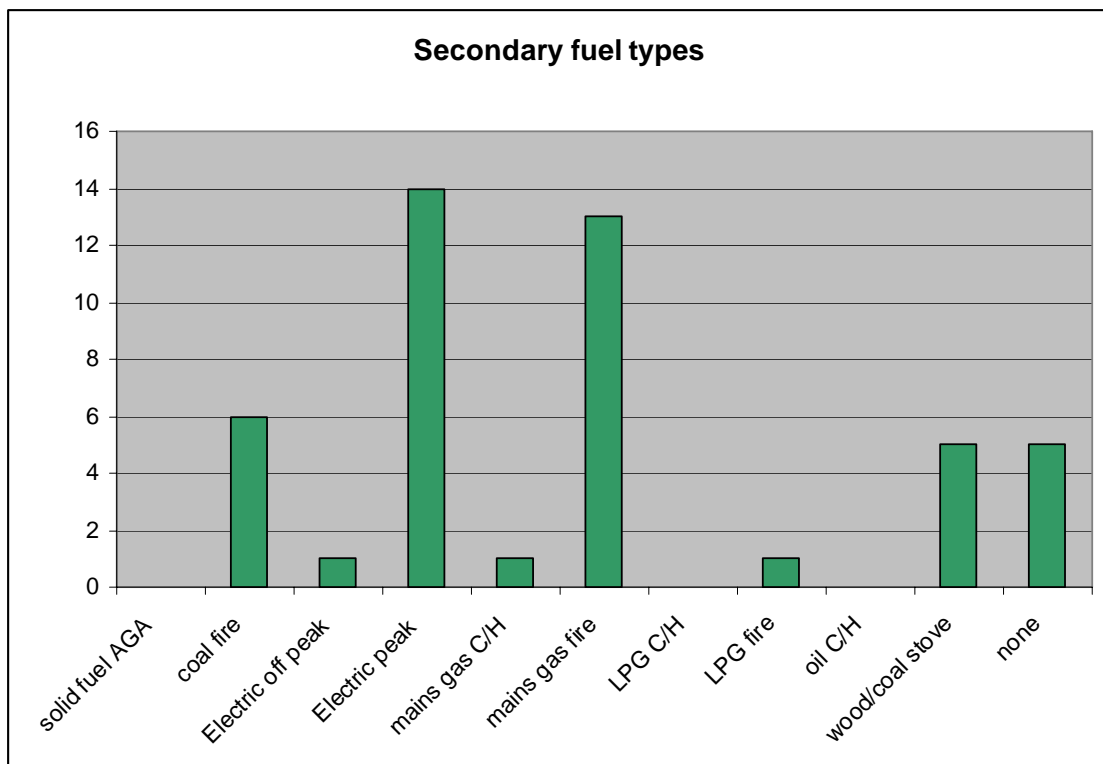
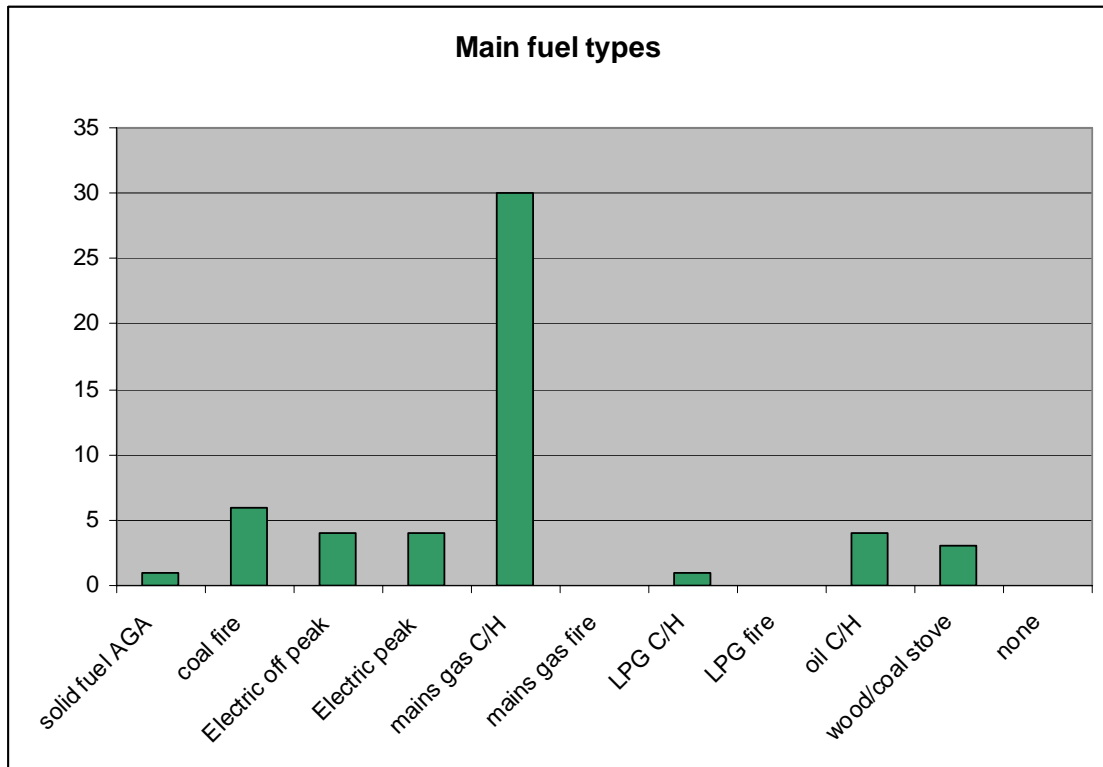
Main householders income and benefits

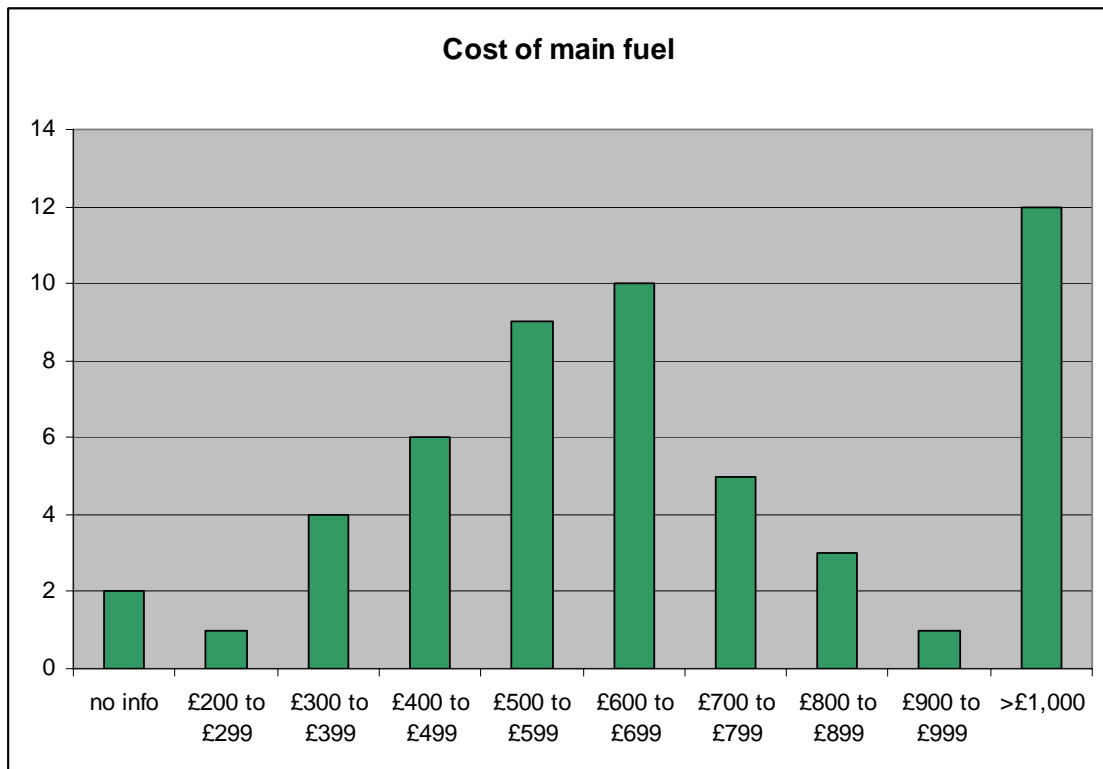
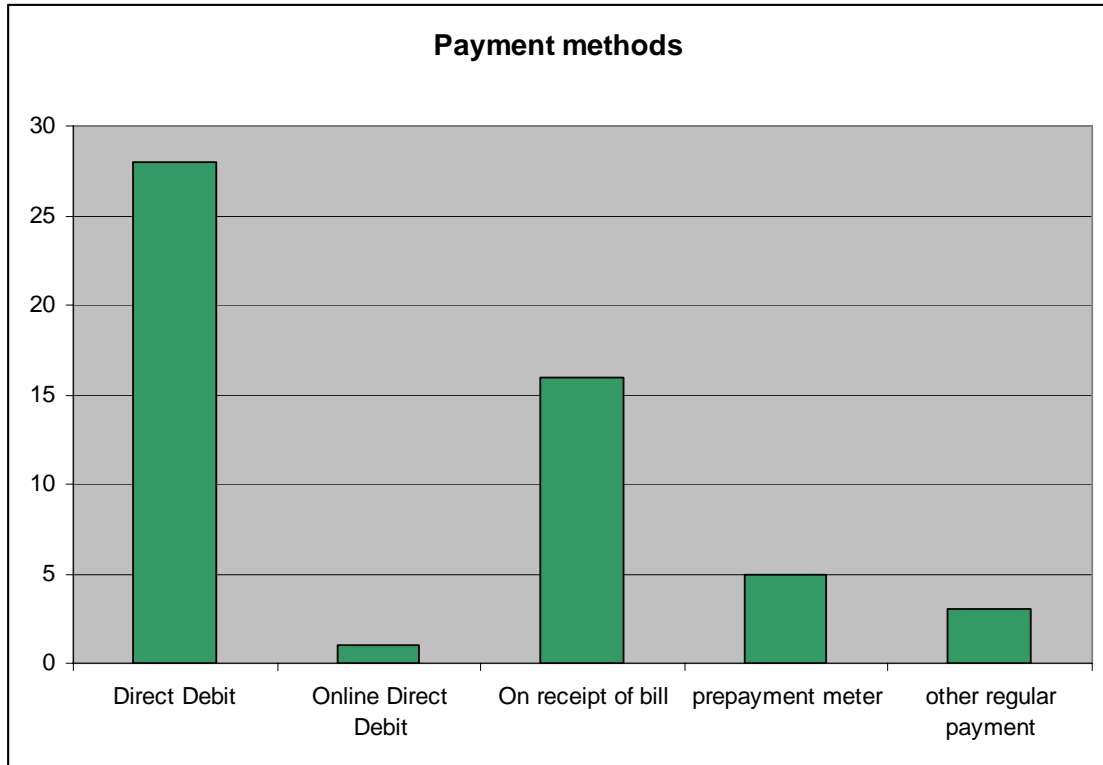




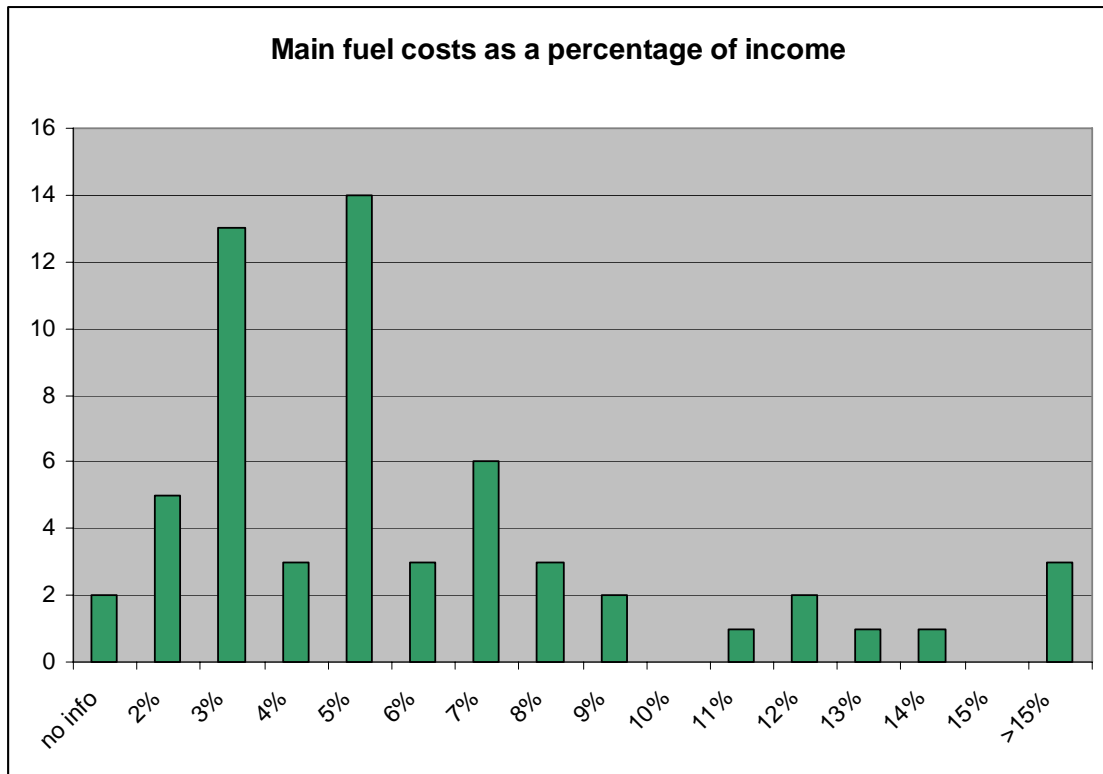
Talysarn and Nantlle Community Energy Survey

Heating, types and costs





Talysarn and Nantlle Community Energy Survey



Appendix 4
Affordable Warmth and Fuel Poverty

Overheating and Underheating

Underheated properties, spend as a proportion of heating requirement	Overheated properties, spend as a proportion of heating requirement	Main heating source	Secondary heating source
0.52		oil central heating	coal fire
0.33		gas central heating	gas fire
0.59		Gas central heating	none
0.49		gas central heating	wood stove
	2.27	electric off peak	
0.23		wood stove	electric peak
0.28		coal fire	electric peak
0.51		gas central heating	none
0.32		gas central heating	electric peak
0.29		gas central heating	gas fire
0.63		gas central heating	gas fire
0.43		Gas central heating	electric peak
0.00		gas central heating	gas fire
0.64		gas central heating	gas fire
0.50		gas central heating	electric peak
0.54		Gas central heating	none
0.51		electric peak	wood stove
	2.23	gas central heating	
0.66		gas central heating	
	1.94	gas central heating	
0.47		coal fire	gas fire
	1.75	gas central heating	
	2.83	electric peak	
0.59		LPG central heating	LPG fire
0.44		oil central heating	
0.57		coal fire	
0.25		wood stove	
0.30		coal fire	electric peak
	2.41	electric off peak	
0.56		electric off peak	coal fire
0.47		oil central heating	wood stove
0.22		coal stove	electric peak
0.65		oil central heating	wood stove

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Households in Fuel Poverty

fuel spend as % of income	Calculated heating requirement as % income	Calculated heating requirement as % income, after improvements	Main heating source	Secondary heating source	Underheated properties, spend as a proportion of heating requirement	Overheated properties, spend as a proportion of heating requirement
4%	10%	6%	gas central heating	gas fire	0.33	
12%	14%	7%	gas central heating	gas fire		
16%	6%	4%	electric off peak	electric peak		2.27
5%	12%	9%	gas central heating	electric peak	0.32	
6%	11%	6%	Gas central heating	electric peak	0.43	
0%	13%	6%	gas central heating	gas fire	0.00	
13%	5%	6%	gas central heating	coal fire		1.94
11%	19%	7%	coal fire	gas fire	0.47	
14%	7%	5%	gas central heating	electric peak		1.75
26%	19%	10%	gas central heating	gas fire		
25%	7%	4%	electric peak	coal fire		2.83
12%	10%	6%	electric off peak	coal fire		
8%	11%	9%	LPG central heating	LPG fire	0.59	
7%	10%	4%	coal fire	none	0.57	
5%	14%	7%	wood stove	none	0.25	
7%	18%	10%	coal fire	electric peak	0.30	
5%	19%	10%	coal stove	electric peak	0.22	

Appendix 5

Heating Costs Carbon Emissions and Benefits form Improvements

Current values, CO₂ emissions, heating costs, SAP ratings

	heating requirement GJ/year			CO ₂ emission tonnes/year				Calculated Heating Costs			SAP 2005 rating / grade
	Average	Max	Min	Total	Average	Max	Min	Average	Max	Min	
Talysarn	65.4	156	15	212.9	5.1	14	1.7	£824.91	£1,740.00	£269.00	44.1 / E
Nantlle	73.8	150.26	36.08	76.4	7.6	15	2.5	£989.86	£1,666.03	£617.71	19.3 / G
All selected	67.0	156	15	289.3	5.6	15	1.7	£856.63	£1,740.00	£269.00	39.3 / E
Whole Area	34258.6			2842.9	5.6			£856.63			39.3 / E

Improved values from all energy efficiency improvements, CO₂ emissions, heating costs, SAP ratings

	heating requirement GJ/year			CO ₂ emission tonnes/year					heating costs				SAP 2005 rating / grade
	Average	Max	Min	Total	Saving from Current	Average	Max	Min	Average	Saving from Current	Max	Min	
Talysarn	32.5	77.95	10	127.1	85.80	3.0	7.2	1.4	£458.09	£366.82	£889.00	£238.00	63.2 / D
Nantlle	32.8	61.75	12.82	43.9	32.50	4.4	7.4	2.2	£438.25	£551.62	£684.55	£232.93	34.7 / F
All selected	32.5	77.95	10	171	118.30	3.3	7.2	1.4	£454.27	£400.29	£889.00	£232.93	57.7 / D
Whole Area (total)	16614.2			1680.4					£232,133.00				57.7 / D
	Total CO ₂ savings	% CO ₂ savings	Total heating cost savings	% heating cost savings									
Whole Area	1,162.5	41%	£205,604.6	47%									

Improved values from all energy efficiency and heating improvements, CO₂ emissions, heating costs, SAP ratings

	heating requirement GJ/year			CO ₂ emission tonnes/year					heating costs				SAP 2005 rating / grade
	Average	Max	Min	Total	Saving from Current	Average	Max	Min	Average	Saving from Current	Max	Min	
Talysarn	28.6	74.8	14.52	97.8	115.10	2.3	4.5	1.3	£406.82	£418.09	£889.00	£261.00	70.8 / C
Nantlle	30.1	61.75	12.82	39.5	36.90	4.0	7.4	2.2	£404.86	£585.00	£684.55	£232.93	44.7 / E
All selected	28.9	74.8	12.82	137.3	152.00	2.6	7.4	1.3	£406.44	£450.19	£889.00	£232.93	67.2 / D
Whole Area (total)	14748.1			1349.2					£207,691.00				67.2 / D
	Total CO ₂ savings	% CO ₂ savings	Total heating cost savings	% heating cost savings									
Whole Area	1,493.7	53%	£230,046.60	53%									

Benefits of individual measures

improved roof insulation										
CO2 emission savings tonnes/year						Heating costs savings /year				
	Total	Number receiving measure	Average	Max	Min	Total	Number receiving measure	Average	Max	Min
Talysarn	11.91	14	0.85	5.1	0.1	£2,218.22	14	£158.44	£657.00	£11.00
Nantlle	9.50	7	1.36	2.2	0.4	£1,603.82	7	£229.12	£380.93	£49.98
All selected	21.41	21	1.02	2.2	0.4	£3,822.04	21	£182.00	£380.93	£49.98
Whole Area	210.39	206	1.02			£37,558.87	206	£182.00		

Improved room in roof insulation										
CO2 emission savings tonnes/year						Heating costs savings /year				
	Total	Number receiving measure	Average	Max	Min	Total	Number receiving measure	Average	Max	Min
Talysarn	6.90	7	0.99	1.6	0.6	£1,290.17	7	£184.31	£267.00	£99.00
Nantlle	2.40	2	1.20	1.3	0.1	£391.82	2	£195.91	£219.61	£172.20
All selected	9.30	9	1.03	1.6	0.1	£1,681.98	9	£186.89	£267.00	£99.00
Whole Area	91.39	88	1.03			£16,528.72	88	£186.89		

Insulate solid walls										
CO2 emission savings tonnes/year						Heating costs savings /year				
	Total	Number receiving measure	Average	Max	Min	Total	Number receiving measure	Average	Max	Min
Talysarn	57.30	33	1.74	5	0.3	£10,307.73	33	£312.36	£731.00	£58.00
Nantlle	12.70	7	1.81	3.7	0.2	£2,469.12	7	£352.73	£604.29	£120.66
All selected	70.00	40.00	1.75	5	0.2	£12,776.85	40	£319.42	£731.00	£58.00
Whole Area	687.88	393	1.75			£125,557.14	393	£319.42		

Cavity wall insulation										
CO2 emission savings tonnes/year						Heating costs savings /year				
	Total	Number receiving measure	Average	Max	Min	Total	Number receiving measure	Average	Max	Min
Talysarn	9.00	10	0.90	2.5	0.2	£1,311.70	10	£131.17	£327.00	£28.00
Nantlle	3.10	2	1.55	2.9	0.2	£349.15	2	£174.57	£323.48	£25.67
All selected	12.10	12	1.01	2.9	0.2	£1,660.85	12	£138.40	£323.48	£25.67
Whole Area	118.91	118	1.01			£16,321.00	118	£138.40		

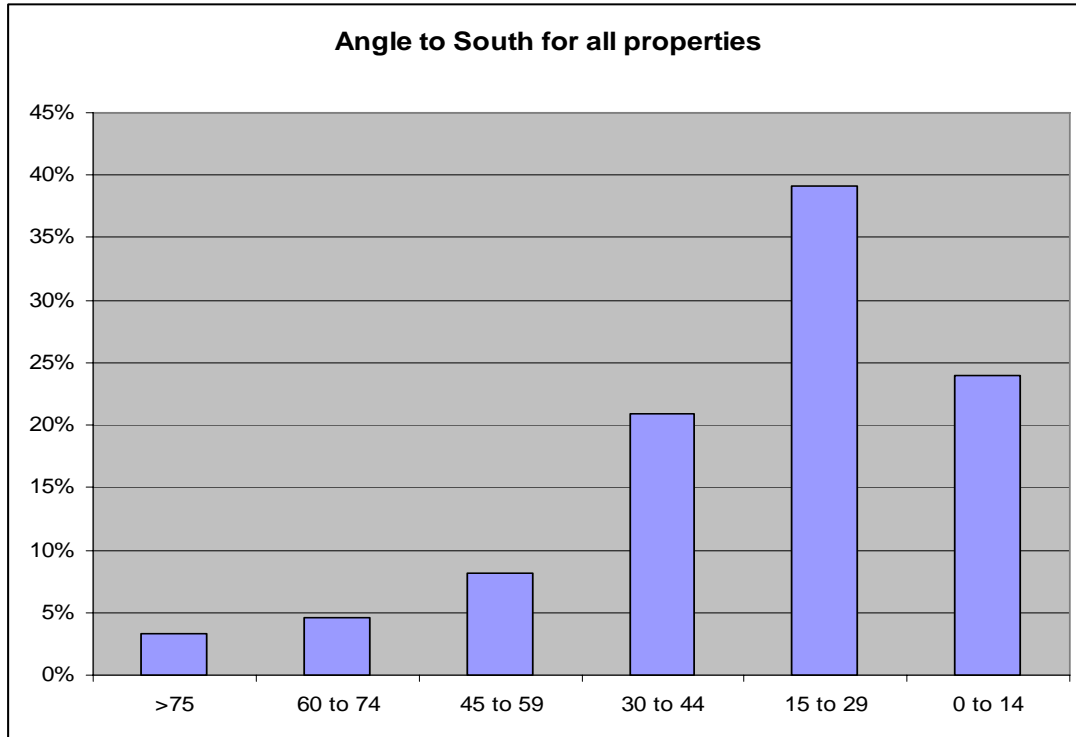
Draught-proofing										
CO2 emission savings tonnes/year						Heating costs savings /year				
	Total	Number receiving measure	Average	Max	Min	Total	Number receiving measure	Average	Max	Min
Talysarn	0.00	0	0.00			£0.00	0	£0.00		
Nantlle	1.10	6	0.18	0.4	0.1	£179.95	6	£29.99	£49.89	£21.96
All selected	1.10	6	0.18	0.4	0.1	£179.95	6	£29.99	£49.89	£21.96
Whole Area	10.81	59	0.18			£1,768.36	59	£29.99		

Heating upgrade										
CO2 emission savings tonnes/year						Heating costs savings /year				
	Total	Number receiving measure	Average	Max	Min	Total	Number receiving measure	Average	Max	Min
Talysarn	49.80	22	2.26	10.2	0.3	£5,094.65	22	£231.58	£1,063.00	£36.00
Nantlle	6.60	2	3.30	3.7	2.9	£403.82	2	£201.91	£233.96	£169.86
All selected	56.40	24	2.35	3.7	2.9		£5,498.47	£229.10	£1,063.00	£36.00
Whole Area	554.24	236	2.35			£54,033.09	236	£229.10		

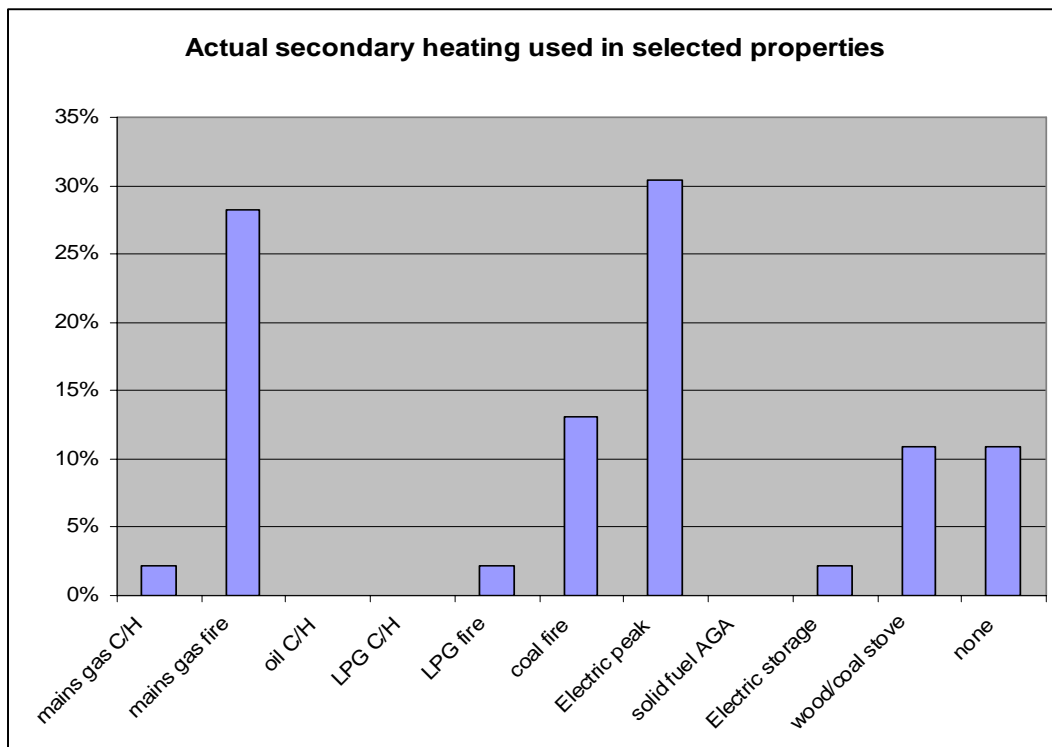
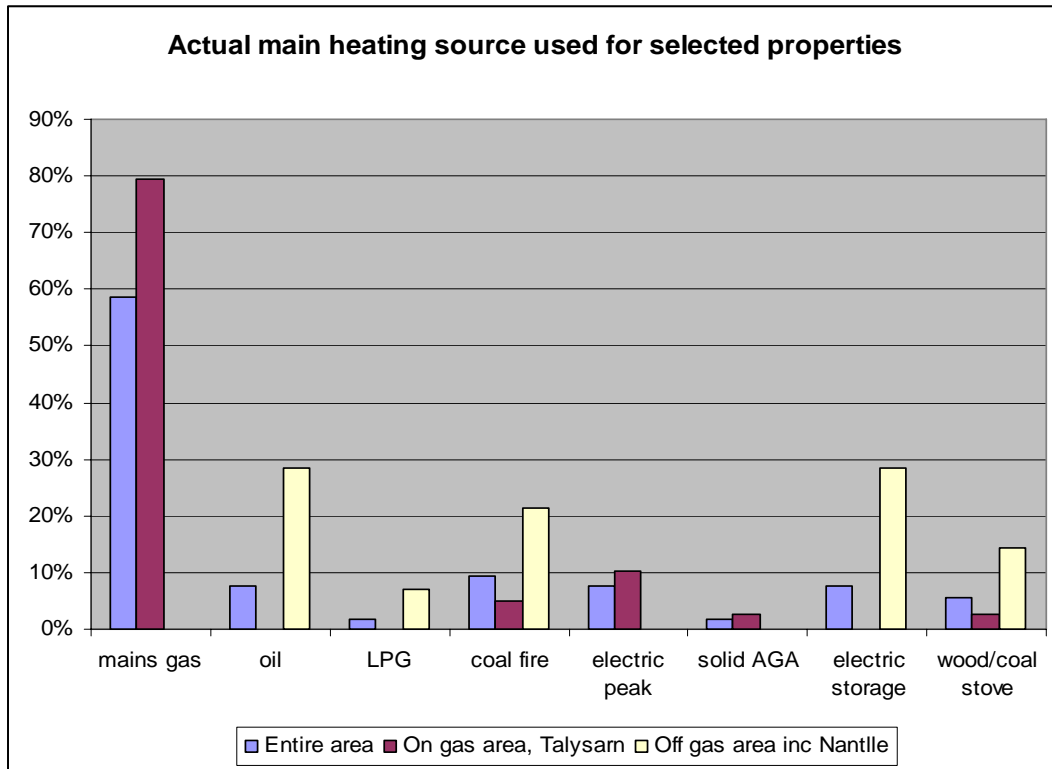
Solar Thermal Panel (2m ²)										
	CO2 emission savings tonnes/year					Hot Water costs savings /year				
	Total	Number receiving measure	Average	Max	Min	Total	Number receiving measure	Average	Max	Min
Talysarn	12.84	42	0.30	0.62	0.23	£2,843.47	42	£66.13	£162.68	£48.22
Nantlle	5.36	10	0.54	0.62	0.33	£1079.65	10	£107.97	£162.68	£68.53
All selected	18.20	52	0.35	0.62	0.23	£3877.74	52	£75.44	£162.68	£48.22
Whole Area	192.83	551	0.35			£41569.98	551	£75.44		

Solar PV Panel (1.5 kWp)									
	Per household				Total all households				
	Total used/ produced (Units/kWh)	Total used/ produced (GJ)	Value of electricity used/ produced	Carbon emissions (tonnes)	Total used/ produced (Units/kWh)	Total used/ produced (GJ)	Value of electricity used/ produced	Carbon emissions (tonnes)	
Current	4,400	15.84	£585.60	2.25	2,424,400	8,727.8	£322,665.60	1239.75	
Savings from PV panel	1265	4.55	£75.8 + £522 (FIT)	0.65	697,015	2,509.3	£41,765.80 + £287,62.00 (FIT)	358.25	
Remaining after savings	3135	11.29	-£12.2 (profit)	1.60	1,727,385	6,220.8	-£6722.20 (profit)	881.6	

Appendix 6
Other data collected



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Appendix 7

Potential Sources of funding

Additional Sources of Grants for Renewables

Besides the grant sources provided by the government, there are a number of other opportunities, some of which may also include or even require energy efficiency improvements to the building. Some are available at short notice so that it is worth having a number of proposals ready that can take advantage of these when they are available.

Countryside Council for Wales: Main Grants Programme

The Countryside Council for Wales (CCW) distributes over £5 million in grant aid each year, and grants of up to £30,000 are available. The CCW normally funds a maximum of 50% of total eligible project costs although voluntary bodies may, exceptionally, be considered for a higher rate of grant where they can provide a justification for this. In most cases CCW funding can be considered 'clean' UK match funding. Some CCW funding is via Convergence and due diligence must be exercised in researching these funds, so as to avoid ineligible applications.

Environment Wales

Environment Wales, administered by the WCVA, aims to support voluntary action, which protects and improves the environment, and contributes to sustainable development.

In order to be eligible for Environment Wales support, projects must meet one or more of the following objectives:

- **Environmental Improvement:** Achieving sustainable improvements to the Welsh environment through practical projects;
- **Education and Awareness:** Increasing understanding of sustainable development and the environment through information, education and advisory services;
- **Environmental Enterprise:** Helping create new environmental initiatives which also allow communities and voluntary organisations to contribute to their social and economic needs;
- **Training and Volunteers:** Supporting and training staff and volunteers engaged in the above activities

There are five grant schemes available:

Pre-project Grants – For specialist help, such as feasibility studies, business plans and community appraisals (£500 to £4,000).

Start-up grants – Available for costs incurred in establishing new voluntary or community groups and developing a project ready for registration (£1,000).

Project Grants – For funding project materials, tools and equipment (£10,000).

Management Grants - For new project-related posts (£1,000 to £12,000).

Training Grants – Available to assist project staff or volunteers with training costs (including travel expenses for courses) (£400).

<http://www.environment-wales.org>

E.ON Source Fund

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The E.ON Source Fund has been developed to support community energy projects, including the installing of wind turbines, which either result in the production of energy from a sustainable source, or which reduce the amount of energy used by a community organisation.

The Fund offers grants of up to £20,000 and is available to community groups, charities and not-for-profit organisations across England, Scotland and Wales.

Naturesave Trust

The Naturesave Trust was formed to promote and encourage the protection, preservation and improvement of the environment for the benefit of the public. It does this by encouraging the greater adoption of sustainable development through the funding of specific environment and conservation projects.

Grants of between £100 and £10,000 are available, with an average grant size of £2,000. The Trust assists projects that deal with the root causes of a specific environmental and/or conservationist problem and those that encourage the greater commercial adoption of sustainable development.

Business grants are available to assist with start-up costs. Funding for specific projects is available for existing organisations. Applicants must seek funding for specific project costs and not general administrative costs of the organisation.

The Polden Puckham Charitable Foundation: Environmental Sustainability

The Foundation aims to address the causes of global ecological damage rather than its symptoms. It particularly supports organisations which are tackling the underlying pressures leading to environmental damage and which promote sustainable living.

Grants are normally between £5,000 and £15,000 and funding can be provided for up to three years. Applicants are expected to report on how the funds have been used within nine to 12 months of receiving the grant. If funding is to cover core costs, an annual report is sufficient.

The Foundation looks to support small registered charities in the UK. Grants can be made to other organisations if they are working with a registered charity.

Scottish Power: Green Energy Trust

Projects are supported that advance renewable energy, i.e. result in the production of renewable electricity or heat and support communities through education and public engagement. Projects are generally required to meet both these criteria and requests must be to support the capital and installation costs of a renewable energy project. Up to £25,000 is available, although most projects receive around £10,000.

Applications are invited from not-for-profit organisations, local community groups and charities to carry out community-based renewable energy and educational products within the UK.

Welsh Assembly Government: Environment Wales Grant Scheme

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The *Environment Wales Grant Scheme* can provide funding towards the provision of management, projects and development. Grants are available to support voluntary/not for profit action that contributes to sustainable development by helping to protect and improve the environment in Wales.

Individual grants range from £400 to £12,000 and funding is available for staff costs, project materials, staff/volunteer training courses and consultancy costs. At least 25% of costs must be met from other sources, including the organisation's own resources (such as membership fees or earned income), local government, lottery funds, charitable trusts and European funds. Funding in-kind (e.g. volunteer time) is also acceptable in some circumstances. A total amount of around £450,000 is available each year to be allocated to successful applicants.

In considering applications for grant aid, Environment Wales will give priority to projects:

- which are working in partnership with other organisations;
- which are innovative or collaborative, and could be used as a model elsewhere;
- which encourage and support the participation of communities in local sustainable development;
- where a grant would raise the quality of work and achieve greater benefits for the environment;
- where a grant may increase the potential to raise income through a project.

Bernard Sunley Charitable Foundation

The Foundation's aim is to provide financial assistance to registered charities at the discretion of the Trustees. There is no minimum or maximum value of grant available, although most grants are single payments between £200 and £10,000.

Big Lottery Fund - People and Places (Wales)

The most likely source of large scale funding for community renewable projects. This scheme will end in 2009 and be replaced by another scheme aimed at increasing the involvement of communities in renewable energy projects.

The People and Places scheme was awarded £66 million between 2005 and 2009 to fund capital and revenue projects which support coordinated action by people to make their communities better places to live. It will support local projects and projects that operate in more than one geographical area, regionally or throughout Wales.

There are three levels of grant under People and Places:

- Grants between £5,001 and £250,000;
- Grants between £250,001 and £500,000;
- Strategic grants from £500,001 to £1 million.

The key outcomes of the criteria are: funding to revitalise communities, improve community relations, and to enhance local environments, community services and buildings. This could be achieved through project outcomes that:

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- provide opportunities for communities and individuals to understand, maintain and improve the environment;
- provide additional services that meet a need in the community.

The Big Lottery Fund encourages funding from other sources, but match funding is not necessarily a stipulated requirement. Projects will be funded for up to three years. Successful projects may apply for extra funding, subject to the continuation of the programme. An outline proposal form may be submitted at any time. A full application form will be sent to the applicant within 30 working days, if the sponsor thinks the project could be funded.

Community Foundation Network

Grants are available for projects in all sectors of the local community. Each foundation has its own character appropriate to the location and grants may be made to a wide range of activities including health, children and young people, arts and culture, the environment and services.

A locally-based charity or voluntary group that is interested in applying for a grant should begin by contacting the Grants Administrator to check its eligibility and to have an informal chat about its ideas.

Waterloo Foundation

The Foundation awards grants to organisations in both the UK and worldwide and is most interested in projects which help globally, particularly in the areas of the disparity of wealth and climate-related issues.

The Foundation makes grants for all types of projects: start-up; initial stages; and valuable ongoing funding. This can include running costs and overheads, as well as posts. The Foundation does not have any upper or lower limit on the amount of funding offered, but it is unlikely the Foundation would offer a grant of more than £100,000.

Low Carbon Buildings Programme

This UK Government funded grant scheme has a specific community stream as well as householder and public authority streams. As UK clean funds, it should be eligible to match with EU funds. However, this funding stream was ended in May 2010. Where phase 2 of the LCBP has been used income under FIT's cannot be claimed, only the lower value ROC's.

ARBED

ARBED is a strategic energy performance investment programme for Strategic Regeneration Areas in Wales. Over 3 years £350 million is hoped to be invested in home energy improvements under ARBED. To be eligible proposals must demonstrate that they will lead to economic growth through the employment opportunities that are generated and reduce both fuel poverty and carbon emissions. Proposals should take a street or community based approach and both registered social landlords and local authorities are eligible to make applications.

Community First Outcomes Fund

Applications are acceptable that provide activities and services in Community First areas linked to Community First work programmes and action plans, that are not part of the core team work. They can provide from £25,000 to £300,000 over a 3 year period and should, in principal represent 50% of the costs of the proposal, though the other 50% can be made up from ‘in kind’ contributions provided these are not re-allocated from other existing activities.