## External Wall Insulation Pilot Scheme

**A Northern Ireland Housing Executive Project** 





**Location:** Coleraine Borough Council

**Commencement date:** March 2013

**Completion date:** July 2013

Works carried out: External Wall Insulation

Housing Executive Home energy conservation authority

## Acknowledgements

The Housing Executive would like to express its gratitude to all tenants who participated in the External Wall Insulation Pilot Scheme and who gave up their time to be interviewed for this report.



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## Foreword

This document provides a summary of the external wall insulation scheme pilot that was undertaken by the NIHE in 2013. It aims to inform the development of a policy for solid wall insulation in Housing Executive properties and enable householders to improve the energy efficiency of their homes, thereby reducing fuel bills, CO<sub>2</sub> (carbon dioxide) emissions and the impacts of climate change. A total of three homes participated in the pilot. The average cost per dwelling was £12,000 which included doors, fascia and barge boards, restoration of pipes, guttering, loft insulation, new energy efficient 'A' rated windows and external insulation. It is hoped the investment made in this pilot scheme will demonstrate the positive impact external wall insulation can have on tackling fuel poverty in Northern Ireland.

# 6 The average cost per dwelling was £12,000..., 9



## Introduction

The Housing Executive has completed a pilot scheme to test the effectiveness of solid wall insulation in 3 semi-detached rural properties in the greater Coleraine area. The pilot aimed to provide more energy efficient and comfortable homes which would enable tenants to start making financial and carbon savings. Previous NIHE schemes to reduce fuel poverty and carbon emissions using wall insulation have largely focused on dwellings of cavity wall construction. However, approximately 9,700 NIHE properties have no cavities.

Solid walled properties are traditionally difficult to heat and let out twice as much heat as cavity walls. They are a source of problems including dampness and condensation as well as placing householders at greater risk due to the difficulty in retaining heat and maintaining thermal comfort levels.

Whilst dry-lining is often a more affordable option than installing external wall insulation, the loss of space and necessity to remove and refit fitted units, radiators and sockets etc. can make this option less popular. Although more expensive, there is no restriction on the depth of external wall insulation used whilst a complete insulating envelope can be formed around the dwelling as seen in the photo on the right. External wall insulation has the added benefit of improving the property's appearance, making it look more modern and more attractive.



The Energy Saving Trust estimates that insulating a 3 bed-semi, gas-heated house could save as much as  $\pm 270$  a year and approximately 600kg of CO<sub>2</sub>. (Carbon dioxide is the main greenhouse gas implicated in global warming.) These savings would be higher for a house heated by oil. These savings, combined with the advantages in thermal comfort mean insulating solid wall properties can play a large role in tackling fuel poverty.

## 6 Ginsulating can play a large role in tackling fuel poverty 9 9

## 2.0 Fuel Poverty What is fuel poverty?

## A household is in fuel poverty if, in order to maintain an acceptable level of temperature throughout the home, the occupants would have to spend more than 10% of their income on all household fuel use.

The recommended temperature for a healthy home is 18°C for young healthy adults and up to 24°C for elderly or very young children (World Health Organisation). The cost of maintaining these temperature levels in an un-insulated solid wall property would be significantly higher than that of an insulated cavity constructed dwelling. In rural areas, there are a higher proportion of older houses with solid walls without access to mains gas which combines to increase rates of fuel poverty. In 2011, approximately half of households living in isolated rural areas in Northern Ireland were in fuel poverty. This is in part because a greater proportion of rural households are not covered by the gas network. The highest prevalence of fuel poverty was found among older people whilst 79% of those experiencing fuel poverty in Northern Ireland in 2011 had an annual income of £10,000k or less (NIHCS, 2011).

#### What causes fuel poverty?

#### Fuel Poverty has three main contributing factors:

- ➡ Poor thermal efficiency of dwelling
- ➡ High fuel costs
- ➡ Low incomes

#### Fuel Poverty in Northern Ireland 2011

- ➡ Fuel Poverty affects approximately 294,000 (42%) households in Northern Ireland.
- ➡ Those at greatest risk of fuel poverty are pensioners and low-income families.
- ➡ More than two-thirds (69%) of households living in dwellings built before 1919 were fuel poor.
- In 2011 the fuel poverty rate was much higher in Northern Ireland compared with the latest figures available for England and Scotland. The main reason for this is a combination of lower incomes, higher fuel prices and higher dependence on oil, electric and solid fuel for heating in Northern Ireland.
- Fuel costs more in Northern Ireland. Electricity costs are among the highest in Europe and whilst natural gas is a relatively cheaper fuel in Northern Ireland, we pay more than customers in Britain and the Republic of Ireland.
- In Northern Ireland, in April 2013, median gross weekly earnings for full-time employees was £460, approximately 90% of the comparable figure for the UK as a whole. (Annual survey of Hours & Earnings ASHE), Monthly Labour Market Report February 2014) (In NI Housing Market Review & Perspectives 2014-17)
- People in Northern Ireland typically have the lowest disposal incomes of any part of the UK, according to figures from the Office for National Statistics (ONS). In Northern Ireland the figure was £13,902 compared to a UK average of £16,791.
- In 2010, around 18% of households in rural areas were in fuel poverty compared with 16% of those in urban areas.
- To help alleviate fuel poverty the Housing Executive invested £35m in 2013/14 on heating conversions and maintenance. In addition, the DSD's Warmhomes Scheme which is administered by the Housing Executive invested £12.6m in 2013/14, on insulation measures and heating replacements in eligible private homes.

External Wall Insulation Pilot Scheme **A Northern Ireland Housing Executive Project** Northern Ireland House Condition Survey: Homes in Fuel Poverty

2001		20	04	2	2006	2009	2011		1
No.	%	No.	%	No.	%	No.	%	No.	%
203,000	33	153,530	24	225,600	34	302,310	44	294,240	42

The above table shows how rates of fuel poverty have changed between 2001 and 2011. Between 2001 and 2004 fuel poverty decreased as a result of energy efficiency works. However, since 2004, fuel poverty has escalated due to rising fuel prices, despite huge investment in energy efficiency programmes.

#### What are the effects of it?

The most popular method among occupants for reducing energy costs is either turning off heating altogether or turning off heating in unused rooms. This, coupled with a lack of insulation can have the effect of creating cold spots in the home leading to condensation problems. Left unchecked this may lead to mould growth which is then fed by the continuing presence of condensation all of which will have a negative impact upon the health of the occupants as well as contributing to disrepair within the property.

#### Why tackle it?

People living in fuel poverty frequently live in cold, damp, thermally inefficient homes. Improving the thermal efficiency of housing stock is imperative to tackle fuel poverty and reduce the carbon footprint of the property. This pilot scheme demonstrated the positive social and economic benefits of installing solid wall insulation as a means to tackling fuel poverty.

Increases in fuel prices make efforts to tackle fuel poverty more difficult by driving already poor households further into debt. The considerable costs involved in bringing a natural gas pipeline to isolated rural dwellings or indeed small rural settlements would result in price hikes for new and existing customers to fund the work. It is simply uneconomical to bring gas, the cheapest heating fuel, to isolated rural areas. Natural gas is not available to the households selected for this pilot scheme.

For this reason this pilot scheme chose two dwellings in an isolated rural area and one dwelling within a small rural settlement, all of which are not connected to the natural gas network.

There are two possible insulation solutions for solid wall properties:

- ➡ Internal wall insulation (IWI)
- ➡ External wall insulation (EWI)

An approximate cost of external wall insulation is between £9k and £25k depending on the level of work required, size of dwelling and method used, (Energy Saving Trust, 2014). The calculated payback period, in some cases up to 40 years, means that many householders and/or landlords are unable or unwilling to finance the work. Building Regulations really only affect newbuild.









## 3.0 Government Targets

#### Carbon commitments and climate change

#### If the UK is to meet its European commitment to reduce carbon by 80% by 2050, emissions from homes will need to be approaching zero carbon by this date.

The UK's housing stock is old and notoriously inefficient in its use of energy, with domestic homes in Northern Ireland being responsible for 17% of our regional greenhouse gas emissions. If we are to succeed in reducing domestic greenhouse gas emissions, homeowners need to be inspired and motivated to take action in reducing the energy they use to heat and light their homes. Climate change is one of Northern Ireland's foremost environmental, social and economic challenges and we all have a key role to play in tackling this issue.

A key objective must be to reduce greenhouse gas emissions that can have a harmful effect on our environment. While there is no specific target or carbon budget for Northern Ireland in the Climate Change Act 2008, it is implicit that Northern Ireland contributes to the UK effort.

#### HECA

In 1996, the Home Energy Conservation Act (1995) designated the Housing Executive as Northern Ireland's sole Home Energy Conservation Authority, a role granted to the 408 local authorities in Great Britain. The Act requires the Housing Executive to develop a strategy to significantly improve the energy efficiency of the entire housing stock in Northern Ireland.



#### Air Quality

Although air quality in Northern Ireland has improved substantially in recent decades (mainly due to 'smoke-free' zones and fuel switching away from coal) pollutants in some parts of Northern Ireland continue to exceed air quality objectives. One of the major causes is the combustion of fossil fuels in industry, transport and homes to meet our daily requirements of energy.

Exposure to air pollution can have long-term effects on health and it also has negative impacts on our environment. A continued effort to reduce air pollution is therefore important, such as burning less fossil fuels, insulating homes and using less energy. The Department of Environment (NI) has Air Quality targets to comply with and this is coupled with Council areas, which have air quality issues, being required to develop an Air Quality Management Plan.

## 4.0 Solid Wall Properties What is a solid wall property?

## Solid walls have no cavity between sections, therefore more heat can travel through this one element design. Solid wall properties made of stone were usually built prior to the Second World War while solid wall properties made from concrete are post-War.

The solid wall properties in this scheme were built of stonework with a later build cavity wall extension. The walls are finished with painted roughcast render with a smooth render painted plinth. For the occupants of this type of dwelling, many of the standard energy efficiency measures taken for granted by the vast majority, such as highly efficient natural gas central heating systems or cavity wall insulation, offer no solution to high energy bills and a cold home. It is estimated that 35% of energy lost seeps through the walls. Almost 9% of Housing Executive homes are non-traditional construction, solid wall dwellings mainly without insulation (HECA 2011). The cover image shows a home that has been fitted with external wall insulation and double glazing.

After the Second World War the majority of properties were built with a cavity, a gap between the outer and inner wall. In the mid-80's these cavities started being filled with blown insulation. New build dwellings from this time were built with cavity wall insulation included at the time of construction. More recently, timber framed houses with insulation attached to the inner wall are becoming more widely used.

#### What are the benefits of external wall insulation?

External wall insulation (EWI) can have an important role in meeting climate change and fuel poverty targets. With almost 120,000 domestic properties across all tenures having solid walls in Northern Ireland, the potential for solid wall insulation is great. These are geographically widespread and account for a wide range of properties, from flats common in urban areas to stone cottages in more rural locations.

#### How many solid wall properties in Northern Ireland?

The Northern Ireland House Condition Survey 2011 estimates that there are 119,000 solid wall properties:

- ➡ 76,000 had no wall insulation
- ➡ 20,000 had internal and/or dry lining
- ➡ 23,000 had partial CWI





The Housing Executive has around 9400 non cavity construction stock comprising no-fines, aluminium, orlit, timber frame and easi-form solid wall properties.

These properties are traditionally very difficult to insulate and may be the source of problems involving dampness and condensation. As well as placing tenants at risk of maintaining comfort levels, this leads to increased levels of fuel poverty.



New AREAS	No of NIHE solid wall properties			
North Belfast	664			
South & East Belfast	286			
West Belfast	1273			
North Down & Ards	532			
South Down	25			
Lisburn/Castlereagh	950			
South	631			
South West	249			
South Antrim	811			
East	629			
West	465			
Causeway	187			
Total	6702			

# 5.0 How the scheme worked

#### The objectives of the pilot scheme were set out to:

- ➡ improve the state of the properties
- ➡ reduce the carbon footprint of the properties
- ➡ reduce fuel poverty amongst tenants

Three properties were selected, one in Portballintrae and two just outside Coleraine. Portballintrae is a harbour village on the Causeway Coast and it has a considerable proportion of older housing. Coleraine is a large town and one of the oldest settlements in Ireland. The two semi-detached properties just outside Coleraine are set in a quiet rural location, approximately a mile from the town boundary. The three properties were all built in the 1940s and are of solid wall construction. All of the properties had double pitched roofs with slates and stained/painted timber softwood single-glazed windows. The two properties just outside Coleraine also had flat roofed single storey extensions at the side of the houses.

The decision was made to provide an external insulation system as it offered several qualities that would help meet the project objectives in relation to thermal performance, structural integrity, aesthetic qualities, and it would cause little disturbance to the existing sitting tenants. It would also provide knowledge that NIHE could use to inform its policy for the rest of its solid wall stock.

#### Before installation

- A trawl of Housing Executive Districts was undertaken and three dwellings were selected in the greater Coleraine area which were in themselves subject to a reasonably high level of exposure to the elements.
- ➡ The scheme was estimated to be on site for approximately 2 months.
- ➡ The cost of the scheme was returned from tender at £36,000 (approx. £12,000 per dwelling).
- In November 2011 approval was granted by the Housing Executive's Chief Executive's Business Committee to proceed with work on-site.
- Money from NIHE's Energy Conservation Unit budget funded the scheme and work started on-site in March 2013.



#### After installation

- ➡ Work was completed in July 2013 (approx. 4 months)
- ➡ All existing windows were replaced with double-glazed PVC windows
- ➡ Roofspace insulation was upgraded to a minimum of 300mm
- ➡ All externals doors were replaced to the two dwellings just outside Coleraine
- ➡ New ridged external insulation was installed at a depth of 150mm with self coloured render finish
- Existing fascia boards and soffits were removed and new PVC fascia and ventilated soffits provided at a thickness of 150mm to the main body of the dwelling with 50mm thickness being provided around external window reveals and at plinth level. This was finished with a two coat, self-coloured acrylic finish.

#### Evaluation

- ➡ Building Control Notice was granted July 2013 and Redecoration Grants were awarded to the tenants
- Evaluation ongoing.

#### Learning point:

As manufacturers generally quote only for the cost of the external wall insulation, home-owners and landlords should be aware that installing external insulation can incur additional costs for replacing doors, guttering, fascias, underground wiring, etc.



## 6.0 Key Findings – case studies

#### External Wall Insulation Pilot Scheme

Interviews with the tenants were carried out in the three properties before the scheme began in March 2013, when the work was being carried out and again on completion, to determine the tenant's energy costs and thermal comfort of the dwellings. A set of questions were asked and tenants were encouraged to add their thoughts and experiences as the case study interview progressed.

#### Case study 1

Prior to the scheme starting Ms S had a lot of draughts, condensation and mould growth in the kitchen and also in her bedroom which were both located at the rear of the property. The tenant reported she had to clean condensation off the windows on a daily basis.

#### Whilst the scheme work was in progress this tenant had minor issues with the scheme;

- a. As a result of cutting the insulation boards on-site there was an accumulation of insulation beads in the outside drains. This resulted in investigation work having to be carried out into a drain blockage and overflow of the storm water outlet in the flat roof. The result of which was a combination of bead build up and a 50+ year old soak away no longer draining correctly.
- b. Scaffolding was erected in February 2013 and remained for the duration of the scheme and for the three weeks when the contractors could not work because of poor weather;
- c. Ms S uses a walking stick at times and there was concerns about the existing state of the rear yard where the tarmac had sunk, after a trench had been dug to place the oil line. After the works were complete the District Office undertook to resurface the rear yard.
- d. External wiring under the fascia boards had to be disconnected by NIE during the scheme. NIE insisted the cables were replaced underground, requiring some excavation work to the rear of the property. This made access by the back door difficult for this tenant and added to scheme costs.

#### Learning point:

#### Cover gutters and downpipes to prevent blocked drains with insulation beads

#### Learning point:

#### Scheme designers should plan for any existing ovehead electricity cables having to be replaced underground.

#### After insulation was installed Ms S provided valuable feedback by indicating;

- e. Problems with draughts and condensation had been resolved.
- f. The house heated up quicker and retained heat better.
- g. Her oil lasts longer. She normally puts the heating on for an hour every morning and then uses the 'boost' switch if she needs the heat on throughout the day. She finds she needs to use this less often. Previous to this scheme Ms S kept very good records of expenses, she was able to tell us that on

average she bought 1500 litres of oil per annum. We will continue to monitor oil usage with her over the next three years.

- h. She has been able to turn her room thermostat down from 25°C to 20°C. (The Energy Saving Trust estimates that turning your room thermostat down by 1°C could save you up to £75 per year).
- i. Before the work was completed Ms S slept in an upstairs bedroom. She has since been able to move her bed downstairs as the spare room downstairs is now much warmer. This has made life much easier for her and removed any potential risk of falling on the stairs

Ms S also commented that the external wall insulation had made a big difference to her home, both in terms of comfort and appearance.



'before' installation

5

Energy performance assessments were taken before the scheme started and again on completion which results in an Energy Performance Certificate (EPC) being produced. These Energy Performance Certificates show an overall energy efficiency rating for your home from 'A' to 'G'. 'A' represents the most energy efficient properties and 'G' the least. The EPC also contains advice on how to cut carbon emissions and fuel bills by making home improvements. If a dwelling does not have insulation installed the EPC will recommend the type and level of insulation required to improve the dwelling performance.



A summary of the key findings taken from the before and after EPCs can be seen below:

	Before	After
Energy efficiency rating of dwelling (SAP)	D	С
Carbon dioxide (CO2) emissions per year	6.7 tonnes	3.5 tonnes
Home heating Oil spend	£20 per week	£16 per week
Electricity spend	£5 per week	£5 per week

It was noted that although the experience was slightly stressful for Ms S she is very pleased with the end results as her home is easier to keep warm and she is saving money.

#### Case study 2

Before this scheme, Ms C home had problems in the kitchen, back porch and rear ground floor bedroom with draughts, condensation and mould growth. She had found that every few days she needed to use a fungicidal/mould wash to clean away recurring mould growth. When first moving into the property in August 2011 Ms C only put the heating on for an hour at a time and only when she really needed it. She would put a blanket round her when sitting in at night rather than putting the heating on. As a consequence the house was almost always cold.

Her only issue during the building work was that the scaffolding was up for three weeks before the contractor started work on the property and during this time she was unable to park her car in her driveway. She also reported that there was a lot of mess from the insulation boards being cut on-site resulting in insulation beads everywhere, which were difficult to remove. However, during the work Ms C stated,

# 6 6 the kitchen is much warmer and I have had a lot of comments from passersby, about what I'm getting done to the house **9 9**

Realising the house is highly visible to passers-by, this was seen as another positive aspect of carrying out the scheme. It was felt that this may draw interest in the work and may encourage more individuals to consider the measure in their own homes recommend it.



#### Learning point:

#### It would seem more practical to provide a sheltered space to cut insulation boards to avoid beads dispersing all round the property.

Her home is close to a main road and is located in a popular seaside village with a lot of traffic en route. Ms C has noticed the house is much quieter now having the old, single-glazed wooden windows replaced with new 'A' rated double-glazed PVC windows which she says have also helped to make the house warmer. Any problems she had with condensation and mould growth have now been alleviated. She stated she felt happier inviting friends to visit as the house looked less "run down" and it's warmer. Overall she is happier in the house now and is more inclined to spend time at home.

Before the scheme began Ms C estimates she was spending £100 per month whereas after, this figure has reduced to approximately £75 per month.

#### A summary of the key findings is given below.

	Before	After
Energy efficiency rating of dwelling (SAP)	E	С
Carbon dioxide (CO2) emissions per year	5.5 tonnes	3.3 tonnes
Home heating Oil spend	£25 per week	£19 per week
Electricity spend	£10 per week	£10 per week



#### Case study 3

Prior to installation Mrs M had a lot of draughts at all the windows and at the front and back door. She had to use a fungicidal paint in the bedroom and the bathroom regularly before the work was carried out. Mrs M stated that she was well informed about what was happening throughout the scheme and the contractors were very good at tidying up but the work was messy from the insulation beads. Before the work was complete she commented that she had already noticed the house was much warmer. She has a keypad meter and spent approximately £10 - £20 per week on electricity.

Unfortunately, after work was completed Mrs M was unable to participate in the post-installation survey.

#### Learning point:

Good communication is vital from an early stage by ensuring a single point of contact throughout.

#### Learning point:

It was difficult to get people to keep a record of electricity/fuel costs. There may need to be some kind of incentive to do so i.e., vouchers for oil.



#### Advantages of external wall insulation

- ➡ Walls retain heat so lose heat less slowly
- Less disruption to occupants/no need for decanting
- ➡ Can enhance exterior appearance
- ➡ Lower risk of moisture build-up and condensation caused by cold walls, windows etc.
- ➡ Thermal efficiency of property greatly improved
- Improved comfort for occupants

#### Disadvantages of external wall insulation

- ➡ Restrictions on when work can be carried out (e.g. due to weather)
- ➡ Require neighbour's agreement if joined properties are privately owned
- ➡ Not suitable for properties with external features which it is felt are desirable to retain
- ➡ External rendering system used can only be carried out in dry, frost-free weather
- Scaffolding is required and alterations to vents/flues that go through the wall, waste pipes, external taps, drains and surface wiring all need to be adjusted.
- May be difficult to carry out where terraced dwellings open onto public footpath (i.e., no gardens), which is the property of Roads Service.



## 7.0 Conclusion

This is the first scheme of its kind undertaken by the Housing Executive and it was therefore a learning experience for those involved. It is hoped that its findings will increase awareness of the benefits of solid wall insulation (ie lower fuel bills) and provide some useful insights in helping to shape future external wall insulation schemes. Although energy prices are likely to increase it is clear external wall insulation offers some protection against the increasing cost of heating your home.

Thermal performance has improved greatly with the U-value of 2.47W/m<sup>2</sup>K dropping to approximately 0.25W/m<sup>2</sup>K, which means that the properties are losing much less heat than before and thus working more efficiently.

The EPCs show the improvements have lowered carbon emissions from a typical 6.1 tonnes to 3.4 tonnes per annum (per property). Thus a total reduction is estimated of 8.1 tonnes of  $CO_2$  emissions per annum across the three properties.

The thermal efficiency has also resulted in a reduction in heating costs per home from a potential £1900 per annum to a projected £1400 per annum. We will continue to monitor these findings over the next three years to provide a longitudinal analysis of the impact of the scheme.

The physical appearance of the properties has also been greatly improved, transforming tired looking properties into homes that residents can be proud of.

# 66...it is clear external insulation offers some protection against the increasing cost of heating your home. **99**

## Appendix 1.

#### EPC for dwelling before scheme

#### **Energy Performance Certificate**

Date of assessment: Date of certificate: Reference number: Type of assessment: Accreditation scheme: Assessor's name: Assessor's accreditation number: Employer/Trading name: Employer/Trading address:

Related party disclosure:

Northern Ireland

26 March 2013 27 March 2013 9877-0127-6680-3826-9922 RdSAP, existing dwelling ECMK

H & A Mechanical Services 28 Five Mile Straight, Draperstown, Magherafelt, BT45 7EB No related party

Energy Efficiency Rating



The approximate energy use and CO<sub>2</sub> emissions are per square metre of floor area based on fuel costs for the heating, ventilation, hot water and lighting systems. The rating can be compared to the benchmark of the average energy efficiency rating for the housing stock in Northern Ireland.

## Appendix 2.

#### EPC for dwelling after scheme

	Date of assessm Date of certificate Reference numb Type of assessm Accreditation sch Assessor's name Assessor's accre Employer/Trading Employer/Trading Related party dis	ent: er: er: ent: leme: : ditation number: g name: g address: closure:		21 November 2013 21 November 2013 9993-3196-8829-1620-7973 RdSAP, existing dwelling Stroma Certification H & A Mechanical Services Limited 28 Fivemile Straight , Drapers Town , BT45 7EE No related party		
Energy Emclency Ratin			See Heart			
		Current	Potentia	al		
A 92 plus B 81-91 C 69-80 D 55-68 E 39-54 F 21-38 G 1-20	hing costs	67	72			
Technical Information	the stand to be	Sales Press		Benchmarks		
ain heating type and fuel: stal floor area: pproximate energy use: pproximate CO <sub>2</sub> emissions:	Boiler and rad 68 m² 217 kWh/m² p 52 kg/m² per	diators, oil per year year		Average for Northern Ireland		

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September 2014 www.nihe.gov.uk