

South & East Ayrshire

AREA BASED SCHEMES WALL INSULATION EVALUATION

2015 –
2017

Executive
Summary
Prospective
Study

Aug 2017





AREA BASED SCHEMES WALL INSULATION EVALUATION



Executive Summary

Introduction:

- This report summarises the initial findings of an evaluation, the aim of which is to investigate the impacts of insulation upgrades administered through the **Home Energy Efficiency Programme for Scotland Scheme (HEEPS): Area Based Schemes (ABS)**.
- The project is a collaboration between the **Energy Agency; NHS Ayrshire and Arran (Public Health); South Ayrshire Council** and **East Ayrshire Council**.
- The initial assessment was conducted on a sample of households, located throughout South and East Ayrshire, during the winter of **2015/2016**. The follow-up visits then took place during the winter of **2016/2017**.

Methods:

- A total of **118 households** were originally recruited as part of the study. From this initial group, **95** of the households participated in the follow-up assessment.
- The households were further split into an **intervention group (58 households)** where the works were scheduled to take place during 2016 and a **control group (37 households)** who would not be receiving the insulation upgrades until after winter 2016/17.
- **Baseline** and **follow-up** assessments involved:



A household questionnaire (completed by a designated householder)
Individual health questionnaires (completed by all members of each household who wished to participate)



A thermal comfort diary (completed over 1 week)
Environmental monitoring (selected households only – 3 weeks of temperature, relative humidity and energy consumption data)



Energy Performance Certificates (EPCs) were also compiled for each property

Results:

Property Conditions

- The majority of households gave positive comments regarding improvements to the condition of their home. Of those who received the insulation upgrades, **91%** agreed that the **appearance of their home** had been improved and **86%** of those involved in street projects commented that the **neighbourhood** had 'improved a lot'
- There was a reduction in the number of intervention households reporting issues like **draughts** and **cold spots** in the property.
- For the intervention group there was a reduction in reports of **window condensation** and **damp stains on walls**. Around **three quarters** of those who reported condensation and dampness issues commented that this had improved following the insulation works.
- Following the insulation upgrades, the **Energy Efficiency Ratings** of the intervention properties increased on average by **6 points** and the number of properties which would be considered below the national average was reduced from **41%** to **18%**
- The **Environmental Impact Ratings** of the intervention properties also increased on average by **8 points** and the number of properties which would be considered below the national average was reduced from **55%** to **22%**. This resulted in an average annual **CO₂ reduction** of **23%**.

EPC Data (Average Values)

	Intervention			Control
	Pre-install EPC	Post-install EPC	% Change	Pre-install EPC
Primary Energy Indicator (kWh/m ² /year)	306	235	-23%	285
Energy Efficiency Rating (EER)	62	68	+10%	63
% with EER below national average (61)	41%	18%	-	31%
Environmental Impact Rating (EIR)	57	65	+14%	60
% with EIR below national average (59)	55%	22%	-	53%
Annual Fuel Costs (£)	£1036	£848	-18%	£992
Annual CO ₂ Emissions (tonnes)	4.7	3.6	-23%	4.2

Fuel Costs

- At the baseline stage there were few reported cases of **difficulties in paying for fuel** however there was a small increase in the number of households stating that they found it 'very easy' to pay their energy bills, compared to 'fairly easy'. Aside from a few individual cases, **stress and anxiety** regarding paying for fuel was not generally seen as an issue in either group.
- Over **half of the intervention group** reported that they had noticed a reduction in their fuel bills compared to the previous year. For those who did report such reductions, the estimated savings during winter were equivalent to around **£30 per month** on average. It is unclear at this stage the extent to which these reported savings can be attributed to the insulation due to difficulties in obtaining accurate data from the households and the fact that energy prices fell during the monitoring period.
- Based on the **EPCs**, the **average saving in fuel expenditure** for the intervention group was **18%** although the figures for individual properties ranged between **4% and 38%**. This was equivalent to average savings of around **£190 per year**.
- Prior to the insulation, it was estimated that **37-46%** of those in the intervention group who provided sufficient income data would be classed as **fuel poor** based on modelled fuel expenditure. The theoretical savings calculated from the EPCs suggested that this had shifted to **22-39%** following the insulation upgrades.

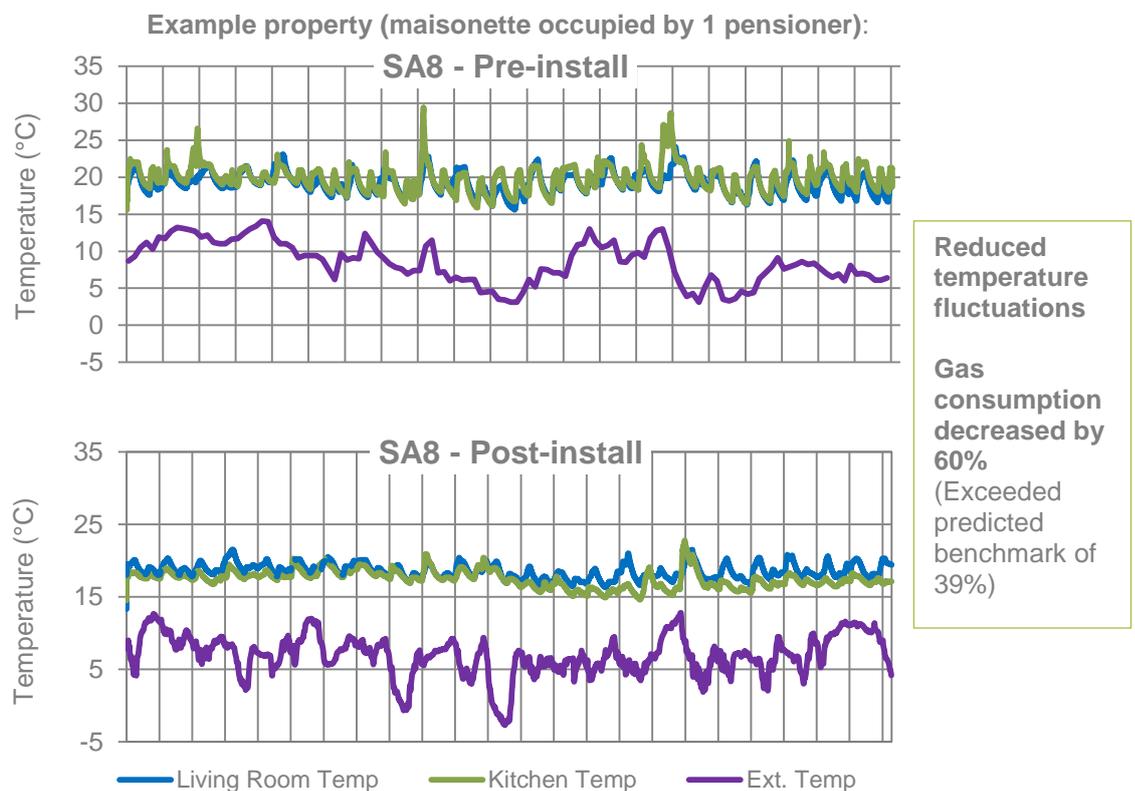
Occupant Behaviour

- The majority of households found that, following the insulation upgrades, their home now **heated up more quickly** (71%) and was able to **retain the heat more effectively** (84%). Around **two thirds** also agreed that there was now a **more even distribution** of heat throughout the property.
- Just under half of the households reported a **reduction in the number heating hours** while a quarter had **turned down their thermostat** and a **fifth had adjusted their TRVs**
- For the intervention group there were apparent reductions in the use of coping strategies such as **secondary heat sources**, **additional layers of clothing** and **hot water bottles**. A reduction in the use of additional heaters was however also observed in the control group.
- Most households in the intervention group **did not monitor their energy very closely** and only **14%** had become more energy conscious since the insulation works. In a few cases the insulation has had the opposite effect whereby the occupants commented that they were now monitoring their energy use less.

Environmental Monitoring

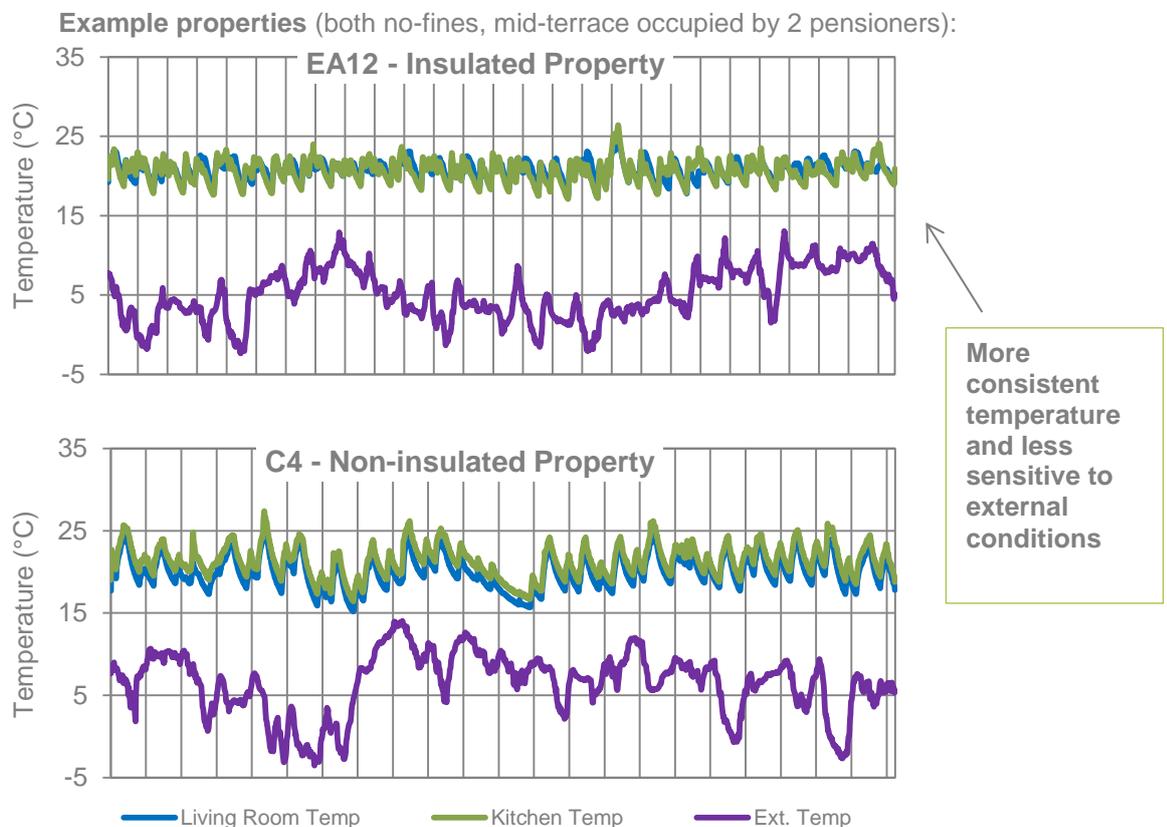
Prospective Case Studies (9 properties):

- This element of the study analysed the same group over two winters and compared the conditions in these 9 properties both before and after the insulation works. Generally speaking the **average internal temperatures** appeared to have been maintained while the **energy** required to meet those conditions was reduced by **30% on average**.
- The **mean relative humidity** values were found to be within the **recommended range** for all properties both prior to and following the insulation upgrades.
- In terms of **energy consumption**, 3 of the properties exhibited a saving which exceeded the predicted benchmark for that property type. In these cases the occupants had typically made **additional behaviour changes** which reduced their consumption (e.g. reduction in thermostat setting or number of heating hours). Consumption was reduced by **36% - 60%** for these properties giving **estimated savings of £210 – £345** on the annual gas bills.
- A further 3 properties achieved savings which were very close to the benchmark figures. In these cases gas consumption was reduced by **20 – 25%** giving **estimated savings of £110 - £155** on the annual gas bills.
- In one case there was still an energy saving (9%) but this was lower than expected and was attributed partly to a **comfort taking element** (increased temperatures) and the **low baseline energy consumption**. These factors also seemed to play a part in the remaining property where an increase in consumption (14%) was observed demonstrating an apparent **'rebound' effect**.



Cross-sectional Case Studies (15 control properties and 25 intervention properties):

- This element of the study compared two groups over the same winter period where one group had received the insulation measures and the other had not.
- Comparing the data from the 2016/17 winter period with consumption data from the previous winter, and after adjusting for differences in weather, there was a notable decrease (~27%) in the average gas consumption for the **insulated properties**. On average this gave an estimated saving of **£150** on the annual gas bills.
- In comparison, the **control group** (non-insulated) were more likely to show an increase in gas consumption between the two winter periods. An **average increase of ~16%** was observed for this group although results for individual households varied considerably.
- **Matched comparisons** were also conducted for **3 pairs** of households. All 3 of the insulated properties demonstrated lower gas consumption than the equivalent control property when normalised to account for the weather conditions. The **insulated properties** also appeared less sensitive to fluctuations in the outside temperature.
- Satisfactory thermal conditions were achieved in the majority of the insulated properties. Analysis of those which still appeared to have below target temperatures demonstrated that **occupant behaviours and other issues with the property** (e.g. heating system or windows) may counteract the potential improvements offered by the insulation.

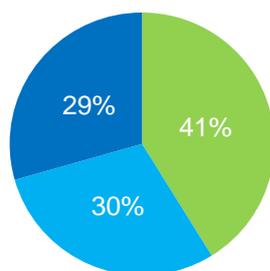


Thermal Comfort

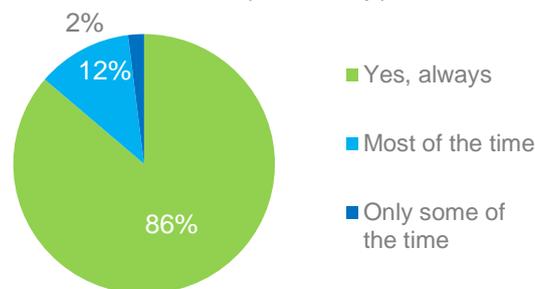
- For the intervention group there was an apparent increase in the number of households reporting that they were “**always**” kept warm enough during winter
- Following the insulation works, **74%** felt that the **overall temperature** had increased with **39%** describing their home as “**much warmer**”. By contrast, none of the control group reported any improvements in temperature.
- For the intervention group, there was an increase in the **average comfort votes** with an apparent shift from ‘neutral’ to ‘slightly warm’ in the mornings and from ‘slightly warm’ to ‘warm’ in the evenings. Conversely, the control group showed a downward shift for the morning comfort levels with the average vote moving from ‘warm’ towards ‘neutral’

“Does Your Heating Keep You Warm Enough During Winter?”

Intervention (Baseline)



Intervention (Follow-up)



Health

From the baseline assessment it was apparent that there were few cases where the environmental conditions were thought to be dangerous to the health of the occupants or where fuel costs were seen as a major financial concern. While this does not prevent participants from benefitting from the insulation, measurable impacts on either physical or mental health may be more difficult to detect when the baseline conditions are perceived to be adequate. Nonetheless, our study provided evidence of **proximal outcomes** (e.g. improved housing conditions, increased indoor warmth/comfort, increased pride in the home and reduced fuel bills) which have **known links to longer term health impacts**. This supports the theory that insulation retrofits can provide the initial steps in **health improvement pathways**. While our study was unable to measure some of the longer term outcomes, some observations regarding more immediate impacts on health are offered:

- There was an apparent increase in the **general health scores** for those in the intervention group who did not have an underlying health condition. This was also the case for the **aggregated physical health score** for this group. However when combined with the observations from the control group, the improvements were not statistically significant*.
- Statistically significant* improvements were found when **general health scores** were correlated with **perceived warmth improvements**. For all those who received energy-efficiency measures, score increases were greater in the group which had experienced temperature improvements compared to those who had not.

*Based on a 95% confidence level.

- There were some individual cases of improvements for those with **underlying health conditions** (arthritis, respiratory problems or cardiovascular conditions) however only a few participants linked these changes to the intervention. The limited improvements observed may be due to relatively **short follow-up period** and the **lack of sensitivity** of the general health questionnaire used. Unlike our study, other assessments which have shown improvements are generally **targeted at those with a specific condition** and involve **larger sample sizes** and/or **symptom specific assessment tools**.
- Despite some anecdotal reports of **improved mood/well-being**, there were no apparent increases in the mental well-being scores.
- There were no statistically significant changes in **recent health service use** in terms of GP or hospital visits however this data was self-reported and subject to the participants recall ability. More accurate analysis of health service use would require further data linkage with the NHS.

Installation

- There were some mixed reports with regards to the installation process. Positive comments were made regarding the **efficiency** and the **work ethic** of specific contractors while negative comments were linked to issues with **mess, delays** and **communication**. Despite these issues, the majority (88%) stated that they would **recommend the scheme** to others.

Conclusions & recommendations:

The evaluation has demonstrated the importance of understanding the **impacts** of the **HEEPS:ABS** programme rather than simply the number of measures or households reached. Overall the reports were positive with the majority of participants stating that they would recommend the scheme to others. All of the households who were insulated reported an improvement in at least one of the anticipated outcomes. The insulation upgrades therefore appear to have contributed to:

- *Marked improvements* to the **appearance** of the properties/neighbourhoods and to the **general housing conditions**
- *Notable reductions* in **coping strategies** and **reduced use of the heating system**
- *Modest improvements* in **perceived thermal comfort** and **measured internal temperatures**
- *Modest reductions* in **modelled fuel costs, energy requirements** and the number of households in **fuel poverty**
- *More substantial reductions* in **actual energy requirements** based on **measured** data (particularly in cases where occupants had adapted their behaviours)
- *Modest improvements* to **general health scores** (linked to perceived warmth improvements) and further **anecdotal improvements** to physical and mental health

While these findings, alongside the results of our previous Retrospective Study, highlight the potential benefits of the insulation upgrades, the study also had some limitations in terms of the available sample and the timescales involved. From our conclusions, the following recommendations and potential areas for further research are proposed:

Key recommendations:

- Despite the fact that all of the properties were targeted based on assumed poor energy-efficiency, there were many cases where the baseline conditions were already satisfactory and the opportunity for potential improvement was somewhat limited. **This could be factored into future targeting of project areas.**
- The **housing typologies** included were dictated by the timescales of the evaluation and were therefore **not representative** of the overall population. Given that the project areas (and property types) change every year, **continued evaluation of future programmes** would allow for alternative construction types to be investigated and compared.
- Difficulties were encountered in obtaining sufficient documentary evidence from the householders regarding their **fuel expenditure**. It is therefore recommended that **actual consumption data** is used where possible. The increased use of **smart meters** may also allow more accurate, historic fuel costs to be obtained as part of any future evaluation.
- The fact that more households were not lifted from fuel poverty highlights the need to **address other drivers** (fuel costs, income and how energy is used in the home) alongside any improvements to the energy-efficiency of the building itself.
- The impacts of the wall insulation may also be off-set by other factors such as inefficient heating systems. A **'whole house approach'** is therefore required in order for some properties to meet satisfactory standards. Where appropriate customers should be **signposted to other schemes** which may offer additional energy-efficiency improvements.
- While EPCs facilitate direct comparisons between properties, they do not always reflect the realities of actual performance. Our case studies highlight the importance of capturing both **modelled data** and **measured data** as well as understanding **occupant behaviour**. It is recommended that collection of this type of data should be included as part of a **continued evaluation process** and that **further post-install advice** on adjusting to the new insulation is included as part of the customer journey as this may help to maximise energy savings.
- A **longer follow-up period** may be required in order to assess any issues with condensation or dampness. It is also advised that, as part of the post-install advice, households are educated on the **importance of effective ventilation practices**.
- The health element of the study was limited by the sample size and timescales. It is recommended that a **further follow-up study** is conducted and that a **second wave of participants** is recruited from on-going projects. This would facilitate further statistical analysis on health outcomes. **Health data linkage** could also be useful in investigating longer term trends in health service use.
- Only a few examples of **internal wall insulation** were included in the sample. A further study focussing specifically on this type of measure would facilitate comparisons between external and internal systems.

This report was prepared by the Energy Agency in partnership with NHS Ayrshire & Arran, East Ayrshire Council and South Ayrshire Council.

If you would like any further information on the study please contact:

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