CAVITY WALL DWELLINGS:
THERMAL IMAGING SURVEY FINDINGS

EVALOC
EVALUATING LOW CARBON COMMUNITIES

EVALOC SUMMARY 4-1 JANUARY 2015

SURVEY DATE & CONDITIONS: February-March 2013; 4 hours after sunset (cold, dry and mainly cloudy).

NO. OF HOUSEHOLDS IN SURVEY: 54

KEY FINDINGS:

- Patchy finish to dwellings with retrofitted cavity wall insulation.
- Particular areas of heat loss below window cills (lack of insulation; localised temperature increase due to radiator).

RECOMMENDATIONS:

- Post-retrofit & on-going diagnostics using thermal imaging & borescopic surveys (non-destructive).
- Review of current retrofit CWI installation certification.

1. Introduction

This briefing note outlines the findings of thermal imaging surveys of 54 dwellings in six communities across England and Wales. The majority were built in the post-war era; between 1945 and 1980 (34 in total). The predominant dwelling types are detached and semi-detached. The majority have a mixed material finish to the front façade; mainly either exposed brick or rendered brick finish.

2. Key findings

The following section outlines specific areas of interest uncovered by the thermographic surveys.

2.1 Dwellings with cavity wall insulation 'as built'

Seven dwellings built post-1965 were constructed with cavity wall insulation and the occupants either know or are unaware of additional insulation being retrofitted. Although the number in the study is too small to make general assumptions, the overall appearance of these buildings is fairly continuous suggesting that the initial workmanship and construction was of good quality. Despite this, there are some issues around lintels, window and door frames, and at ground level that are consistent with other cavity wall dwellings with retrofitted cavity wall insulation.

2.2 Retrofitted cavity wall insulation

42 of the dwellings are known to have had cavity wall insulation (CWI) retrofitted, with most undertaking it prior to 2008 funded through a variety of sources including Government schemes such as Warm Front, the current residents themselves, and social landlords.

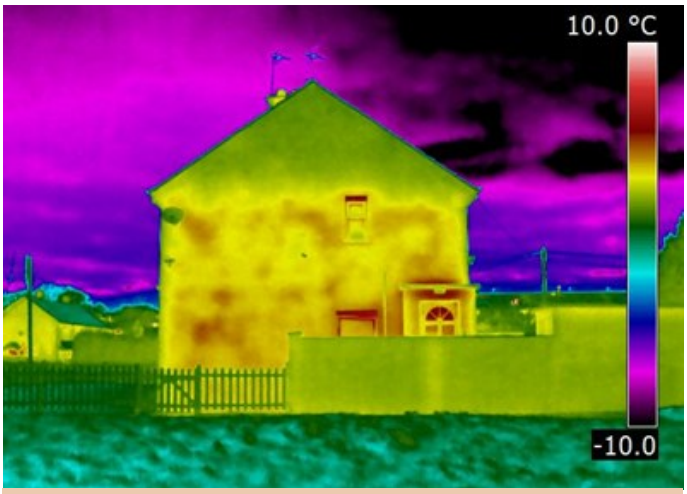
The thermographic images highlight inconsistencies in the appearance of the walls in 34 of the 42 dwellings.

This is potentially indicative of issues relating to missing or defective retrofitted insulation. Previous research suggests that there a number of reasons for this, even if the insulation has been installed to industry standards including:

- Low compactness of insulation
- Mortar snots and other blockages/debris within the cavity
- Small cavity width
- Inaccurate estimated amount of insulation required
- Incorrect settings of the machinery leading to lack of insulation
- Too wide spacing of drill holes leading to possible voids in insulation layer
- CWI not spreading into cavity but gathering around injection hole
- Poor quality of inner leaf leading to crumbling brickwork

There is a higher percentage of the dwellings with cavity wall insulation retrofitted prior to 2008 having issues than those with insulation installed post-2008 (88% to 64%).

This could indicate improvements in the industry since 2008 (in terms of equipment, knowledge and technique, and quality assurance procedures), but it may also indicate the lowering of performance of the retrofitted insulation over time. Further research and investigation into the long-term performance of retrofitted cavity wall insulation appears to be critical in this instance.



Patchy wall façade indicative of poor installation of cavity wall insulation; clear line along roof line suggests good performance of loft insulation.

2.3 Roofs and Eaves

36 out of the 54 cavity wall dwellings are experiencing higher temperatures at the eaves line and/or show a lack of a solid line at the loft level. This could be due to a number of reasons, including;

- Sheltering from night sky radiation,
- Warm air rising from windows,
- An existing ventilation gap into the loft space,
- Loft insulation not being installed correctly (not reaching the wall heads completely),
- Thermal bridging near the wall heads.

In addition, there also appears to be issues with the junctions between the roof and chimney in some buildings. Although elevated temperatures can be expected on and around chimneys, the extended area of higher temperatures suggests that there could be local issues with either the roof tiling and/or the flashing details.

2.4 Lintels

In a number of cavity wall dwellings (39), lintels appear at higher temperatures than the rest of the elevation. Whilst particularly obvious in exposed brick dwellings, most likely due to the different material used (generally concrete), it does highlight that this is an area of significant heat transfer.

Areas of localised heat loss beneath windows apparent in dwelling to right (dwelling to left has radiator reflector panels installed).

2.5 Areas surrounding structural openings

Areas of higher temperatures appear around all sides of the window unit. This could indicate poor installation and sealing of the window unit itself but also a lack of insulation (especially relevant to retrofitted CWI dwellings) being packed tight up to the window opening.

2.6 Cills and below windows

42 out of the 54 dwellings have areas of higher temperatures below the cills. Whilst the usual problems with interpreting protruding features apply, the inconsistent pattern of most suggests that this could be due to a number of issues:

- Poor installation and sealing of the window unit,
- Lack of insulation being packed tight up to the window opening (gaps in insulation),
- Localised areas of heat loss due to the location of radiators on the external wall.

2.7 Projecting window design

13 out of 14 dwellings with either bay windows or other projecting window designs have significant areas of higher temperatures, suggesting potential locations of heat loss around these features. This is likely due to the difficult detailing and construction of the junctions, and increased likelihood for poor workmanship.

2.8 Infill Panels and Cladding

The thermal images indicate inconsistencies across tile cladding and infill panels. Whilst the different materials (and therefore emissivity) may have implications on this, the unevenness of the façade suggests that areas are suffering from insulation issues; either missing or incomplete installation, the delamination of the wall cladding from the main wall structure, or the degradation of the infill panel material.

2.9 Extensions and unheated adjoining spaces

Whilst examples of extensions were few, all showed unusual areas of higher temperatures around the junctions between the walls and roofs of the existing building and the extension. Whilst this may be due to limitations in the survey techniques, it may also signify:

- Thermal bridging and gaps at the junctions,
- Lack of retrofitted insulation in and around the corner details.

Unheated garages also appeared to show heat loss, suggesting inadequate insulative barrier between the main heated areas and such unheated adjoining spaces.

2.10 Ground Level

18 out of 27 dwellings (where images of the external wall at ground level were taken) show elevated temperatures at ground level. Evidence from other research suggests that this is potentially indicative of cavity wall insulation not extending below the DPC line. As such, particularly in suspended floor buildings, this could create air passages from the internal heated spaces to outside at ground level.

3. Recommendations

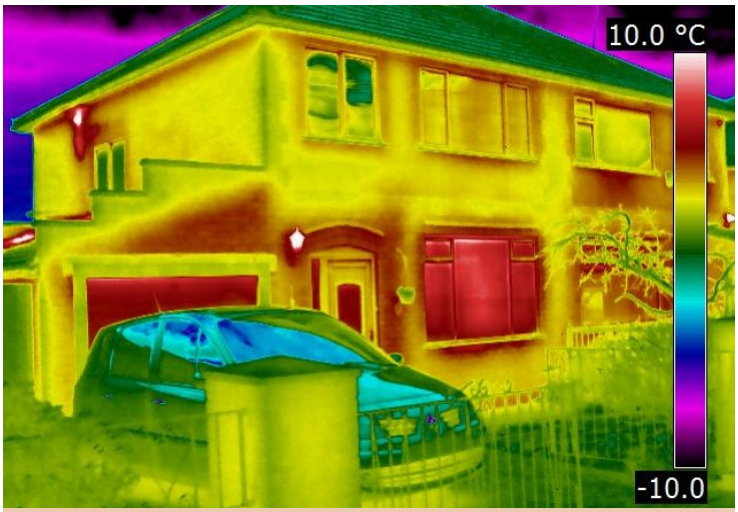
Findings relevant to a number of different stakeholders have been uncovered through the thermographic surveys. The following section outlines the principle recommendations and comments relevant to the key stakeholders.

3.1 Householders

- Simple low-cost measures such as radiator reflector panels, thick curtains and draughtproofing strips can make significant improvements in terms of reducing heat loss through walls.
- Bay windows are often of different construction (and quality) to main building and require particular care and detailing when upgrading their thermal performance.
- The performance of loft insulation can be significantly reduced if not installed fully (including up to eaves) but any existing ventilation gaps should be retained to mitigate unintended consequences such as interstitial condensation and subsequent damage to structural issues.
- Awareness of rights and compliancy procedures in relation to wall insulation installations is critical to achieving maximum benefits from improvements.

3.2 Community Organisations

- Thermographic surveys can be used to:
  - Provide feedback on projects involving energy efficiency measures and provide advice and support to residents to ensure issues are rectified where possible.
  - Raise awareness in occupants of key heat loss areas and provide advice, support (where funding and human resources allow).
  - Assess existing situation in order to co-ordinate future activities.
  - Undertake non-intrusive pre- and post-retrofitting monitoring such as thermal imaging (and follow-up rectifications, if applicable) to ensure performance of insulation is acceptable.
- Be aware of the difficulties in the interpretation of the thermal images; and ensure no further works are undertaken without further investigation.
- Partnerships with intermediary organisations (including academic institutions, community networks and local authorities) at both national and local levels can bring expertise and resources otherwise lacking.
- Ensure advice to residents includes:
  - Information on compliancy certification and guarantees.
  - Knowledge and awareness to wide variety of measures, from low to high cost.
  - In dwellings where uneven cavity wall insulation appears, ensure discussions with the occupants are held and potential follow-up action is undertaken including contacting the installers etc.



Area of possible heat loss shown in unheated garage; highlights need for adequate insulation and sealing between adjoining heated and unheated spaces.

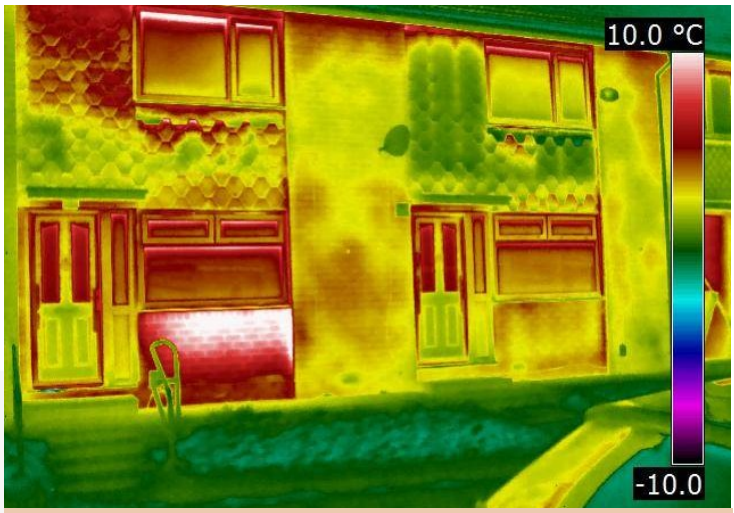
3.3 Installers

- Ensure full survey is undertaken of existing building prior to retrofit works to provide clarity on a) applicability of proposed improvements, b) existing conditions and quality, and c) correct materials to be used.
- Work with community and/or intermediary organisations to provide post-retrofit evidence of improvements.

3.4 Policy advisors

- Review self-certification process for installation of cavity wall insulation and other such minor works improvements currently not fully covered under building regulations.
- Include post-retrofit monitoring and evaluation techniques, particularly non-intrusive measures such as thermal imaging in policy and regulation implementation.
- Assess current standards of compliancy in relation to cavity wall insulation.

Please refer to the more in-depth EVALOC reports on individual communities and overall thermal imaging survey report which can be found in the Communities & Energy toolkit on the EVALOC website.



Heat loss below window (brick finish but likely to be uninsulated; fluctuations across facade(possible deflection and peeling away of cladding).

4. References and further resources

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EVALOC
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For further information please contact:

Professor Rajat Gupta
Low Carbon Building Group
Oxford Brookes University
Headington Campus, Gipsy Lane
Oxford OX3 0BP

Phone: (+44) 1865 484049
Fax: (+44) 1865 483928
E-mail: rgupta@brookes.ac.uk

www.evaloc.org.uk

The EVALOC project seeks to assess, explain and communicate the changes in energy use due to community activities within six selected case study projects under the Department of Energy and Climate Change's (DECC) Low Carbon Communities Challenge (LCCC) initiative, a government-supported initiative to transform the way communities use and produce energy, and build new ways of supporting more sustainable living.

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