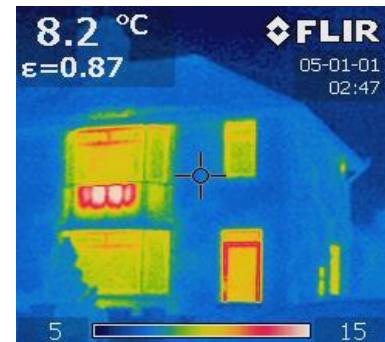


The CAG Project Guide to: Running a thermal imaging project

This guide was compiled in 2018 making use of resources created by several Community Action Groups: Sustainable Didcot, Greening Chinnor, Low Carbon East Oxford, Low Carbon Headington and Local Environmental Action Florence Park (LEAF). The CAG Project would like to thank all contributors for sharing their resources. The creation of this guide was supported through funding from Low Carbon Hub.



1. Introduction

What is thermal imaging?

Thermal imaging or 'thermography' works by detecting the infra-red light emitted by a building and using it to determine the temperature of the surface of walls, windows, doors, roofs etc. Objects at different temperatures emit varying amounts of infra-red light and a thermal imaging camera translates these differences into an image with different colours representing cool to hot temperatures.

Why do thermal imaging?

Thermal imaging is a strongly visual way of engaging with people in your local community. By providing people with images of their own homes, the issue of energy efficiency becomes less abstract and more immediately relevant to them. A thermal image of the outside surface of a house can show areas which are conducting heat from the inside to the outside of the house, helping to identify:

- Draughts
- Whether cavity wall and loft insulation is patchy, missing or has been bridged by a conducting structure.
- Poor or broken seals around windows and doors
- Poorly insulated (e.g. single glazed) windows

Information and energy-saving advice given alongside the survey may help the homeowners, landlords or residents make improvements which will:

- Save them money on their bills
- Make their homes more warm and comfortable
- Reduce carbon emissions

2. Planning your project

There is no right or wrong way to conduct a thermal imaging project. Different community groups prefer different approaches for choosing properties to survey and giving feedback to residents. What you choose will depend on the capacity of your group and how you want to engage with your community.

Timeline

Having the right weather conditions for thermal imaging is vital, so it is important to plan your project in advance to make the most of the cold winter!

September - November:

- Agree an area to be thermal imaged.
- Book a thermal imaging camera through The CAG Project.
- Advertise the thermal imaging offer locally or inform selected residents.

- Book the venue and any speakers and stalls (*if doing a feedback event*).

December:

- Record survey requests and book visits (*if you require access to property*).
- Send out pre-survey questionnaires and/or information about the process to residents including a save the date for any feedback events.
- Recruit volunteers to help do the surveys.
- If your group is new to thermal imaging, you can get in touch with the CAG Project who will be able to help with arranging training on how to use the cameras and interpretation.

January-February:

- Collect the camera, check functionality, charge and calibrate.
- Download appropriate camera software onto your computer.
- Create a risk assessment.
- Check the weather forecast!
- Produce schedules for surveying and assign volunteers.
- Go surveying! Often the weather will be cold and dry enough in December and March as well.
- Record numbers of volunteers and hours spent surveying.



March-April:

- Check all images are downloaded and clear enough to interpret.
- Create a database or use Community Energy Manager (see section 4) to store and assign all images to the correct property.
- Analyse each image to highlight areas to address and make notes/prepare a feedback report (*depending if you decide to give interpretation advice at a feedback event or send a personalised report*). Ensure you leave enough time to do this before you need to present the report – preparing a personalised report could take between fifteen minutes to an hour each to do!
- Send out images to residents by email or post with a personalised or general report.
- Send a feedback event reminder and more details to residents (*if doing a feedback event*).
- Organise equipment, refreshments, risk assessment and volunteers for feedback event (*if doing*).
- Create participant evaluation form to send to residents or get filled in at the event.
- Record numbers of volunteers and hours spent organising images, reports or events. Don't forget to record the number of attendees at your event.

Post April:

- Collate participant evaluation form responses.
- Enter all recorded hours and events into ResourceCIT (see section 8).
- Record any interested residents to survey next year.
- File any personal data securely or destroy.
- You may wish to follow up residents after six months to a year to see if they have implemented any energy efficiency measures.

3. Community engagement

Choosing which properties to survey

There are two main approaches:

Requests: Advertise the opportunity locally and ask individuals to request a survey of their home if they are interested.

Pros –

- Can prearrange visits so you can gain access around the building to survey and make sure internal heating is on.
- Pre-survey questionnaires to residents can add knowledge of property to help explain anomalies.

- Can obtain contact details making communication easier.
- If already engaged, residents might be more likely to take action as a result.

Cons –

- Requires a longer lead-in time.
- Is more time-consuming to collect requests and make bookings.
- Demand might be higher than group has time to survey.

Blanket surveys: Choose a particular area or street and survey all homes and present images to all residents whether they've requested them or not.

Pros –

- Can help to reach residents that might not otherwise request a survey.
- Can target areas more vulnerable to fuel poverty etc.
- Is useful to make comparisons between similar properties on the same street for example.
- Less travel time between properties.

Cons –

- If residents are not already engaged, there may not be any meaningful follow-up actions.
- Although you do not require permission to take images of houses from the street so long as you don't trespass, if your group decides not ask residents to request surveys you should still inform people that you will be surveying their house by letter or flyer in case of concerns over privacy. People could be given the opportunity to opt out.

Publicity

Some ways to advertise your opportunity locally and get residents engaged are:

- Posters on the street and community notice boards
- Flyers delivered door-to-door
- Local newsletters and mailing lists
- Information given out through local schools, GP surgeries or community centres
- Social media e.g. local Facebook groups
- Online platforms such as "Nextdoor"
- Word of mouth!

It is worth pointing out in your publicity that you are offering a free service as people can sometimes be suspicious that you are salespeople!



Poster by Stig: <https://shtiggy.wordpress.com/>

Case study: Low Carbon East Oxford

LCEO found that a good way to recruit more volunteers, as well as gain more engagement and local knowledge about the area, was to ask for at least one person from each street surveyed to volunteer to help survey the street.

Informing residents

It is important to send information to residents about what they can expect from participating in the thermal imaging project before you start imaging. You could send a letter or email including the following points:

- Thermal imaging is best on a cold, dry night so your group will be in touch with them by email or phone to book a slot to visit or notify you of the evening they will be in your area.
- The visit shouldn't take more than 15 minutes and they don't have to be present unless they want to give imagers access to the side or back of the house.

- Information that infra-red radiation cannot pass through glass and so the camera cannot see through the windows, doors or walls, therefore the thermal imaging survey will not invade their privacy.
- The residents should:
 - Set their house heating system to operate 2-4 hours before so that they have an average inside temperature of at least 18°C.
 - Remove any obstacles (cars etc.) that may block the image views.
 - Open all curtains and blinds.
 - Turn off porch and outside lights.
 - Make sure young children and any dogs are safely indoors in case of the need to open garden gates.
 - Warn the neighbours that there will be people walking around the house in the dark.
- The next stage of the project e.g. when and how the resident can expect to get their image and any dates for feedback meetings.

It can also be useful to ask residents to fill in a pre-survey questionnaire, giving you some background information about the house, which will help you look out for particular features and aid interpretation of their images. An example survey can be found in Appendix 1.

4. Surveying

Practicalities

Timing:

Be realistic about how many homes your group can survey. Groups taking around 10 images of a house could do around 3-6 houses per evening and between 25 to 50 properties in a winter, while if taking just one or two images of the front of the house along a single street, some groups took up to 80 images in one evening! Also think about how you will give feedback to residents before getting trigger happy – if you intend to give a personalised report these can take 15 mins to an hour to prepare. It is good practice to go out in groups of 3-4 to share taking images and keeping records.

Conditions for imaging:

Cold (less than 5°C), frosty and dry weather is the best weather for thermal imaging. Rain or fog within the previous 24 hours can cool the walls through evaporation (the camera also needs to be kept dry!). Go out least two to four hours after sunset, after solar gain during the day has dissipated and heating is likely to be on in houses (the temperature different between inside and outside should be at least 10-15°C).

Equipment checklist:

- Thermal imaging camera with batteries charged and space on memory card
- High-vis. vest
- Warm clothes and hot drinks
- Torch
- Map
- Pens and clipboards
- Copies of residents' pre-survey questionnaires
- Record sheets

Safety:

The CAG Project provides public liability insurance for thermal imaging activities, but it is important to conduct a risk assessment (see Appendix 2 for an editable template) for the survey activities and make sure all volunteers follow procedures. Do not survey alone and let someone know where you're heading and how long you expect it will take. Do not enter strangers' houses and if you need to gain access to the side or back of the house do not go through the house.

Using the camera

- You should read the instruction manual for the camera you are using as all brands and models of cameras are slightly different.

- Although you can adjust some settings in software after taking the images, it is important to be consistent in setting your camera parameters e.g. emissivity (e.g. the capacity of a surface to emit heat), temperature scale, image mode and colour scale (e.g. most groups use rainbow).
- Create a folder in the image library or root directory of the camera so all images are saved in the same place.
- Use the survey record sheet (see Appendix 3) to note the number of the image taken against the address of the property, as well as information about the weather conditions and camera settings used.
- If your camera doesn't number images automatically you can use a system of holding up fingers and gestures and taking images between the images of the house to indicate the house numbers. Record keepers can record the sequence.
- You'll normally take images from the other side of the street if wanting a full image of the front of the house as the camera has a narrow field of view.
- Do not stand in front of glass or windows when taking images to avoid reflections.
- Photograph the front door before knocking on the door to lessen heat loss.
- You may want to take a digital photo at the same time to cross reference with the thermal image when you come to analyse the images.
- Allow camera to calibrate between each image - it may take a few seconds.
- Download images and recharge camera nightly.

Top tip: Rather than using a fixed scale you can adjust it manually to get more accuracy for the conditions on the night. Measure the temperature of a wall then set the temperature measurement scale using wall temperature as the lower end of the range and 10 above that for the upper end of the range.

Community Energy Manager

The Community Energy Manager (CEM) Tool, designed by Bioregional, is a database which helps community groups manage their energy efficiency projects. Thermal imaging and energy audit records and images can be stored on the tool, organised and visualised geographically, with overlaid census and other open neighbour data to help determine areas of need or demand. The tool also has a survey function which helps information gathered from residents feed directly into the database. Community groups in Oxfordshire can register for an account for free.

www.communityenergymanager.org

5. Interpreting

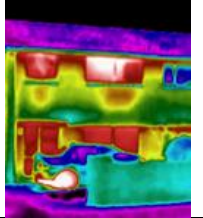
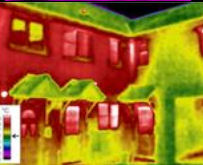
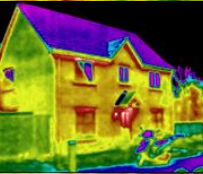
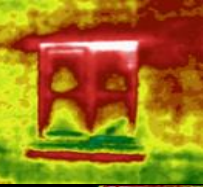
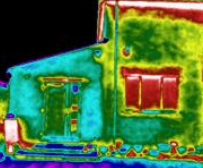
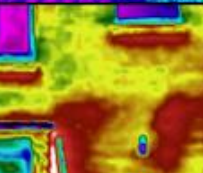

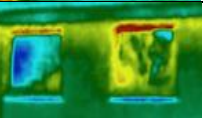
It is important to remember that as a community group you are not professional thermographers and so can only offer general interpretation and advice to the resident. There are patterns and trends to look for however which will help you interpret most standard images. You can also download software from the thermal imaging camera's manufacturer which have helpful analytic tools.

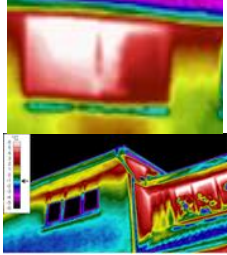
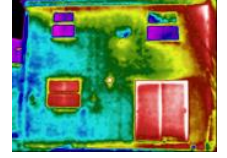
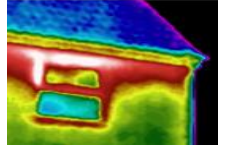
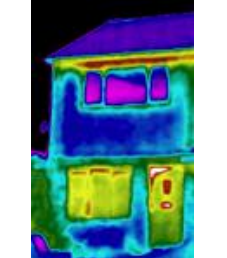
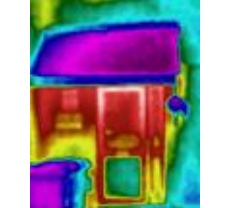
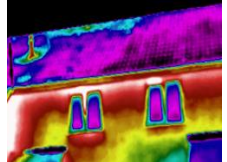
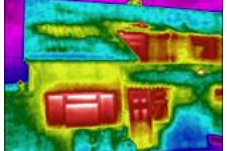
General points

- Each image is calibrated from high to low and therefore if using a rainbow scale all images will show white/red as hot and black/blue as cold. The scale reference on the picture shows the top and bottom temperatures.
- The image is designed to show relative temperatures for the house. It is not comparable with other houses. The difference in temperature between different parts of the image shows the extremity of the heat loss e.g. look for colour differences across a wall or other surface.
- Consider how different materials can appear to be different colours even though they are the same temperature because they are better or worse at emitting infra-red light e.g. bare breeze-block compared to white painted render. Metal has lower emissivity so may appear colder than it really is.

- Crucially white and dark red points/areas in the images highlight areas of concern where heat is being lost.
- Windows, glass and most roofs reflect infra-red light and so appear in pictures as colder than they actually are as they are showing reflections of the sky.

Detailed interpretation guide

<p>Radiators – Look out for hot spots where radiator are leaking heat through the wall from poor insulation behind them (<i>under the windows in image</i>).</p> <p>Bay windows – Double bays are often uninsulated below the windows and there is seldom any insulation in the roof of single bays.</p>	
<p>Uninsulated walls – Cavity walls may not be insulated. Solid walls are often uninsulated (<i>image shows house with cavity wall insulation on right compared to neighbours on left</i>).</p>	
<p>Sheltering effect – patches under the eaves, window ledges, sheltered corners and under porches (<i>as in image</i>) will appear slightly warmer than the rest of the wall as the air isn't circulating so much.</p>	
<p>Thermal bridges – there may be hotter areas due to thermal bridges crossing the cavity wall made by structures such as lintels over windows (<i>shown red in image</i>), or at the intersection between upstairs and downstairs. Corners are a particular type of thermal bridge. They will be warmer than the main wall when seen from outside. These are structural issues which cannot be easily addressed.</p>	
<p>Extensions – modern extensions may appear colder (<i>as in image</i>) than the main house as cavity wall insulation better than it used to be. Extensions over 20 years old may be made of uninsulated solid wall and so will appear warmer.</p>	
<p>Poor insulation – inconsistencies in the temperature of walls may be due to patchy cavity wall insulation or places around structural features like windows where it might not have reached.</p>	
<p>Heat exchangers and other anomalies – extractor fans, air bricks and vents will show up hotter than the wall (<i>see white spots in image</i>) as they are exchanging warm internal air with the outside (some degree of ventilation is needed in a house).</p> <p>Outside lights or boiler flues will also show up hot and need careful interpretation as will give a false high reading therefore skew the rest of the image. A hot stripe along the wall may be the drain from sink or bath.</p>	
<p>Windows – glass reflects infra-red light meaning that upstairs windows often show reflections of the cold sky, or trees etc (<i>top image</i>). Dormer or velux will almost certainly reflect the sky and can show on the image as an extreme low, skewing the</p>	

<p>image. However, many houses with dormer windows appear to show heat loss where the dormer enters the roof.</p> <p>Sometimes windows do show some heat from the window itself and is likely to be hotter towards the edges of the glass (<i>middle image</i>), corresponding to the places on the inside where condensation starts to form.</p> <p>High performance window such as triple glazed windows (<i>the left hand window in bottom image</i>) will appear significantly better insulated, thus colder.</p>	
<p>Patio doors/French windows – these can often appear hotter than windows (<i>note white frames losing heat on image</i>).</p>	
<p>Window frames – hot spots on the frames might indicate drafts or breaks in the window seal (<i>white line on left of image</i>). Many modern window have air vents above the window which show up as obvious hot lines. You can easily see hot air pouring out of open windows.</p>	
<p>Doors – compare the door with the surrounding walls and check for hotter lines around the edges, cat flaps and letter boxes indicating draughts, as well as any glass in the door which might be reflecting the infrared light. However, if the door was recently opened to it might be hotter around the edge where it was open (<i>see top left corner of door</i>).</p>	
<p>Porches – over the door shelters or porches will provide some sheltering and so the door may be a few degrees warmer underneath.</p>	
<p>Roofs – because they reflect the sky, roofs will look colder than the walls. You can compare the temperature within the roof itself, but not with the walls. Look for hot spots along the ridge (<i>as in image</i>) which might indicate warm air in the loft cavity i.e. not enough loft insulation. If the temperature under the eaves is more than a few degrees warmer than the normal sheltering effect, it might indicate hot air escaping from the loft cavity due to lack of loft insulation. Hot spots might indicate flues (<i>as in image</i>) or hot water tanks.</p>	
<p>Double & single story roofs – look for warmer patches in areas that might not have been insulated well such as at the transition between single and double stories or in the roofs of single story extensions or entrance halls.</p>	

6. Feedback to residents

There are two approaches to passing on images and giving feedback to residents – the pros and cons are outlined below:

Written feedback: Thermal images are sent to the resident/s by email or post. The image would be accompanied by written information to help the resident/s understand the image. This could either be a personalised report identifying areas for attention specific to their image or it could be a general guide pointing out general things for them to look for in their own image and energy efficiency measures to address these issues.

Pros –

- It can be quicker to give generalised advice if the group is short of time and volunteers or took many images.
- Ensures residents that can't attend events (e.g. due to childcare or work responsibilities) get feedback.

Cons –

- Residents new to thermal imaging might need their image to be explained in more detail to help them understand it.
- It can be harder to know if the resident has engaged or taken action if there is no face-to-face discussion.

Feedback in person: Residents are invited to a meeting or event where they receive their image and can speak 1-2-1 to a member of the group who will be able to point out areas for attention and make tailored recommendations on ways to address issues with efficiency measures. You may like to book time slots of 10-15 mins for each house or have an open drop-in.

Pros –

- You could give away energy saving freebies or have additional talks or stalls from experts or local installation companies about energy efficiency measures at events.
- Community events can provide the additional benefit of bringing neighbours together and increasing community cohesion.
- Events can be a good way of raising awareness about your group's other activities or recruiting new volunteers – make sure you bring along sign-up sheets and/or flyers about other events.

Cons –

- Events can be time-consuming to organise and deliver and you need more volunteers.
- Venues may charge for bookings.
- Risk of low turn-out from residents.

Top tip: You could edit the interpretation table included above to use as a general written guide to give out to residents with their images. An example of a more tailored interpretation report is included in Appendix 4.

Case study: Local Environmental Action Florence Park

Some Community Action Groups have chosen a mixture of feedback approaches! For example, LEAF emailed residents their image with a standardised interpretation guide giving general advice but have also invited them to come to a community event, where they could obtain further energy efficiency advice.

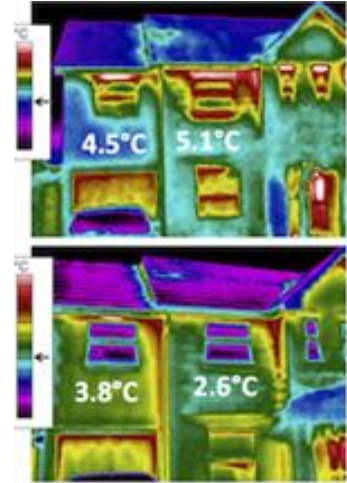


7. Energy efficiency advice

Quick wins

Based on your interpretations, you can give resident's general advice on how they might make their home warmer, save money on their energy bills and reduce their carbon emissions. Here are some of the basic points you could cover in your feedback session or report:

- Cavity wall insulation can save up to 25% of heat loss from a house (*the image on the right shows the main house before and after installing cavity wall insulation – the temperature reading dropped from 5.1 to 2.6°C showing lower heat loss*).
- Solid walls, particularly underneath single bay windows, can be clad with insulating materials. Insulated wallpaper can be also used for very cold walls.
- Insulating the loft with the recommended 300mm of insulation can save up to 20% of heat loss from a house. It is important to make sure the insulation goes right up to the edge as the smallest gap can lose a significant amount of heat.
- Stop draughts from doors and windows with draught excluding tape, fabric draught excluders along the bottom of doors and door or letter box brushes.
- Cover doors and window with thick curtains, especially French windows. You can buy ready-made thermal curtains or sew in thermal liners.
- Radiator foil behind radiators reflects the heat back into the room, rather than allowing it to escape through the walls. A roll which uses sticky adhesive is approximately £5-10 per roll but you can also use normal kitchen foil.
- Thermostatic radiator valves can be fitted which give more temperature control.
- Radiator fans sit on top of radiators and blow hot air into the room, warming it up faster.
- Specialist secondary glazing film can be put up inside single glazed windows.
- Chimney balloons (or even an old pillow) can be fitted inside chimneys to prevent draughts.
- Fit an insulating jacket onto hot water tanks.
- Insulate hot water pipes with foam or reflective lagging.



Grants & Resources

In Oxfordshire, as well as nationally, there are many ways that the local authorities and other bodies are providing funding, support and advice to help both homeowners and landlords, particularly those who might be vulnerable to fuel poverty, make their homes more efficient. A few sources of advice are listed below, but do research what exists in your locality as well:

- **The Cavity Insulation Guarantee Agency** – can help you track and claim on the 25 year guarantee if you think your insulation wasn't fitted correctly. <https://ciga.co.uk/>.
- **Better Housing, Better Health** – is a free service for anyone living in Oxfordshire which provides advice and refers resident's to grants to help pay for efficiency improvements. <http://www.bhbh.org.uk/>.
- **Affordable Warmth Helpline** – call free on 0800 107 0044 for impartial and expert advice from the National Energy Foundation.

Community buyer's clubs:

Your group could help facilitate neighbours joining forces to bulk buy insulation or get deals on multiple properties from insulation installation businesses. Why not do some research on reputable local suppliers and coordinate a meeting with interested residents?

- **The Local Energy Advice Programme (LEAP)** – this scheme is open to vulnerable resident’s in Oxford and offers free home energy audit and small repairs and measures. Anyone can refer or self-refer. <https://www.projectleap.org.uk/>.
- **Oxford City Council website** – lists grants and other programmes available to homeowners, private landlords and tenants in Oxford as well as nationally. https://www.oxford.gov.uk/directory/26/energy_saving_grants_and_offers.
- **Cherwell Energy Efficiency Project Grant** – provides a contribution towards energy improvements in private rented properties in Cherwell district. <https://www.cherwell.gov.uk/info/79/housing-advice/237/keeping-warm-at-home>.
- **The National Energy Foundation** – has a useful website with many schemes and resources to help resident’s and community groups. <http://www.nef.org.uk/>.
- **The Energy Saving Trust** – have loads of useful resources and tips to improve home energy efficiency <http://www.energysavingtrust.org.uk/>.
- **Government Energy Grant Calculator** – lets you answer a quick questionnaire and directs you to other relevant sources of information. <https://www.gov.uk/energy-grants-calculator>.

8. Measuring impact

Participant evaluation

It is really important for your group to measure and understand the impact your activity has had in terms of resident engagement. Doing an evaluation questionnaire with participants will also help you improve your project next year. You can find an example questionnaire in Appendix 5

ResourceCIT

Resource Community Impacts Tool (ResourceCIT), an easy to use online tool which supports community groups to monitor and report on the impact of different activities including thermal imaging and energy advice.

It can measure the KWHs of energy saved, as well as the resulting carbon emission and consumer costs saved. It can also measure the value of the volunteer time spent working on the project.

In order to calculate the energy saving impacts you need to ask participants about their intentions to implement a number of energy saving measures and enter this into the tool. The tool makes an assumption of their likelihood of making changes and produces a projected figure. See the questions on the evaluation questionnaire in Appendix 5.

You can access ResourceCIT here: <http://www.resource-cit.co.uk/> . Contact The CAG Project team for a log-in if you don’t have one.

Make sure you record the following to enter into ResourceCIT:

- Date of activity
- No. of organisers involved in organising/delivering activity
- Average no. of hours spent per organiser
- No. of attendees (e.g. residents surveyed)
- Average no. of hours spent per attendee (e.g. time spent giving feedback).

Appendices

Appendix 1: Pre-visit questionnaire

This questionnaire is intended to get some background information about your house in preparation for thermal imaging by [insert group name here]. We will use this information to aid us in the interpretation of the images. Please return this questionnaire to: [insert email or address here].

Please circle/highlight your answer.

1. **What is the age of your house?** Pre 1900 / 1900-1930 / 1930-1995 / post 1995
2. **What type of property is it?** Detached house / Semi-detached house / End-terrace house / Mid-terrace house / Detached bungalow / Semi-detached bungalow / Maisonette / Flat / Mobile home / Other: _____
3. **Is your house:** Owned / private rented / council or housing association?
4. **What are the walls made of?** Cavity wall / Solid wall
5. **If cavity walls, is the cavity insulated? or if solid walls, is the surface insulated?** Yes / No / Don't know
6. **What material are the walls made of?** Brick / Stone / Timber frame / Breeze block / Other: _____
7. **What are the windows?** Triple glazed / double glazed / single glazed / mixture of double and single
8. **What is the roof made of?** Slate or tile / Thatch / Other: _____
9. **Do you have loft insulation?** Yes / No / Don't know
10. **If you do have loft insulation, what is the thickness? Is the entire loft covered?** _____
11. **What is the main method that you use to heat your house?** Gas central heating / Electric heaters / Oil fired boiler / Wood burning stove / Wood chip boiler / Other: _____
12. **If you have a gas boiler, approximately how old is it?** _____
13. **Describe any energy efficiency measures you have already installed (e.g. radiator foil, pipe lagging)?**

14. **Describe any problem areas or issues of concern (e.g. damp, draughts) you'd like us to check?**

15. **If you have been thermally imaged before please tell us when and what work been done since then.** _____
16. **How aware are you of what you can do to make your home more energy efficient?** Not aware / Somewhat aware / Already aware
17. **Are there any hazards around your home we should be aware when surveying i.e. ponds, dogs etc?**

Personal details:

Name: _____


Address: _____

Phone: _____ Email: _____

What age group are you in? Under 30 / 31-40 / 41-50 / 51-60 / 60+

(This information will be kept confidentially and will not be shared with any third party)

Appendix 2: Risk Assessment Template

CAG PROJECT RISK ASSESSMENT TEMPLATE Please note – this is only a suggested template. You must edit according to your own activities.										
	CAG Name:			Activity: Thermal Imaging						
	Date:			Location:						
	Risk assessment completed by:			Signed:						
	Risk assessment reviewed by:			Signed:						
	IDENTIFIED HAZARD	HAZARD APPLIES TO:	likelihood	Severity	Risk	CONTROL PROCEDURES			Revised Likelihood	Revised Severity
Trip hazards from uneven ground and equipment	CAG members, volunteers, public	2	3	6	<ul style="list-style-type: none"> Place equipment in a safe place away from walkways. Check for obstruction and clear any trip hazards. In the case of uneven ground, give warnings verbally where needed. 			1	3	3
Food poisoning/allergic reactions from pre-prepared food and refreshments provided	CAG members, volunteers, public	2	3	6	<ul style="list-style-type: none"> CAG members and volunteers tasked with food preparation must be made aware of basic food safety principles (such as washing their hands, checking products for freshness, washing products, etc.). CAG members, volunteers and public reminded to wash hands before eating and drinking if they have been doing activities where they may have come into contact with harmful micro-organisms/dirt. Food and ingredients communicated to all so that they're aware of potential allergens. 			1	3	3
Burns and scalds from hot drink making facilities	CAG members, volunteers, public	2	2	4	<ul style="list-style-type: none"> CAG members, volunteers, public warned to be careful when making hot drinks where necessary. First aid kit to be carried in case of more severe burns. 			1	2	2
Extreme weather related risks such as illness/hypothermia	CAG members, volunteers, public	2	3	6	<ul style="list-style-type: none"> In extreme wet, windy or snowy weather those participating in activities are advised to wear appropriate warm and waterproof clothing. 			1	3	3
Participant being taken ill or suffer from an attack of a medical condition e.g. asthma, diabetes, epilepsy	CAG members, volunteers, other members of the public	2	5	10	<ul style="list-style-type: none"> CAG members and volunteers to get participants to indicate if they have an existing medical condition they should be aware of when signing up to the event. Participants advised to carry medication with them at all times. CAG members to seek medical advice and/or call an ambulance if the situation escalates. 			2	4	8

Injury from using thermal imaging camera and/or using and installing electrical energy saving devices such as electric shocks or cuts.	CAG members, volunteers, public	2	3	6	<ul style="list-style-type: none"> • CAG members to ensure that participants given adequate training in how to use the equipment. • Condition of equipment checked for breakages and loose wiring and if hazards are found the equipment should not be used until fixed by a trained person. • CAG members should avoid using equipment in the rain or near water. 	1	3	3
Injury from tampering with home electrical items such as electric shock.	CAG members, volunteers, public	2	3	6	<ul style="list-style-type: none"> • All participants to ensure they do not touch or tamper with any electrical item in the home that they do not understand or have training to do so. 	1	3	3
Risk of kidnapping, verbal or physical abuse and harassment from members of the public when working outside on the street and in the houses of members of the public.	CAG members, volunteers	2	4	8	<ul style="list-style-type: none"> • CAG members and volunteers should avoid entering the houses of members of the public that they do not know well or feel uncomfortable with. • They should also never work alone and ensure that they inform another person the address of where they are going. • If CAG members and volunteers are subject to harassment or abuse from members of the public they are working with or in the street they should stay calm, not react and leave the situation immediately. If the situation escalates the police should be informed. 	1	4	4
Road traffic accidents from working on streets and pavements during hours of darkness	CAG members, volunteers, public	3	5	15	<ul style="list-style-type: none"> • Participants briefed on being aware of road safety whilst moving around. • Participants warned that they participate in the activity at their own risk and are personally responsible to helping to ensure their own safety on the road by employing common sense. • Hi-vis tabards or jackets to be worn by all participants to enhance visibility to road users. 	2	5	10
ON-SITE AMMENDMENTS – Please record any additional hazards and control procedure identified on site.								
<p>Guidance: Likelihood is scored between 0 (no risk) – 5 (inevitable). Severity is scored from 0 (no risk) – 5 (very severe). Risk score = Likelihood X Severity. Revised risk score: < 8 = satisfactory – activity can proceed control procedures in place 8 > 12 = acceptable - be vigilant and stop activity if extra risk occurs, > 12 = unacceptable - activity should not go ahead</p>								


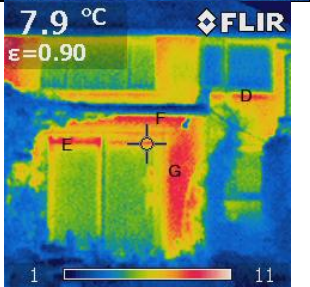
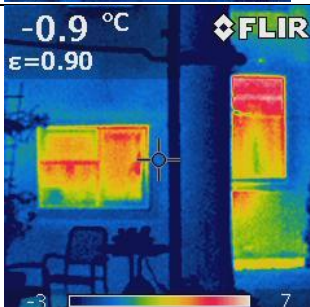
Appendix 3: Survey Record Sheet Template

General details:				
Camera model & lens:		Date:	Volunteer names:	
Software:		Weather conditions:		
Camera settings e.g. Emissivity, temperature scale, colour:		High & Low air temperature		
Image record:				
Image no.	Time	House address	Orientation/direction	Comments e.g. <i>environment, building materials, inside temperature if known, any lights or anomalies</i>

Appendix 4: Example tailored interpretation report

Date: _____

Address: _____

Image	Interpretation
	<p>Front elevation</p> <p>Is there a radiator below the first floor window (A)? If so, installing a reflective backing sheet behind it might cut minor heat loss here. There is significant heat loss from the bay window, even with curtain closed. Heat loss is concentrated at the top of the window (B) and is worth investigating further: are any draughts felt here? Are the upper opening windows (B) fully closed?</p>
	<p>Rear elevation from back garden</p> <p>There is significant but localised heat loss from below the right-hand first-floor window (D). The left-hand French window is leaking heat at the top (E). Is there a trickle vent open here that could be closed most of the time, or is the door poorly fitting? The most serious leakage of heat occurs to the right of the French window (G) and above it (F).</p>
	<p>Rear, ground floor</p> <p>Quite a lot of heat loss through both south-facing windows (panes & frames), especially the right-hand one. This would be a priority area to tackle (e.g. are these windows double-glazed?). Heat loss could be reduced with curtains. Note the warm wall area below the right-hand window. This is probably heat from a radiator being conducted through the solid wall; this could be mitigated by installing a reflective panel behind the radiator.</p>

Appendix 5: Participant Evaluation Questionnaire

We were able to provide free thermal imaging surveys and advice free of charge but we would appreciate your help evaluating our project by filling in this short confidential form. *Please circle which answer most applies to you*

1. **After the thermal imaging survey and advice how aware are you of what you could do to make your home more energy efficient?** Not aware / Somewhat aware / Very aware
 2. **How would you rate the information and advice you received about your thermal image?** Not very helpful / Average / Very helpful
 3. **As a result of the survey and advice provided will you:**
 - a. *Install solid wall insulation:* Yes, I plan to because of today / I had decided already but today helped / I had already planned to / I already have this / No
 - b. *Install loft insulation:* Yes, I plan to because of today / I had decided already but today helped / I had already planned to / I already have this / No
 - c. *Install cavity wall insulation:* Yes, I plan to because of today / I had decided already but today helped / I had already planned to / I already have this / No
 - d. *Install double glazing:* Yes, I plan to because of today / I had decided already but today helped / I had already planned to / I already have this / No
 - e. *Change your behaviour to reduce energy consumption in your home:* Yes, I plan to because of today / I had decided already but today helped / I had already planned to / I already do / No
 4. **Were you told about financial grants and schemes available to make improvements to energy efficiency?** Yes / No
 5. **Do you feel like you know your neighbours better or have an increased sense of community as a result of the project?** Not really / A little / Very much
 6. **As a result of service provided, are you likely to get more involved in your local Community Action or Low Carbon Group?** Yes / Maybe / No
 7. **Would you tell your neighbour about your survey and share the advice you were given? You can ask your neighbour to get in touch with the group to book a survey next year.** Yes / No
 8. **Would you be interested in joining up with other local residents to bulk buy insulation or get deals with installation companies?** Yes / Maybe / No
 9. **Any comments or suggestion of how to improve the project next year?**
-