# Maximisation of energy efficiency savings in Climate Challenge Fund projects

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## 1.    Key Points

- The best way to encourage behaviour change to maximise energy savings is by combining behaviour change strategies within an organisation. These strategies are also effective when engaging with the wider public.

- Moments of change, such as the reopening of a community building, are a key opportunity to maximise the adoption of new behaviours, yet this strategy is under-utilised by CCF project participants.

- Automated energy efficiency measures guarantee a degree of emissions savings (as long as devices are adequately checked and maintained), especially for organisations that lack the staff to ensure things are turned off. But behaviour change costs less, and can be implemented more easily in the home.

- Energy efficiency measures should be prioritised (based on savings per pound invested) to help project participants make decisions about which energy efficiency measures to adopt.  These prioritised activities should also be shared with the wider public to assist in decision making for the home.

- Rebound effects are currently not addressed in CCF projects.  Rebound effects should be considered by CCF projects and addressed during the application process; this is critical for estimating emissions savings over the project lifetime.

- There is a lack of easy-to-follow guidance for public engagement and maximising 'spill-over' effects for CCF project participants. Given that public engagement is a key part of most CCF projects it would be useful to create a simple guide for community buildings to engage with the public on climate change behaviours.

## 2.    Introduction

The Scottish Government asked ClimateXChange to review the evidence and provide good practice advice on how community buildings can best achieve carbon emissions savings through energy efficiency measures and associated behaviour change[1]. The evidence reviewed is based on projects funded through the Climate Challenge Fund (CCF) and the wider academic literature. An interim report was previously provided to the Climate Challenge Fund Team at the Scottish Government to assist the CCF panel in judging the current round of CCF applications.

This report examines evidence of good practice in previously funded energy efficiency projects where emissions savings have been maximised in community buildings. This includes the best way to encourage changes in behaviour to help increase energy and carbon savings. The report is in two parts.

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[1] The recommendations provided in this report align with many of the recommendations provided in the Scottish Government's recently published Low Carbon Behaviours Framework (2013), but draw also on evidence from the wider literature.

The first part explores current evidence to identify good practice in community buildings energy efficiency projects.  The key questions addressed are:

- The best strategies and techniques for encouraging behaviour change to ensure emissions savings are maximised from energy efficiency measures in community buildings. This includes identifying what user knowledge is required and any rebound effects that should be considered.
- Expected behavioural 'spill-over' from community projects and the best methods to encourage this.

The second part of the review provides recommendations on guidelines for best practice for reducing carbon emissions and changes to energy consumption behaviours.  The key objectives addressed are:

- Recommended strategies to be included in future guidance for community projects.
- How much consideration should be given to behavioural change and the best techniques to achieve this.
- The best methods for maximising 'spill-over' behaviour change effects in the wider community.

## 3.    Strategies for encouraging behaviour change for maximised emissions savings

Encouraging behaviour change is a difficult task and new behaviours or habits often take a long time to take effect. That said, there are strategies organisations can adopt to help maximise emissions savings and reduce energy consumption. The energy efficiency measures funded by the CCF (insulation, window glazing and draught proofing) will help reduce carbon emissions. Changing energy consumption behaviours within a community building will also reduce carbon emissions and energy costs.  Of the CCF projects reviewed, the following strategies were effective in encouraging positive behaviour change in energy efficiency:

- **Goal setting and commitments from employees and facility users**.  Glasgow East Synergy (CCF-770) initiated a green office policy for employees, committing them to turning devices off in the evening, buying goods locally, recycling at home and cycling or taking public transport to work.  St. Ninians Old Parish Church Hall Upgrade (CCF-585) asked parishioners to reduce their personal footprint by 1 tonne annually. Ultimately, 40 people from the parish reduced their annual footprint by 0.92 tonnes annually.

- **Reminding, signposting and alarms**. Jura Power down (CCF-778), Garelochhead Youth and Community Centre Carbon Reduction Project (CCF-409) and DEAFinately Greener (CCF-055) all posted signs around the newly insulated building reminding users to turn off lights and appliances, and recycle. Cutting Carbon at the Community Centre (CCF-1338) went a step further and placed signs around the building alerting users that lights had new automatic sensors and installed an alarm to prevent external doors from being left open.

- **Removing the need for behaviour change.**  Jura Power down (CCF-778), St. Ninians (CCF-585) Oxnam Community Energy Saving Project (CCF-1387) and Cutting Carbon at the Community Centre (CCF-1338) all adopted measures that removed the need for building users to change their behaviours.  This included installation of motion-detected lighting, automatic power downs for computers and timed controls on heating systems. It is important to note that this strategy reduces the likelihood of 'spill-over' effects into the domestic sphere, but it does guarantee a reduction in energy use (as long as there is a programme of planned checking and maintenance for all devices). Conversely, changing behaviour is a potentially faster and less costly approach to achieving emissions savings (Osbaldiston and Schott, 2012).

The wider academic literature shows that combining strategies is most effective in maximising behaviour change. Proposed CCF projects hoping to achieve high levels of carbon emission savings from behaviour change should use a combination of strategies, such as those listed above.  Other strategies that have been shown to be effective

when combined include goal setting, rewards, instructions, prompts, justifications, easy actions and changes in beliefs or attitudes (Osbaldiston and Schott, 2012).

A key strategy that the projects reviewed did not take advantage of is the opportunity provided by moments of change, such as the re-opening of a community building.  Much behaviour is habitual and is fostered through a stable environment. Research has shown that a disruption in an individual's environment, whether it is physical or social, provides an opportunity to change habits (Centre of Expertise on Influencing Behaviour, 2011).  CCF projects should use the improvements made to buildings as a way to not only display energy efficiency measures undertaken, but as an opportunity to break old habits and start new ones. This can be implemented through the introduction of awareness policies and briefings for new and existing staff members and an official building re-opening event.

*User knowledge required for maximising energy efficiency and encouraging behaviour change*
Currently CCF participants are given a great deal of useful information on what measures to take to maximise emission savings in community buildings through the advice provided by Keep Scotland Beautiful, the Energy Savings Trust (EST) and the Scottish Community Development Centre.  The Community Action for a Sustainable Scotland (CASS) guide (2009) provides easy checklists for project participants to ensure they are doing everything within their means to reduce energy consumption. What the current guidance is lacking and what project participants need to know is what are the highest priority activities to undertake.  Prioritising activities not only aids project participants in decision-making, but also leads to an increase in adoption of these activities and possibly long-term change (Andreasen, 1995).

We have created a hierarchy of activities for energy efficiency in Figure 1 based on information from the CASS document (Every Action Counts Programme, 2009) and estimated savings from the EST.  This prioritisation is simply based on emissions savings per £ invested and does not relate to lifetime or operating costs.  A visual representation of prioritised activities such as that shown in Figure 1 would be easy for project participants to use and to share, but given the complexities associated with buildings in Scotland, more in-depth guidance could be useful as community organisations decide to take on more aggressive measures.  This guidance could be expanded to include a breakdown of the percentage of energy usage in the community centre, such as lighting, heating and devices. Hampshire County Council includes this in its energy efficiency tool kit and states that for most community buildings 85% of energy usage is devoted to heating, 5% to lighting and 10% to other devices or appliances (Hampshire County Council, 2013). This information differs from the CCF guidance in the Low Carbon Route Map (Keep Scotland Beautiful, 2011), which provides a breakdown of domestic energy usage – but obviously the energy needs and usage of a community building are different from those of a home. Such a breakdown could help future projects in determining an emissions baseline when CCF or EST advisors are unavailable to provide one-on-one advice.
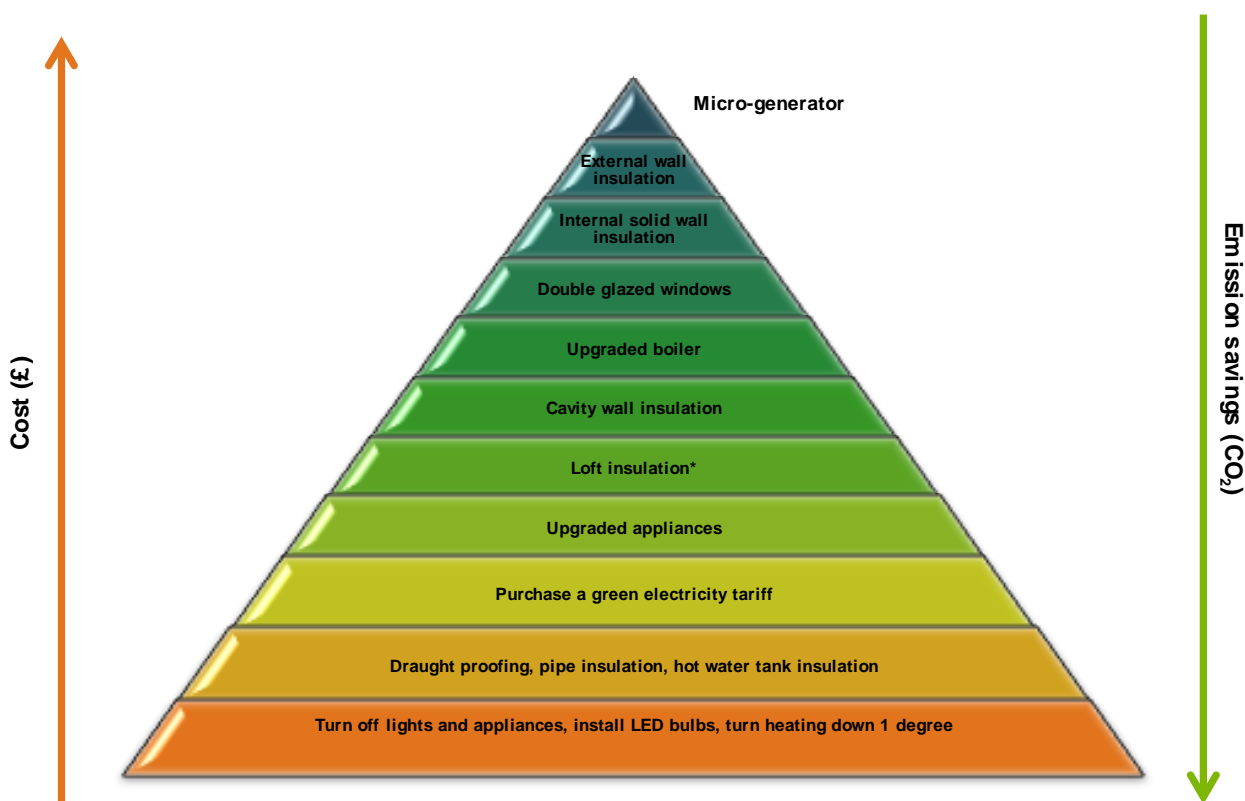
Figure 1: Hierarchy of energy efficiency activities



*Figure 1: A visual prioritisation of low carbon activities both community buildings and private homeowners can undertake to reduce carbon emissions and energy usage. It is important to note that costs can vary by location, whether installation is contracted out or 'DIY', the quality of materials used, etc. *Loft insulation is cheaper to install than cavity wall insulation but actually has greater emissions savings* (Centre of Expertise on Influencing Behaviour, 2011) (Energy Saving Trust, 2013)*.

Project participants also need better guidance on how to engage with the wider public. Most projects relied heavily upon information sharing as a means to encourage changes in behaviour. This was conducted through either distribution of pamphlets, workshops or events with low levels of engagement (CCF-0092, CCF-514, CCF-770, CCF-778, CCF-1265). Sharing information is a valuable tool but project participants need to be aware that information alone does not lead to behaviour change (Jackson, 2005) nor does simply promoting the benefits (Andreasen, 1995).

Project participants need to know how to effectively engage with employees, members and the wider community. Encouraging behaviour change is a large component of CCF projects and participants need a well thought out and effective plan for engagement prior to starting a project. Participants would greatly benefit from better guidance on this. Corner and Randall (2011) describe social marketing techniques that have proven to be effective in encouraging community-wide behaviour change. The technique follows simple steps: understand your audience, tailor the desired behaviour change to their preferences, remove barriers to performing the behaviour and follow up with the audience for feedback (Corner and Randall, 2011). CCF projects could benefit from including these strategies in their public engagement plans. Currently there is a lack of practical guidance on public engagement techniques that is easy to follow or indeed aimed at community centres.

*Rebound effects considered by CCF projects*

The projects reviewed did not consider rebound effects yet this is something that each of the projects encountered. St Andrews Episcopal Church Carbon Reduction Programme (CCF-1060) was the only project reviewed that mentioned this. The project participants were surprised by a 25% increase in their energy bill when they were expecting a lower bill. This arises from the fact that buildings became more comfortable after energy efficiency measures were completed and therefore were used more. Increased building usage and engagement is one of the goals of these projects, therefore community buildings must be aware that estimated emissions savings may not be as high as predicted. The additional benefit is that although buildings will experience higher usage, they will be operating more efficiently and users will take notice of the comfortable surroundings. The CCF should include an alternative metric in its criteria, such as kWh per person-hour spent in the building, to highlight the increase in energy efficiency. This will help offset any disappointment project participants may experience from not meeting emissions savings targets. Other sources of building emissions will also increase from increased usage; this includes greater emissions from more people travelling to and from the community building and an increase in waste production. CCF project applicants should be aware of this and develop a plan to address these increases through the lifetime of the project and beyond.

*Expected behavioural 'spill-over' effects and the best methods for encouragement*

Measuring 'spill-over' effects is difficult and therefore it is hard to comment on expected effects. Current literature fails to address these effects adequately (Osbaldiston and Schott, 2012; Corner and Randall, 2011). The most widely used method for obtaining information on these effects is by surveying. A key issue is that people are less inclined to share information about their personal consumption habits. Multiple projects experienced this first hand with low response rates to surveys and low participation in energy monitor loan programmes. Secondly, people are not always truthful on surveys. They often respond with answers they believe are the most socially responsible (Carrington et al, 2010). The most effective way for measuring 'spill-over' effects is by measuring the carbon footprint of participants at the beginning and the end of the project lifetime. The best way to encourage people to participate in sharing the personal information needed to make these measurements, such as a personal or household carbon footprint, is to incentivise self-reporting. The best example of a CCF project that successfully did this was St Andrews Episcopal Church Carbon Reduction Programme (CFF-1060). They implemented a car-sharing scheme and users that self-reported a reduction in car miles during the week were given a ticket to place in the weekly offering plate.

CCF projects that succeeded in encouraging and measuring 'spill-over' effects include Leave a Smaller Footprint (CCF-1059), Whitehouse (CCF-1428), St. Ninians (CCF-585) and Synergy (CCF-770). A key contributory factor to the success of these projects was that these community organisations already had close ties to the community prior to applying to the CCF.

## 4.    Best practice for reducing carbon emissions

*Best strategies for reducing carbon emissions and increasing energy efficiency in community buildings*

The most effective strategies for energy efficiency involve a combination of reduced consumption, and more efficient usage of lighting and heating systems. Efficacies of energy efficiency measures vary by site and project. Additionally, the energy efficiency measures are generally part of a suite of changes to the facility and usage. Therefore, the measuring of the efficacy of an individual change is not quantified in this report, but the guidance presented in Figure 1 is recommended. To expand on the recommendations in Figure 1, the projects recommended are best divided into two sections: lighting and heating. The following recommendations are in order of most effective and costly, to most affordable and less effective.

Lighting schemes

- **Zoned lighting** through the creation of sub-circuits allows for smaller groups of lights to be used for smaller meetings.
- **Motion Detectors and Timers** will best perform in seldom-used areas as demonstrated by St. Ninians (CCF-585). Additional consideration must be given for areas of high use, as motion detectors can become a nuisance and risk being over-ridden by users.
- **Bulb and fixture replacement** provide the most affordable improvement for lighting systems, which can reduce electrical consumption without loss of lighting. LEDS should be selected wherever possible. For example, St Andrews Episcopal Church (CCF-1060) installed LEDs for incandescent and replaced old fixtures. The project resulted in a drop from 16 kW to 3 kW.

Heating schemes

- **Insulation upgrades** can offer increased heating efficiency in all community buildings. Walls (external and internal), floors and lofts should all be considered when upgrading insulation to maintain heat in the building.
- **Double-glazed window** installations along with draught proofing helps to seal the building and take demand off the heating system.
- **Boiler upgrades, replacement, or change to ground-pumped heating** can provide great savings, but usually require a specialist to assess base and peak demand for the facility.
- **Zoned heating (including good heating controls in each room / zone)** should always be installed during the time of a boiler upgrade if it cannot be installed alone. As with zoned lighting, zoned heating allows for smaller divisions of the building to be used comfortably for smaller meetings, while decreasing demand on the heating system.
- **Draught proofing and appliance insulation** are some of the most affordable fixes, and can provide a noticeable upgrade for the comfort in the community centre and for its patrons.
- **Timed heating sensors** provide the final measure for energy efficiency, (as explained above in section 3) but also depend on user behavior. Oxnam Community Energy Saving Project (CCF-1387), St. Ninians (CCF-585), and Cutting Carbon at the Community Centre (CCF-1338) all adopted this measure and experienced a high level of emissions savings over the lifetime of the projects.

Similar to behaviour changes discussed in section 3, the combination of multiple upgrades within each scheme provides the best means of maximising energy efficiency. For example, an upgraded boiler will not allow for great energy savings unless the building is properly insulated to retain the heat generated.

*Consideration of behaviour change when adopting energy efficiency measures*
The energy efficiency measures for community buildings funded by CCF projects do not rely on direct behaviour change to achieve carbon emission savings. Most buildings can, and do, achieve significant savings from installing insulation, double glazed windows and energy efficient lighting, activities all funded by the CCF. Where automated systems can be installed, such as motion detect lighting, timer activated heating and auto shut offs on appliances, community organisations can experience greater cost savings and carbon emission reductions. This is especially helpful for organisations that do not have the resources to ensure building users follow recommended energy saving behaviours. As mentioned earlier this does limit 'spill-over' effects but sharing information about the new system combined with the justification behind it should help to overcome this issue.

Behaviour change when adopting energy efficiency measures needs to be considered when encouraging uptake of the same measures in the home. CCF project participants need to be aware of the complexity associated with behaviour change. As stated previously, behaviour change cannot be achieved simply by providing information. Project participants need to consider the following when trying to encourage changes in behaviour:

- The nature of the proposed behaviour (e.g. long-term or one-time purchase);
- How the message about the proposed behaviour will be delivered;
- The perceived cost to the people whose behaviour you are trying to change (i.e. time, resources, money).

The considerations listed above apply to all types of behaviour change, including changes in travel, turning appliances off, turning the heating down 1°C or installing a new boiler.

*Best strategies for maximising 'spill-over' effects*

Strategies for encouraging 'spill-over' effects have been mentioned throughout this brief and are the same as the strategies for encouraging behaviour change. To maximise these effects it is essential to prioritise activities so people can easily make decisions on actions to take in the home. The hierarchy of activities in Figure 1 could easily be applied to energy efficiency in the home. Prioritising these activities not only supports long-term changes in behaviour but also tells people where to start.

Maximising 'spill-over' effects also requires a high-level of engagement with the wider community. Smaller organisations find this difficult and should be encouraged to create partnerships with other community groups to expand their reach.

Lastly, when communicating about behaviour change in the home it is important for organisations to know their audience and what is important to them.  Community groups have a unique opportunity to form close bonds and a high level of trust with people within the community. People are more receptive to receiving information from trusted sources.

## 5.    Recommendations for future guidance in community buildings

The CCF has provided useful guidance for community building projects aiming to decrease energy bills and carbon emissions. The recommended CASS document (Centre of Expertise on Influencing Behaviour, 2011) allows users to identify activities at different levels of difficulty to undertake. We recommend that future guidance includes a prioritisation of activities to help decision makers and support long-term behaviour change. This could include the simple guidance presented in Figure 1, but should also go beyond that to identify the highest areas of energy usage within a community building.

Secondly, future CCF projects should consider possible impacts of changes made to community buildings. These may be both positive and negative. For example, energy efficiency measures undertaken from CCF funding may lead to increased use, which provides positive community benefit, albeit with an increased overall emissions profile. A community centre that is used more often will not only use more energy but it will also have more people travelling to and from the centre, as well as a higher production of waste. On the positive side, it may lead to increased community cohesion. These effects will have an impact on the emissions savings realised over the lifetime of the project compared to estimated savings. We also recommend an easy-to-use guide to public engagement is provided to CCF applicants so they may create a well thought out plan before starting a project. Given the complexities associated with behaviour change and public engagement, project participants need simple instructions on the best ways to encourage change and also engage the wider public. This may need to be something the CCF creates, as such guidance is currently lacking from the wider literature.

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