

## Climate Action Fund: Learning Signposts #2

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### Approaches to carbon measurement

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#### Summary of key points:

- The background to carbon measurement and reporting has its roots in the 1994 [United Nations Framework Convention on Climate Change \(UNFCCC\)](#) and the [Kyoto Protocol](#)
- Carbon dioxide equivalents (CO<sub>2</sub>e) is the universal unit of measurement to indicate the global warming potential (GWP) of a range of greenhouse gases (GHGs), expressed in terms of the GWP of one unit of carbon dioxide.
- There are a range of carbon calculators/toolkits available, many of these free of charge, that can be used to estimate the carbon footprints of individuals, households, activities or areas.
- It is also possible to measure carbon emissions for a range of activities using carbon conversion factors.
- It is much easier to estimate the carbon savings associated with some activities (e.g. installation of energy-saving equipment) than others (e.g. behaviour change over the long-term). Either way, a sensible timeframe should be attributed to the carbon saving of each activity.
- If the range of activities for which carbon emissions need to be measured are many and/or complex, it may be possible to have a bespoke carbon toolkit developed for your project, but there will be a cost associated with this, so will need to be budgeted for.



#### Who this is for:

This learning signpost is for people involved in Climate Action Fund projects to help them work out how to assess or measure the carbon emission impacts of their projects.

This note is meant to act as a starting point. This second version captures updates from two of the Climate Action Fund projects on their approaches to carbon measurement.

There is a glossary and jargon buster accompanying this learning signpost to explain terminology and abbreviations used.

## Starting point:

Before we start it is worth exploring the background to carbon measurement and reporting and why it is important.

### Background to carbon emission measurement.

In 1994, the [United Nations Framework Convention on Climate Change \(UNFCCC\)](#) came into force, ratified by 197 countries, with the aim of preventing “dangerous” human interference with the climate system. Its ultimate goal was to stabilize greenhouse gas concentrations (GHGs) “at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system. The onus was on industrialised countries as the source of most past and [then] current greenhouse gas emissions, to do the most to cut emissions at home.” Signatories were required to regularly report on their climate change policies and measures and to submit an annual inventory of their greenhouse gas emissions, including data for their base year (1990) and all the years since.

In 2005 the [Kyoto Protocol](#), currently ratified by 192 countries, came into force (although it had been adopted in 1997) and set binding emission reduction targets for 37 industrialised countries and economies in transition as well as the European Union (EU) as a whole. The UK targets fell within those set for the EU as it was an EU member state at that time and was committed to reduce GHG emissions by 8% from the 1990 base year between 2008-12.

[The Climate Change Act 2008](#) committed the UK to an 80% reduction in carbon emissions relative to the levels in 1990, to be achieved by 2050. In June 2019, secondary legislation was passed that extended that target to “at least 100%”.

The [Paris Agreement](#) (adopted in 2015 and came into force in 2016) requests that ‘each country outlines and communicate their post-2020 climate actions to reduce their Greenhouse Gas emissions in order to reach the goals of the Paris Agreement. and actions they will take to **build resilience to adapt** to the impacts of rising temperatures.’ These are known as their Nationally Determined Contributions (NDCs). In the UK, the Climate Change Committee<sup>1</sup> was established under the Climate Change Act 2008. It is an independent. Statutory body whose purpose is to ‘advise the UK and devolved governments on emissions targets and to report to Parliament on progress made in reducing greenhouse gas emissions (GHGs) and preparing for an adapting to the impacts of climate change’. The UK was the first country to set legally binding carbon budgets<sup>2</sup>, that is the total amount of GHGs that the UK can emit over a 5 year period. Every tonne of GHGs emitted to 2050 will count, so if there is an increase in GHG emissions in one sector, there will have to be a corresponding decrease in GHG emissions in another sector.

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<sup>1</sup> <https://www.theccc.org.uk/about/>

<sup>2</sup> <https://www.gov.uk/guidance/carbon-budgets>

In April 2021, the UK Government set an emissions reduction target of 78% compared to 1990 levels by 2035. For the first time, the sixth carbon budget will include the UK's share of international aviation and shipping emissions, which will be a major milestone in achieving the 2050 net zero target.

An indication of the importance of carbon measurement is that rules and regulations are being developed to require organisations to reduce carbon emissions. A recent example was the announcement by Chancellor of the Exchequer, Rishi Sunak to coincide with COP26, that all listed companies in Britain will have to produce a strategy for reducing their carbon emissions, or face fines.

### **How are carbon emissions measured/reported?**

Reports, articles and media generally use the term carbon emissions when referring to greenhouse gas emissions. This is because a globally agreed system needed to be found for measuring/reporting GHG emissions in order to have a reliable, comparable method within and between countries for robust measurement and reporting of progress against climate change targets.

Carbon dioxide equivalent (CO<sub>2</sub>e) is the universal unit of measurement to indicate the global warming potential (GWP) of GHGs, expressed in terms of the GWP of one unit of carbon dioxide. For example, the gas with the highest GWP is sulphur hexafluoride (SF<sub>6</sub>), used in the production of insulation for medium and high voltage electrical installations. It has a 100-year GWP of 23,900 times that of CO<sub>2</sub>.

GWP is a term used to describe the relative potency, molecule for molecule, of a [greenhouse gas](#), taking account of how long it remains active in the atmosphere. The global-warming potentials (GWPs) currently used are those calculated over 100 years. Carbon dioxide (CO<sub>2</sub>) is taken as the gas of reference and given a 100-year GWP of 1. The source of GWPs in the UK is the [carbon conversion factors](#) from the Department of Energy Security and Net Zero and [Department of Business Energy and Industrial Strategy \(BEIS\)](#). These are freely accessible and can be used to assess the carbon emissions (CO<sub>2</sub>e) of a given activity.

Throughout this learning signpost the terms carbon and carbon emissions are used interchangeably to describe GHGs and CO<sub>2</sub>e.

**Methodologies, methods and tools** – most of the resources flagged in this note are specific 'tools', which will need to fit within your overall monitoring and evaluation approach/framework for assessing the carbon impacts your project is trying to deliver. As carbon conversion factors, described above, are updated annually, it is worth checking when tools were last updated to ensure that you are using the most up to date data.

### **How to measure carbon emissions of your project/activities?**

It is likely that your project will want to measure carbon emissions associated with some or all of your project activities. It is up to your project to identify the activities/areas you wish to measure the carbon emissions of. You may already have done this in your grant application, project plans or evaluation framework. If not, you may want to work collaboratively with your partners, project team and beneficiaries to identify which activities you want to measure the carbon emissions of.

*In future phases of the CAF programme, we may identify activities/areas of particular interest or that are useful to measure carbon emissions consistently across the programme. So we are keen to hear what decisions you make and what you find useful to inform developments of the guidance in future.*

### **Different approaches to carbon measurement.**

This section describes four different carbon measurement approaches that might be useful to consider when making decisions on carbon measurement for your project/activities.

#### **(a) Area-based carbon measures**

For area-based carbon footprints, these can be done on a territorial basis, which includes all emissions generated within a defined spatial area including from transport, industry and agriculture activities, or on a consumption basis, which includes the upstream and downstream emissions from residents' consumption of food, manufacture goods and personal transport activity, irrespective of where the emissions themselves occur. The [Impact tool](#) can provide results on both a territorial and consumption basis and show these as both total and per household carbon emissions for each. The [Place-Based Carbon Calculator](#) provides results on a consumption basis. They are both free to use; details are provided below.

Example: [Our Streets Chorlton](#) used the [Place-Based Carbon Calculator](#) to help understand Chorlton's carbon emissions; what the average carbon footprint per person was across two wards in Chorlton and where the carbon emissions were coming from. The results and a presentation can be found [here](#)

Area-based tools are useful to provide a snapshot of the carbon footprint of an area and the carbon emissions of different sectors/activities within that area, so can be useful at an early stage of a project as they may help inform project activities and/or help to identify areas with a similar profile to explore further, or with whom to open a conversation. As these are for whole areas across multiple activities and sectors, whether on a territorial or consumption basis, these are unlikely to provide results that will show the carbon impacts of individual projects. However, these can be useful in identifying priorities for action on carbon emission reduction across an area. Through working in partnership with local organisations, such as local authorities, it may also be possible to influence other activities that over time would contribute to changes in carbon impacts that could be measured by area-based toolkits.

#### **(b) Individual carbon footprints**

For individuals, there are many free online carbon calculators available to estimate an individual's or household's carbon footprint. These tend to be 'off the shelf' and many are free to use. They vary enormously in format, platforms, level of detail / data to input, whether results can be saved etc. and so results for an individual or household can also vary. In considering whether one of these might be a useful tool for measuring some activities associated with your project, you may want to consider how

usable these are for the groups that you want to use these, for example, what/how much data needs to be inputted, language used, how easy it is to navigate from page to page.

These toolkits will provide a snapshot of an individual's/household's carbon footprint. In order to measure the impact of a project's activities on these, a before and after footprint will need to be done by project participants/beneficiaries, i.e. at the start of a project/activity and again at the end (see process section below)

Example: Ashton Hayes, a village in Cheshire set out an ambition in 2006 to become the first carbon neutral village in England and established [Ashton Hayes Going Carbon Neutral](#). One of the first things that was done was using a household carbon footprint to assess the carbon footprint of household and the whole village. Since 2006 five carbon footprint surveys have been carried out, which show that the community has managed to cut its carbon emissions by 40% through behavioural changes such as switching off appliances and changing to low energy light bulbs.

You may wish to consider taking a sampled approach if it's not appropriate or possible to complete large numbers of carbon footprints.

A review of 11 online individual carbon calculators was undertaken in 2020 for the [National Association of Local Councils](#), which would be a useful starting point for projects considering using these; we have picked out a few of these in the table of suggested tools below.

### **(c) Sector-specific measures**

For particular sector activities that your project may be delivering, it might be worth considering using a sector specific carbon toolkit. Some of these may charge for use, others, such as the CAF-funded Farm Carbon Toolkit are available free of charge (details below). These are more likely to include measures for activities that your project is delivering. The Farm Carbon Toolkit has been designed specifically to assist farmers/growers to understand their GHG emissions and make decisions based on this for their farm/enterprise.

Example: The Climate Action funded [Farm Net Zero](#) project works with a community of farmers in East Cornwall, assessing the farms' carbon footprints each year of the 5-year project. It uses the [Farm Carbon Calculator](#) to produce the carbon footprint, which is specifically designed for farms and covers the main sources of farm emissions (fuel, fertiliser, materials) and also includes areas that can capture carbon from the atmosphere (hedgerows, woodland, soil carbon). The project team has a list of all the elements to include in the carbon footprint that they fill out with the farmer and then enter into the Calculator. This has the "emissions factor" for each of the elements included in it, so works out the farm's carbon emissions, carbon capture and overall carbon balance.

For the soil carbon measurement, soil samples are taken every other year of the project, using the protocol outlined in the [Soil Carbon Project Field and Lab Guide](#), funded by Agri-Tech Cornwall. Repeating the soil sampling will allow the team to record the effects of management practices on the soil carbon storage, and hopefully see an increase over the course of the project.

### Learning

Ideally, all the carbon footprints would have a consistent start point and recording period. However, this is not always practical.



### Successes:

#### ***Soil sampling kit - Alex Bebbington, FNZ***

- Carbon footprints have been provided to the farmers involved in the project and the project team met with the farmers to discuss these and opportunities to improve them. These meetings helped inform the programme of farm walks to look at practices that can help to reduce farm carbon footprints (examples include a hedgerow management event to optimise carbon storage in hedges, a grazing management event to look at how to grow quality grass with a reduction in the amount of carbon-intensive artificial fertiliser and an event looking at methane capture technology from cattle manure storage and how it can be processed for use as a fuel).

### Challenges:

- It has been challenging to have a defined and consistent start point for all the farm businesses involved in the project to measure from. However, it is more important for a farm to compare with itself year-on-year.
- It can be difficult to get data from some people, especially as they run busy farms and full records are not always immediately available. This is addressed by building relationships and communicating with the farmers to make sure they are engaged in the process throughout

### Do

- Make carbon footprinting an easy process, e.g. by having a simple list of the main things to include.
- Ask for feedback from the people you are doing a footprint with.

### Don't

- Get too hung up on the finer details of the farm business, a broad approach suits the main elements of the carbon footprint.

#### **(d) Bespoke carbon footprints**

There may be no single existing carbon toolkit that covers all activities your project is delivering, so you may decide to use more than one toolkit for different activities. Alternatively, you may decide to have a bespoke carbon toolkit developed that would encompass most of the activities your project will deliver. This could be organisational, activity, area or demographic community based. There is usually a cost to developing these, so careful consideration would need to be given as to the value of this to the project and how to resource this.

Example: The Centre for Sustainable Energy (CSE) as part of the Bristol Community Climate Action programme developed a number of bespoke area based carbon footprints as part of the development stage one of their Climate Action funded project. This was a predictive exercise of what would happen in carbon terms if all aspects of the programme were delivered as partners anticipated. An example of this is the [Easton and Lawrence Hill](#) carbon footprint.

In the delivery stage two of the programme, most of CSE's carbon measurement work is focused on calculating the carbon savings of the community partners' 'demonstration projects' and where possible the carbon savings of the other strands, such as the mentoring and leadership programme.

The steps taken to build a framework for carbon savings monitoring of the demonstration projects are:

- Ensuring there is an accurate picture of the activities that each community partner is doing as part of their demonstration project. Work on this is ongoing and revisited as the partner's projects evolve.
- Based on this, decisions are made on which parts of each project carbon saving calculations can be done, e.g. energy efficiency measures being installed in homes and community buildings; reductions in food waste; diversion of food waste going to landfill and to composting; changes in people's diets.
- A monitoring spreadsheet is created for each community partner to ensure they are collecting the right information so that carbon savings calculations can be done.
- The carbon savings are calculated using greenhouse gas conversion factors (see earlier). For example, the carbon factor for use of grid electricity is 170gCO<sub>2</sub> per kWh, so to work out the carbon savings of an activity, the factor is multiplied by the data from the monitoring spreadsheet. If energy efficiency measures reduced electrical consumption by 10 kWh, the carbon saving is 1.7kgCO<sub>2</sub>.

Learning so far

It is difficult to calculate the carbon savings of certain activities/interventions, such as training and awareness raising. In some cases a decision was made not to calculate potential carbon savings, where these are very small, and the assumptions made would be too great, e.g. in providing climate change awareness training to refugees. Another approach to minimise assumptions being made will be to work with a small cohort of residents engaged in part of the programme to do more in-depth monitoring and calculate carbon savings from these measured changes. For example, engaging with individuals involved in a food and food waste behaviours project to look at what degree food waste going to land fill is composted instead as a result of changes.

Do

- Make pragmatic decisions about what you are able to calculate carbon savings for if savings would be very small, and a lot of assumptions would have to be made.
- Keep returning to the method developed to check it still works,
- Make sure that information needed is collected on a regular basis.



## Process

Whichever approach your project decides to use to measure the carbon impacts of the identified project activities, there are a number of steps to consider in doing this:

- It is useful to do the carbon measurement at the start/early on in the project. This will provide a **baseline** which should be recorded, against which you can measure progress throughout and at the end of the project. This will involve data gathering which, depending upon who is using the carbon toolkit, may require surveys, household energy data collection etc.
- Following the first carbon measurement, **review** the results, and processes involved in using the toolkit and **refine** these as necessary
- **Repeat** the carbon measurement at regular intervals, making a record of this each time you do it. The interval will vary from project to project and may vary between activities within a project.
- **Feedback** results to the people who have taken part in the project and other stakeholders on a regular basis. This can be very helpful for motivating behaviour change.
- **Repeat**

## Other considerations

### Skills and Capacity to undertake carbon measurement

One of the key considerations in deciding which approach to take in measuring carbon emissions of your project will be what skills and capacity you have to do this. If this is limited, then keep it simple by using an off the shelf carbon toolkits, examples of these are described in the table below.

### Project design

You may decide to use carbon measurement to help in your project design, i.e. do you want the project focus to be on the activities that will deliver the biggest carbon reductions? If this is the case, then there may be other things to consider to determine whether your project can actually influence or deliver those carbon emission reductions. For example, if the highest carbon emission reductions for your project would be delivered through energy efficient retrofitting of buildings, issues such as property ownership or tenancy agreements may need to be considered to see if this is possible.

### Behaviour change measures

One of the questions asked by projects is how to measure the **carbon impacts of behaviour change**. The UK [Climate Change Committee](#) estimates that the majority of changes needed to achieve net zero will involve some form of behaviour change, including the adoption and usage of low carbon technologies. It is a challenge to measure directly, as changing behaviours that lead to carbon emission reductions happen at different times. Some of these can be picked up through individual or sector/business carbon toolkits, as will show the before and after carbon footprints. In order to assist with identifying which behaviours could deliver the biggest carbon emission reductions, the Department of Business Energy and Industrial Strategy (BEIS) and the Department of Environment Farming and Rural Affairs (Defra) commissioned a [Net Zero Societal Change Analysis' report](#), produced in June 2021 to better understand the possible impact of different societal and behavioural changes in

achieving the UK's 2050 net zero emissions target. It prioritises just under [40 behaviours](#) that would help the UK achieve net zero carbon. You may find this useful when making decisions on project activities and carbon emission reduction. The report and appendices are detailed, so the [summary report](#) might provide a good starting point

### Which carbon emissions can organisations measure

For organisations looking to measure their carbon emissions, decisions will need to be made on what should be included, described as Scopes 1, 2 and 3, set out below:

- **Scope 1** – Emissions from operations that are owned or controlled by the reporting organisation
- **Scope 2** – Emissions from the generation of purchased or acquired electricity, steam, heating, or cooling consumed by the reporting organisation
- **Scope 3** – All indirect emissions (not included in scope 2) that occur in the value chain of the reporting organisations, including both upstream and downstream emissions

If using an existing toolkit to measure an organisation's carbon emissions, it would be helpful to find out which scopes are being used to determine carbon emissions.

### Long term carbon measurement

Given that some carbon impacts of projects may be realised after a project has ended, you may wish to consider putting systems in place for people to continue to use the toolkits and report results as part of a project's legacy. Alternatively you could use one of the approaches/toolkits described above and below, using likely changes/data projections for inputs, or you may wish to consider using carbon conversion factors described above. You will need to caveat your reporting on these carbon measurements that they are using likely changes/data projections and existing carbon toolkits/conversion factors.

### Data storage and consistency of data

In collecting/reporting on carbon emissions it is important to ensure data collection and storage complies with legal requirements. The [Quicksilver carbon calculator](#) includes guidance on data protection and consistency that you may find useful.

## FAQs

### Q. Where to go for further help/support

There are links provided throughout this learning signpost to sources of information and toolkits that can help individuals/projects in measuring their carbon emissions. Grant holders within the Climate Action Fund programme have a range of knowledge and experience in carbon measurement. Information on projects is available through [Slack](#).

### **Q. What if my/the carbon emissions of the activity are low or carbon emission reduction is not the main focus of the project?**

If yours or the carbon emissions of the activity you are looking at are low, then you/your project may decide to focus efforts on other areas that have a higher carbon footprint to see how they could be reduced, as this is likely to deliver higher carbon reductions. Even if yours/an activity's carbon emissions are low, there may be changes that you can make to reduce the carbon emission further.

Alternatively, direct delivery of carbon emission reductions through your project may not be the priority, your project may be focusing on other activities, such as awareness raising, capacity building, research or innovation that may lead to carbon emission reductions in the long term.

### **Q. How could we communicate information about carbon emissions?**

The National Lottery has produced a [media and communications toolkit](#) to help community-led climate action projects it funds with communicating and sharing the work they are doing.

## **Links**

For information on calculating travel distances:

[www.gov.uk/government/collections/national-travel-survey-statistics](http://www.gov.uk/government/collections/national-travel-survey-statistics)

For grid electricity: [www.nationalgrideso.com/future-energy/future-energy-scenarios](http://www.nationalgrideso.com/future-energy/future-energy-scenarios)

Datasets on annual greenhouse gas and carbon dioxide emissions relating to UK and England consumption: [www.gov.uk/government/statistics/uks-carbon-footprint](http://www.gov.uk/government/statistics/uks-carbon-footprint)

## **Existing tools**

The list below outlines a number of existing frameworks, tools and methods covering: broad socio-economic outcomes; well-being; social cohesion; economic outcomes (e.g. green jobs) and engagement. This is a starting point and will be added to as the CAF programme progresses – it's not an exhaustive list or an endorsement of particular tools or approaches. It can also be overwhelming to consider the options available. So please do ask and share feedback on [Slack](#) about any tools or approaches that you have found useful (or not!).

## Examples of carbon measurement tools and methods

Area/ project/ activity type	Available tools	About this tool	
Farming/Food growing	<a href="#">Farm carbon toolkit</a>	A free toolkit, available online to measure CO <sub>2</sub> e for farming and food growing activities.	
Small communities	The <a href="#">IMPACT Community carbon calculator</a> has been developed by the Centre for Sustainable Energy (CSE), to enable parishes or small communities to estimate their carbon emissions. The spatial boundary used for this is the civil parish area.	<p>This toolkit has been designed to enable parishes or small communities to estimate their carbon emissions.</p> <p>The spatial boundary used for this is the civil parish areas of England.</p> <p>The calculator can present the area's carbon footprint on either a territorial or a consumption basis.</p> <p>Results are presented graphically, but it is also possible to access the raw data behind the calculations.</p>	
		<p>Pros:</p> <ul style="list-style-type: none"> <li>Results can be shown for the whole area or on a per household basis (CO<sub>2</sub>e).</li> </ul>	<p>Cons:</p> <ul style="list-style-type: none"> <li>As the spatial boundary used for this is the civil parish areas of England, it excludes Scotland, Wales and Northern Ireland and many urban areas in England.</li> </ul>

Area/ project/ activity type	Available tools	About this tool	
Area based	<a href="https://www.carbon.place/">https://www.carbon.place/</a>	<p>This is another tool for estimating the carbon emissions of an area. It is based on Lower Super Output Areas (LSOAs) in England. You don't need to know what the LSOA is for the area you wish to get a carbon footprint on, as these are shown in map form and you can simply click on the chosen area on the map.</p>	
		<p>Pros:</p> <ul style="list-style-type: none"> <li>This may be particularly useful for areas in England that aren't parished (often urban areas).</li> </ul>	<p>Cons</p> <ul style="list-style-type: none"> <li>The tool does not cover Scotland, Wales or Northern Ireland.</li> </ul>
Individual activity (information taken from <a href="#">National Association of</a>	<a href="#">Carbon Footprint Tool</a>	<p>Carbon Footprint. This is a free carbon calculator. You can choose whether to calculate a carbon footprint for an individual or household. There is also a free online emissions calculator suitable for micro businesses</p>	

Area/ project/ activity type	Available tools	About this tool	
Local Councils review of online carbon calculators)		Pros: <ul style="list-style-type: none"> <li>• provides the breakdown of carbon emissions for each of 6 categories.</li> <li>• There is a resource link with information to help reduce carbon emissions.</li> </ul>	Cons: <ul style="list-style-type: none"> <li>• There are some limitations in some categories, e.g. there are limited airports that can be selected for air travel.</li> </ul>
	<a href="#">Resurgence carbon calculator</a>	Resurgence. A free online carbon calculator. There are 2 free online carbon calculators, one quick and one more in depth version.	
	<a href="#">WWF carbon footprint</a>	Pros: <ul style="list-style-type: none"> <li>• There is information and guidance provided throughout the toolkit.</li> </ul>	Cons: <ul style="list-style-type: none"> <li>• Requires more detailed information to be input</li> </ul>
Pros: <ul style="list-style-type: none"> <li>• quick and easy to complete</li> <li>• guidance is given on steps to reduce carbon emissions based on the results</li> </ul>		Cons: <ul style="list-style-type: none"> <li>• the score is calculated on approximations</li> </ul>	
Conversion factors	<a href="#">Greenhouse gas reporting: conversion factors 2021</a>	The Greenhouse gas reporting: conversion factors 2021. These can be used to measure the carbon emissions (CO <sub>2</sub> e) of a given activity and are updated annually	

