

Bwyd a Diod Cymru
Food & Drink Wales

Sustainability Training

Measuring your Carbon Footprint & Developing a Carbon Reduction Plan

Table of Contents

1 Module overview

2 Section 1: The Business Case for Measuring your Carbon Footprint and Developing a Carbon Reduction Plan

4 Identifying cost-saving opportunities

5 Increased access to finance & funding

7 Section 2: What is Carbon Footprinting?

11 Section 3: Measuring Your Carbon Footprint

20 Section 4: Moving from Carbon Footprinting to a Carbon Reduction Plan

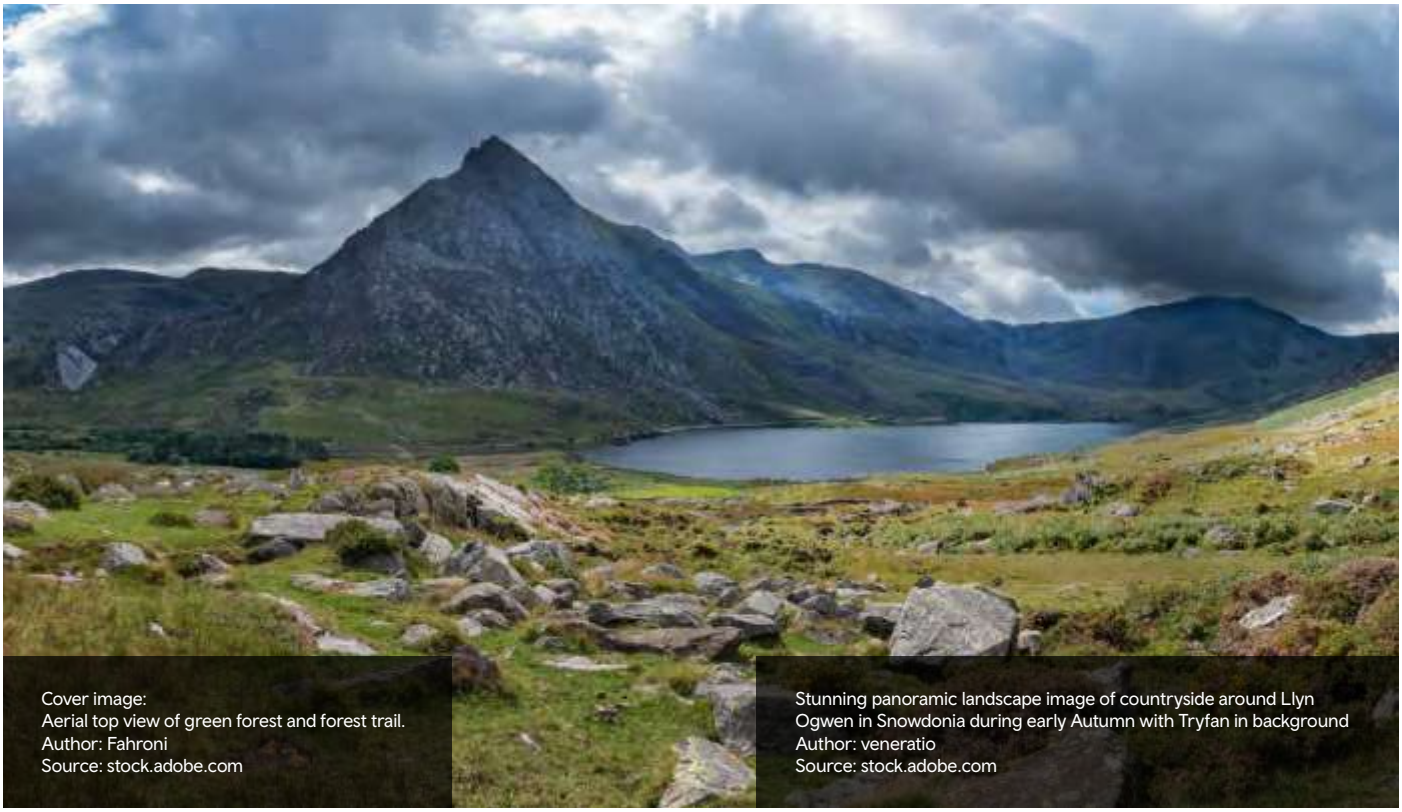
25 Section 5: Communicating Your Carbon Reduction Plan

28 Section 6: Key takeaways

29 Key resources

30 Glossary

31 Bibliography



Cover image:
Aerial top view of green forest and forest trail.
Author: Fahroni
Source: stock.adobe.com

Stunning panoramic landscape image of countryside around Llyn Ogwen in Snowdonia during early Autumn with Tryfan in background
Author: veneratio
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Module Overview

This module is divided into six sections:

Section 1 – The Business Case for Measuring your Carbon Footprint & Developing a Carbon Reduction plan

Why carbon measurement and reduction matters for Welsh food and drink businesses, covering the financial, operational, and reputational benefits to understanding and addressing emissions.

Section 2 – What is Carbon Footprinting?

Explains the key concepts underpinning footprinting such as emission Scopes 1, 2, and 3, emission factors, and the role of footprinting in building effective decarbonisation and wider sustainability strategies.

Section 3 – Measuring Your Carbon Footprint

Provides practical guidance on data collection, calculation methods, and tools for accurate measurement, including Wales-specific considerations.

Section 4 – Moving from Carbon Footprinting to a Carbon Reduction Plan

What is a Carbon Reduction Plan, establishing a roadmap, and prioritising actions to reduce emissions.

Section 5 – Communicating Your Carbon Reduction Plan

Offers guidance on transparent reporting, stakeholder communication, and best practices for presenting progress.

Section 6 – Key Takeaways

Key learnings from this handbook.



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The Business Case for Measuring your Carbon Footprint and Developing a Carbon Reduction Plan

Measuring and reporting your carbon footprint is not just an environmental responsibility, it is a strategic necessity for Welsh businesses both today and for the foreseeable future. An accurate carbon footprint is the first step in developing a carbon reduction plan which provides a structured process to act on emissions hotspots identified in your footprint. You can set practical reduction targets, and recommend and implement measures that deliver environmental, financial and reputational benefits.

Retailers, distributors and trade partners increasingly demand carbon data from their suppliers, and financial institutions are beginning to prioritise low-carbon investments and clients. **By understanding the sources and scale of your business's emissions across scopes 1, 2 and 3, you gain the insight needed to shape practical, cost-effective actions that deliver both environmental and financial benefits for your business:**

Good to know
Understanding your business's carbon footprint enables you to take practical steps towards environmental and financial benefits.

	Carbon Footprinting	Carbon Reduction Plan
Cost savings & efficiency	Identifies where energy, water, raw materials & fuel are being wasted, revealing efficiency opportunities across operations (e.g. energy use, refrigeration, transport, waste).	Translates identified inefficiencies into a prioritised programme of actions (quick wins & longer-term investments) that reduce operating costs & exposure to rising energy prices.
Data-driven decision making	Provides a quantified emissions baseline across Scopes 1, 2 & 3, highlighting emissions hotspots and their relative contribution to total emissions.	Uses hotspot data to prioritise actions based on impact, feasibility & cost, guides capital investment & operational change.
Market access & competitiveness	Enables compliance with retailer & trade customer requirements for emissions data, footprint disclosure & transparency.	Demonstrates credible action & progress through targets & a roadmap, strengthening supplier status & positioning the business as a preferred low-carbon partner.
Access to finance & funding	Provides the emissions data increasingly required by lenders, investors & green finance providers.	Strengthens funding applications by evidencing a structured decarbonisation strategy, helping unlock grants, loans or preferential finance terms.
Supply chain resilience & risk management	Improves understanding of up & downstream emissions risks, particularly within Scope 3 (ingredients, packaging, logistics).	Sets out a plan to engage suppliers & partners to reduce Scope 3 emissions, improving resilience to climate, price & regulatory risks.

	Carbon Footprinting	Carbon Reduction Plan
Regulatory readiness & compliance	Establishes emissions data aligned with recognised standards (GHG Protocol), supporting current & future reporting requirements.	Provides a documented plan aligned with standards & policy expectations (e.g. GHG Protocol, SECR, PPN 06/21, WPPN 06/21), helping future-proof the business.
Brand reputation & trust	Enables credible, evidence-based sustainability claims backed by robust data, reducing the risk of greenwashing.	Demonstrates commitment through targets, actions & progress reporting, building trust with customers, investors, staff & consumers.
Strategic planning & long-term resilience	Creates a baseline against which progress can be tracked over time, supporting year-on-year comparison.	Converts the baseline into a long-term trajectory aligned with Welsh and UK Net Zero targets, embedding carbon management into business strategy.
Contribution to Net Zero & climate goals	Quantifies the business's contribution to greenhouse gas emissions & identifies where reductions will have the greatest climate impact.	Sets out how & when emissions will be reduced, aligning business action with national carbon budgets & Net Zero commitments.

To help you consider sustainability advantages of growing your business we have developed the "Growing your Business Sustainably" module.



Forest top-down image.
Author: toa555
Source: stock.adobe.com

Identifying cost-saving opportunities

A clear picture of your carbon footprint can reveal where energy or resources, and therefore money, is being wasted, and where improvements can be made. Implementing energy efficiency measures and transitioning to green energy sources can potentially reduce operating costs, improving your bottom line, whilst cutting emissions. These investments not only lower energy bills on installation, but also future-proof businesses against rising energy costs and emissions-related regulatory change.

Some key areas **where savings can often be made** after footprinting:

Area	Description of possible savings
Energy Efficiency	• **Electricity and gas use:** Identifying high energy consumption in production processes can lead to upgrades like LED lighting, efficient motors, or heat recovery systems. • **Switching to renewable tariffs:** Often cheaper in the long term & reduces exposure to fossil fuel price volatility.
Refrigeration & Cooling	• **Maintenance & leak prevention:** Reducing refrigerant leaks lowers both emissions & costly refrigerant replacement. • **Upgrading equipment:** Modern refrigeration systems are more energy-efficient, cutting utility bills.
Process Optimisation	• **Reducing waste:** Lowering food waste reduces disposal costs & raw material purchases. • **Improved production scheduling:** Minimising idle time for machinery saves energy. The Food Loss & Waste training module offers in-depth insight about how emissions & costs arising from waste can be reduced.
Transport & Logistics	• **Route optimisation:** Reduces fuel use & maintenance costs for delivery fleets. • **Vehicle upgrades:** Transitioning to electric or hybrid vehicles can lower fuel costs over time.
Packaging	• **Lightweight or recyclable materials:** Cuts material costs & waste disposal fees. • **Local sourcing:** Reduces transport costs & emissions. The Food Packaging training module offers in-depth insight into how emissions & costs arising from packaging can be reduced.
Water & Waste Management	• **Efficient water use:** Lower water bills & wastewater treatment costs. • **Recycling & circular practices:** Can reduce landfill fees & sometimes generate revenue.
Supply Chain Engagement	• **Bulk purchasing or supplier collaboration:** Lower costs through economies of scale & reduced transport emissions.

Click here to Learn how Llaeth y Llan used its carbon reduction plan as a strategic planning tool which helped them identify areas to cut costs and improve efficiencies.

Increased access to finance & funding

Businesses that demonstrate a proactive approach to decarbonisation may be better positioned to access cheaper capital through specialist green finance or grants or soft loans linked to capital investment in sustainability improvements. The Development Bank of Wales offers the Green Business Loan Scheme, and the Welsh Government's Food Business Accelerator Scheme explicitly encourages applications for capital investment which improve productivity and sustainability. The Santander-Tesco supply chain finance programme is another example of a financial instrument which "rewards" sustainability reporting and progress towards targets. Launched in 2021, this supply chain finance scheme offers Tesco suppliers preferential finance rates based on their carbon data disclosure, emissions reduction targets and progress against sustainability goals. Suppliers can benefit from accelerated payment of invoices, reducing debtor days and improving their cashflow. Tesco benefits from the scheme with the collation of data from its downstream suppliers which supports the retailer with its scope 3 reporting requirements.

Good to know

Calculating your footprint & setting measurable reduction targets could:

- Unlock access to cheaper money
- Accelerate your transition to low-carbon operations
- Create a virtuous circle of investment, cost reductions & environmental benefits

Enhanced competitiveness

In today's marketplace, **sustainability is a competitive differentiator and a commercial necessity**. Businesses that lead on understanding and reducing their emissions, and climate action in general, strengthen their market brand reputation and build trust with customers, investors, and partners.

Many supply chains now require robust environmental credentials as a condition of entry into their supply chains. Key trade customers have challenging emissions reductions targets and expect their suppliers to play their part in achieving those targets.

Demonstrating climate leadership through transparent carbon reporting and subsequent development (and adherence to) reduction plans ensures continued access to these customers and consumers as environmental requirements evolve and helps to position your business as a preferred supplier.

Supermarket	Key Requirements
Tesco	Annual reporting of Scope 1 & 2 emissions (plus farm-level for agri suppliers); encourages alignment with SBTi targets.
Sainsbury's	Suppliers covering 80% of Scope 3 emissions must disclose via Manufacture 2030/ HIGG and set 1.5 °C-aligned SBTi targets
Morrisons	Own-brand suppliers report emissions biennially; collaborate via Manufacture 2030 and WRAP Net-Zero Action Programme

Summary of Major UK Supermarkets & Supplier Carbon Footprinting Requirements

Supermarket	Key Requirements
ASDA	High-impact suppliers share environmental, social, governance, and carbon data via EcoVadis; linked to sustainability finance incentives
Waitrose	Seafood suppliers use SCEPT tool for emissions profiling (fuel, packaging, transport
Co-op	Suppliers align with Co-op's SBTi targets and Net-Zero Standard
M&S	Suppliers expected to reduce carbon in line with SBTi guidance, and share emissions data to contribute to M&S's carbon reduction roadmap

Key Takeaway:

Measuring and reporting your carbon footprint and developing a carbon reduction plan:

- **Highlights potential cost savings through operational efficiency gains.**
- **May help unlock access to finance.**
- **Protects and enhances relationships with key trade customers.**
- **Enhances brand integrity and trust with consumers.**
- **Contributes to national and global carbon reduction targets, protecting future generations.**



Photo of poplar trees.
Author: vahit
Source: stock.adobe.com

What is Carbon Footprinting?

A carbon footprint represents the total greenhouse gas (GHG) emissions caused directly and indirectly by an individual, organisation or nation, expressed as a number of COe (carbon dioxide equivalents). This metric, COe, includes the emissions from six key greenhouse gases identified under the Kyoto Protocol:

- Carbon dioxide (CO_2).
- Methane (CH_4).
- Nitrous oxide (N_2O).
- Hydrofluorocarbons (HFCs).
- Perfluorocarbons (PFCs).
- Sulphur hexafluoride (SF_6).

These six collectively account for the vast majority of GHG emissions. Your business's carbon footprint is the total of emissions you are directly or indirectly responsible for through your business operations.

Why carbon footprinting is essential

Carbon footprinting is the foundation for targeted and effective climate action for businesses, organisations and individuals. It quantifies environmental impact, enables the identification of emissions hotspots (which are often areas of inefficient operation), and the development of strategies to reduce emissions, therefore cutting both costs and environmental impact.

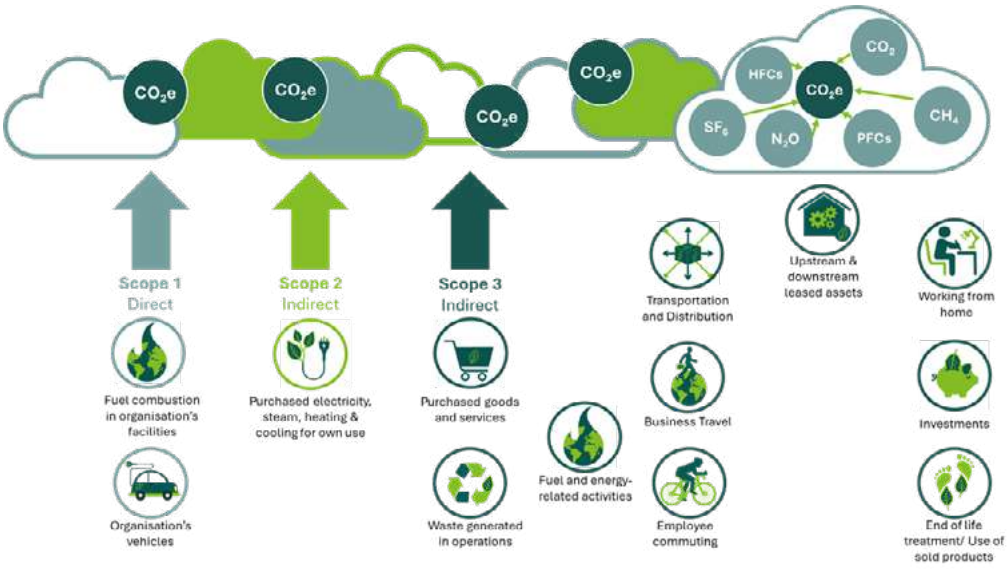
Emission scopes

The Greenhouse Gas Protocol divides emissions into three scopes:

- **Scope 1: Direct emissions** from sources owned or controlled by the business, such as fuel combustion in boilers, company vehicles, and refrigerant leaks.
- **Scope 2: Indirect emissions from energy** purchased by the business, such as electricity, heat, or steam.
- **Scope 3: Other indirect emissions** from activities not directly controlled by the business but linked to its operations, such as purchased goods and services, waste disposal, business travel, and upstream supply chain activities.

For most businesses, Scope 3 emissions dominate, particularly in sectors like food and drink where agricultural inputs and packaging have significant carbon impacts.

The figure to the right showcases an overview of scopes 1, 2 and 3 emissions



Why understanding scopes matters

Understanding how the different scopes emissions are categorised is key to understanding the areas in which your business activities are generating the most greenhouse gases and therefore where to focus action. These high-emission areas are known as emissions 'hotspots'. A carbon footprint will break down overall emissions down by scopes 1, 2 and 3 and then highlight hotspots within each of these. Carbon footprint reporting standards require that emissions be categorised into scopes to ensure transparency and equivalency of reporting.

Businesses have varying degrees of control over their sources of emissions, depending on which scope they come under. It is easier to act on hotspots occurring in scopes 1 and 2, and more challenging to address those within scope 3.

Good to know

Understanding scopes helps to:

- Identify emission hotspots.
- Prioritise reduction strategies where impact is greatest.
- Align with supply chain and government.
- reporting standards and targets.

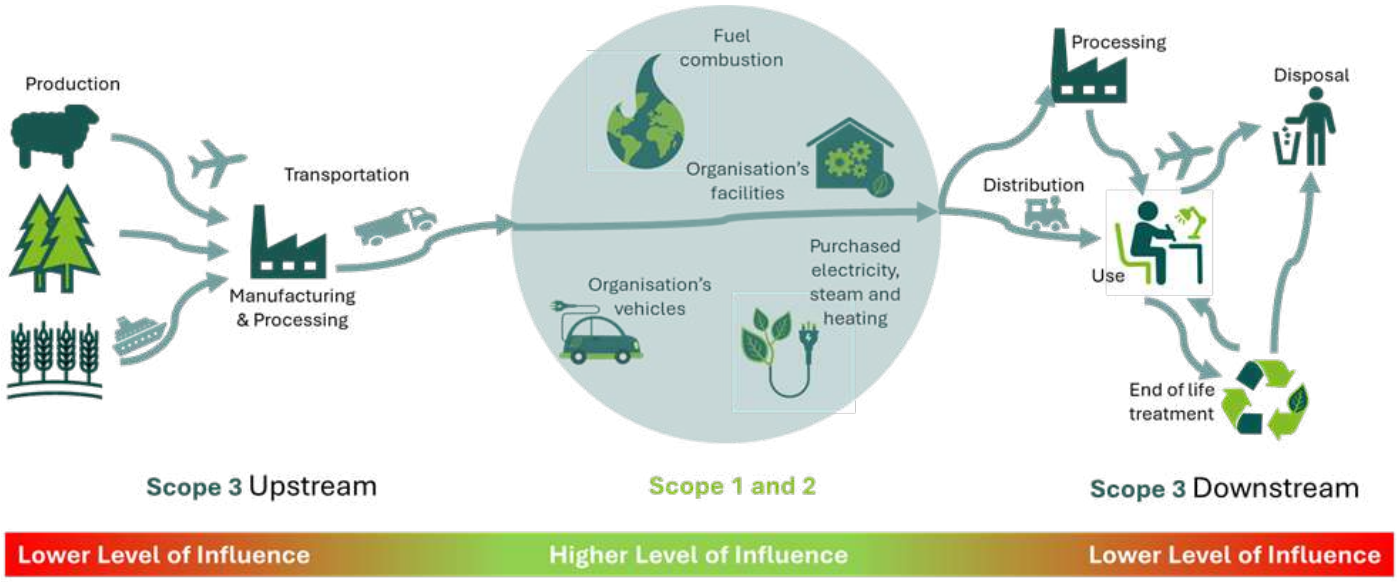


Figure above. Levels of influence over emissions depending on scope (Adapted from Content made by The Carbon Trust for their Carbon Footprinting for SMEs module.)

What are emission factors?

Emissions from a particular activity or operation, expressed in CO_2e, are calculated using consumption ('activity') data, and emission factors. For each activity, there is both a standard unit for measuring activity data (e.g., kWh of electricity, litres of fuel, £ spent on goods, kg of goods) and an associated emission factor (calculated by Department for Energy Security and Net Zero and updated annually). The emission factor for a particular activity is a coefficient that converts the activity data measured into kg COe.

For example, raw basmati rice, as purchased, has an emission factor (cradle to farm gate) of 3.17kgCO_2e per kg purchased. Therefore, if a manufacturer purchased 1 tonne of basmati rice, emissions attributable to this purchase (as part of their scope 3) are equal to 1000 x 3.17, i.e. 3170 kgCO_2e.

Likewise, field grown tomatoes imported to the UK (average derived from main import markets), as purchased, have an emission factor (cradle to farm gate) of 0.801 $kgCO_2e$ per kg purchased. Therefore, if a manufacturer purchased 3.5 tonnes of imported tomatoes, emissions attributable to this purchase (as part of their scope 3) are equal to 3500 x 0.801, i.e. 2803.5 $kgCO_2e$.

As a non-ingredient based example, the 2024 emission factor for steam generated onsite is 0.17965 $kgCO_2e$ per kWh generated. Therefore, if a manufacturer generated 5 million kWh of steam onsite during 2024, emissions attributable to this (as part of their scope 1 – offsite steam would be part of scope 2) would equal 5 million x 0.17965, i.e. 898,250 $kgCO_2e$. This concept is summed up by the equation below:

Emissions (kg CO_2e) = Activity Data × Emission Factor

Therefore, emissions from a certain activity over a set period of time, expressed in kg CO_2e, equal the activity data from that period of time, multiplied by the emission factor that applies to that particular activity and time period. A business's total carbon footprint is the total emissions from **all** activities across scopes 1, 2 and 3, added together.

It is vital that the year in which activity data was collected matches the year a particular emission factor was published for accurate emissions to be calculated, i.e. if calculating emissions from natural gas usage in 2023, the 2023 emission factor for natural gas consumption **must** be used when applying the equation to accurately calculate emissions.

Common sources of emissions for food & drink manufacturers:

Rank	Emissions Source	GHG Protocol Scope	Further Detail
1	Purchased goods (raw ingredients including supplied water & packaging)	Scope 3	Agriculture-driven sourcing, especially livestock-derived products, dominates food sector emissions; packaging of these purchased goods adds further lifecycle impacts.
2	Energy use & process heat	Scope 1 (fuel), Scope 2 (electricity)	Major onsite energy demand for cooking, heating, brewing etc.
3	Refrigeration & cooling	Scope 2 (electricity), Scope 1 (fugitive HFC leakage)	High electricity demand plus potent refrigerant emissions.
4	Transport & logistics	Scope 1 (owned), Scope 3 (third-party)	Inbound & outbound cold-chain transport contributes sizeable CO.
5	Waste disposal (food & packaging)	Scope 3 (waste), Scope 1 (on-site processing emissions)	Landfill methane & waste processing emissions are notable, but lower than sourcing & energy.
6	Employee commuting & business travel	Scope 3	Relatively minor contributor compared to core operations.

Rank	Emissions Source	GHG Protocol Scope	Further Detail
7	Purchased heat/steam	Scope 2	Only relevant for facilities using collective / district energy set-ups.
8	Water treatment & wastewater	Scope 2 (hot water – via fuel combustion), Scope 3 (treatment)	Contributes via energy use in heating/cleaning, & can be larger for companies with higher water consumption such as beverage manufacturers, but is typically minor in the overall footprint for all food & drink manufacturers.
9	Capital goods & equipment	Scope 3	Embodied emissions from equipment are distributed over many years, lower annual impact.
10	Upstream & downstream distribution	Scope 3	Includes third-party storage & customer transport, smaller share than direct logistics.
11	Use of sold products	Scope 3	Negligible for foodservice, limited for packaged goods.
12	End-of-life of sold products	Scope 3	Packaging waste disposal from consumers, but minor vs business waste.
13	Leased assets & franchises	Scope 3	Emissions governed by tenant operations variable but generally lower unit volume.

The table above covers a summary of key emissions sources for food and drink manufacturing businesses globally. Rank in table and information provided in further detail column sourced here.

Key Takeaway:

- An accurate carbon footprint lays the groundwork for transparent reporting and an actionable carbon reduction plan.
- Understanding the different emissions categories helps to identify which parts of your business is generating most of your emissions and therefore where to take action.
- Updated emissions factors are published every year by the UK Government.
- It is vital to match the year that the emissions factor was published to the year that you are collecting the data for. If you are collecting data for 2024, then you must use the emissions factor for that activity which was published in 2024.

Measuring Your Carbon Footprint

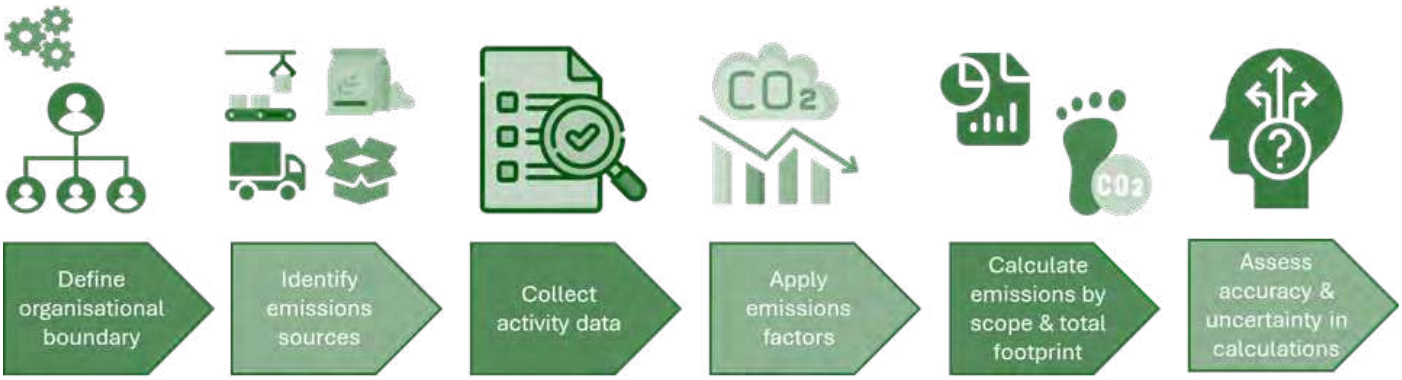
Accurate emissions measurement is the foundation of effective carbon management and climate action. This allows you to establish a baseline for your business's emissions, identify emission hotspots, and track progress over time.

(Note: some organisations refer to a carbon inventory rather than a footprint, but generally the terms are equivalent).

Good to know
Aligning your carbon footprint and report to your financial year allows you to track and report key carbon metrics alongside key financials.

To start with, you need to decide your reporting baseline year.

Once you have established your reporting year, the footprinting process breaks down into **six steps:**



Use this useful checklist to prepare for the carbon footprinting process.

Step 1: Define your organisational boundary

Decide which operations and sites to include in your carbon footprint. It is common for an organisational boundary to be defined either using:

- **Operational Control:** Include all sites and activities you manage day-to-day – "do we run it day to day?".
- **Financial Control:** Include sites where you have financial authority - "do we own it or pay for it?".

For most small and medium sized enterprises (SMEs), operational control is the simplest and most relevant organisational boundary. Financial control is more common for large groups and aligns with financial reporting.

Larger and more complex companies may choose to define their organisational boundary in a third way, known as "equity share". This is when an organisation accounts for GHG emissions from operations and assets according to its share of equity in the operation.

Defining your organisational boundary helps to make sure that emissions are not double-counted or missed. It also helps others (customers, investors, regulators) know what your footprint covers and allows year on year comparisons.

Step 2: Identifying potential emission sources

The next step is to map out all business activities that might generate emissions (sources) across scopes 1, 2, and 3:

- **Scope 1: Direct emissions** e.g. Gas for cooking/heating, company vehicles, refrigerant leaks.
- **Scope 2: Indirect emissions** (from energy consumption) e.g. Purchased electricity for production and offices.
- **Scope 3: Indirect emissions** (upstream / downstream) e.g. Purchased ingredients and packaging, outsourced transport, waste disposal, business travel, employee commuting.

The table below shows examples of common sources of emissions for each scope:

Category	Sources
Scope 1: direct emissions	• Generation of heat • Onsite generation of electricity & heat • Physical or chemical processing • Transportation of employees/goods in company-controlled vehicles • Fugitive emissions from company-controlled sources: specifically F-Gas leakage from refrigeration & air-conditioning systems
Scope 2: Indirect emissions from energy	• Generation of purchased electricity • Generation of purchased heat or steam • Generation of purchased district heating
Scope 3: Indirect emissions	• Purchased goods & services • Fuel & energy-related upstream activities • Upstream transportation & distribution • Waste generated in operations • Business travel • Employee commuting • Upstream leased assets • Downstream leased assets • Downstream transportation & distribution • Processing of sold products • End of life of sold products • Franchises • Investments

Note: not all of these sources will be relevant for all businesses.

Step 3: Collecting activity ðata for sources

Once you have mapped and identified sources of emissions, you can start gathering the activity data for each emissions source. The table below outlines some example emissions sources, and their associated activity units (e.g. kWh) and where the appropriate activity data can be captured from (e.g. energy meters). Note that emissions sources in scopes 1 and 2 tend to use activity units based on consumption, whereas for many scope 3 sources, activity units are spend/cost-based due to the lack of accurate consumption figures.

Read how Edwards the Welsh Butcher really benefited from gaining clarity over their scopes 1, 2 and 3 carbon emissions through thorough and robust data collection.

Emissions Source	Activity Unit	Activity Data Source
Electricity	kWh	Utility bills or smart meters
Gas	kWh	Utility bills
Refrigerants	kg	Maintenance logs
Purchased goods	£ spend or Quantity (e.g. kg, litres etc.)	Procurement records
Waste disposal	kg or £	Waste contractor invoices
Transport	miles or litres	Delivery logs, fuel receipts

Table above showcases example emissions sources & their associated activity data units & sources of data.

The appropriate activity data units for any emissions source within scopes 1, 2 and 3 can be found alongside their associated emissions factors in DESNZ's published guidance.

Whilst emissions factors can vary by reporting year, the appropriate activity data unit for a given source tends to remain the same year-on-year.

Step 4: Applying emission factors

Having collected all your activity data, this then needs to be converted into kg CO_2e using the UK Government conversion factors (DESNZ) for the **same year** the activity data was collected (i.e. if activity data is from 2024, 2024 emissions factors **must** be used).

Emissions (kg CO_2e) = Activity Data × Emission Factor

Example:

1,000 kWh electricity × 0.207074 kg CO_2e/kWh = 207.07 kg CO_2e

Doing this for each of your emissions sources, gives you individual emissions in kg CO_2e for each source. This table shows how emissions factors are applied, using the example activity data from the section "What are Emissions Factors?"

Emissions (kg CO_2e)	Activity data	2024 Emissions Factor
3,170 kg CO_2e (1,000kg x 3.17)	1 tonne basmati rice	3.17 kgCO_2e per kg purchased
2,803.5 kg CO_2e (3,500kg x 0.801)	3.5 tonnes of field grown, imported (to the UK) tomatoes	0.801 kgCO_2e per kg purchased
898,250 kg CO_2e (5 million x 0.17965)	5 million kWh of steam generated onsite	0.17965 kg CO_2e per kWh generated



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Step 5: Calculate total emissions by scope and footprint

To calculate your carbon footprint, add up all of your emissions for each scope (refer to step 2 for a reminder on the categorisation of sources into scopes 1, 2 and 3) to give your total emissions by scope. Then add the three scope totals together to give your overall total. The table and pie chart below contains the scope 1, 2 and 3 emissions for a fictional bakery.

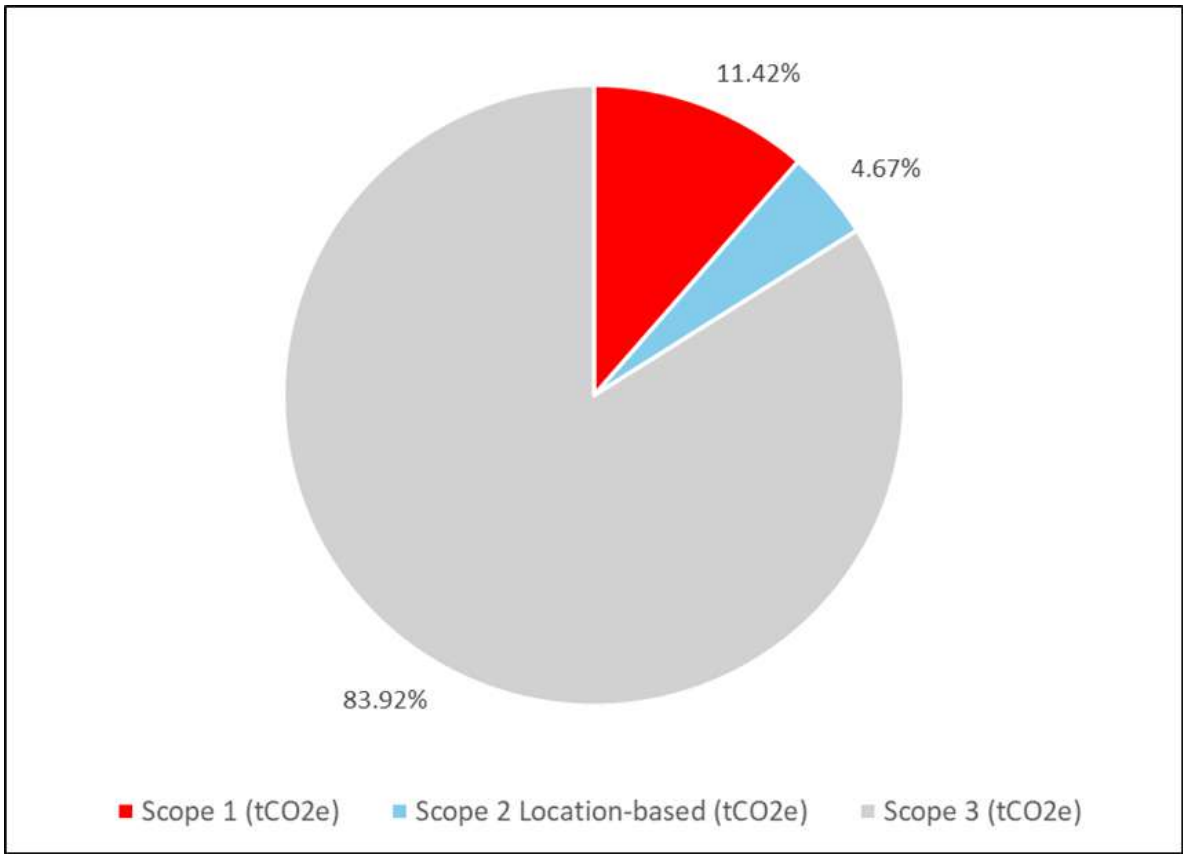
Good to know

*Always report totals for scopes 1, 2 and 3, and your business's total footprint in tonnes CO_2e (tCO_2e) for reporting clarity (tonnes is the standard for scope and footprint totals). This may require conversion from kg CO_2e: divide totals expressed in kg CO_2e by 1000 to convert them to tCO_2e.

Bakery example: emissions by scope / footprint

The table and figure below showcase an example bakery's breakdown of emissions across scopes 1, 2 & 3:

Scope	Emissions (tCO_2e)	%
Scope 1	296.54	11.42%
Scope 2 – location – based	121.21	4.67%
Scope 3	2,179.89	83.92%
Total location-based	2,597.64	100.00%



You can provide a more detailed breakdown of emissions across the three scopes as shown in the table below:

The following as an example bakery's baseline GHG emissions.

(*Example*) Bakery's (Baseline Year) GHG Emissions (tonnes CO_2e)			
Reporting Scope	**GHG Emissions Source**	**GHG Emissions (tonnes CO_2e)**	**Percentage of GHG Emissions (%)**
Scope 1	Stationary Combustion	-	-
	Mobile Combustion	296.54	11.42%
	Fugitive emissions	-	-
Scope 2	Purchased Electricity (Market-Based)	121.21	4.67%
	Purchased Electricity (Location-Based)	121.21	4.67%
Scope 3	Purchased Goods & Services	2,021.17	77.81%
	Upstream Transportation & Distribution	1.87	0.07%
	Waste Generated in Operations	28.52	1.10%
	Business Travel	3.85	0.15%
	Employee Commute & Homeworking	107.15	4.12%
	Downstream Transportation & Distribution	17.33	0.67%
Total GHG Emissions (Market-Based)		2,597.64	100%
Total GHG Emissions (Location-Based)		2,597.64	100%
GHG Emissions per £M turnover (Location-Based)		229.78	-
GHG Emissions per employee (Location-Based)		19.10	-

You can calculate your GHG emissions per £million of turnover to give you an intensity metric. This metric is useful in demonstrating a decoupling of emissions increases from turnover increases. Put simply, this can show that whilst your business has been growing, your emissions are not growing at the same rate.

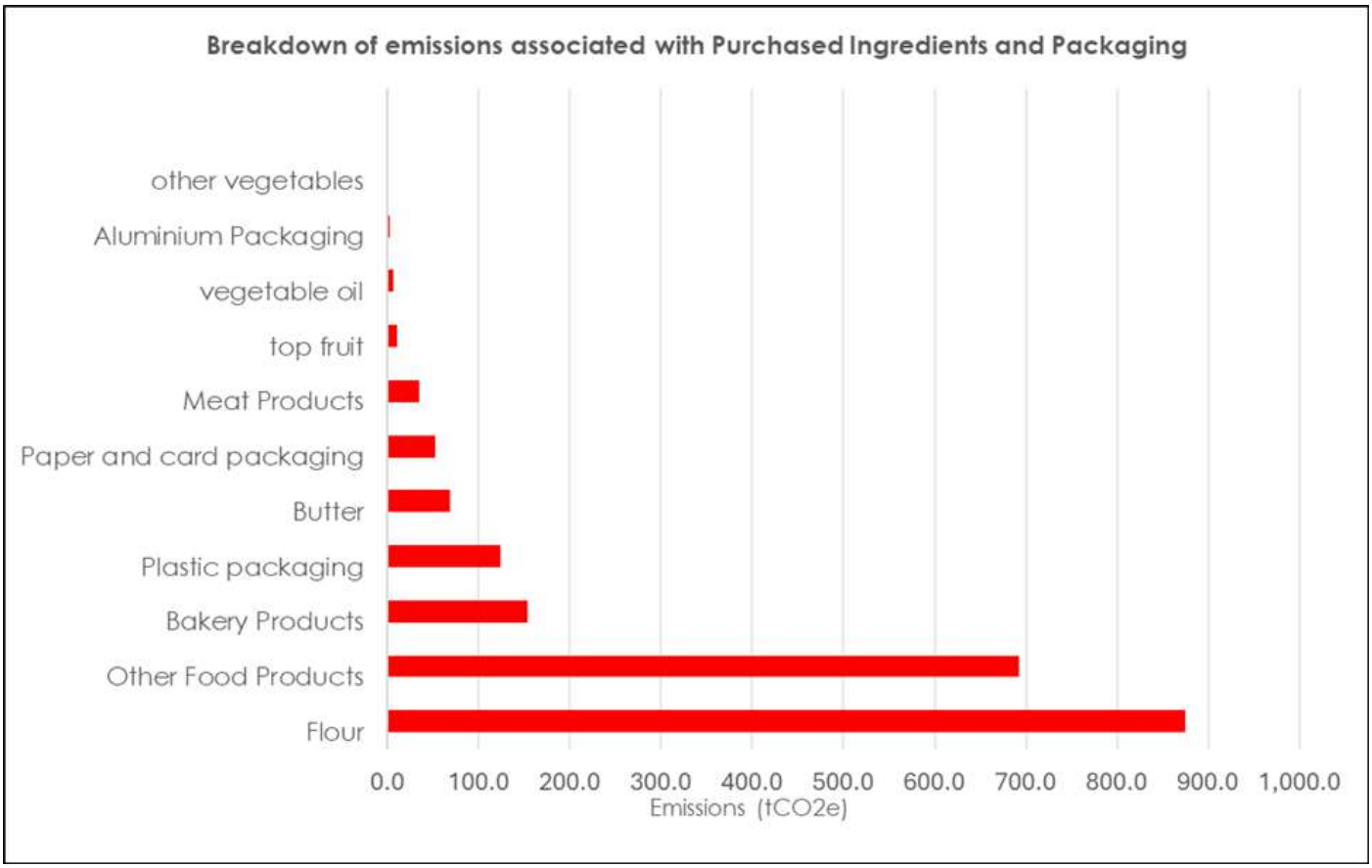
The table above shows that 'Purchased Goods & Services' accounts for nearly 78% of our bakery's emissions.

The table below is an example bakery's breakdown of emissions across purchased ingredients & packaging (part of scope 3). Unsurprisingly, the purchase of flour is a significant contributor to emissions in this bakery example.

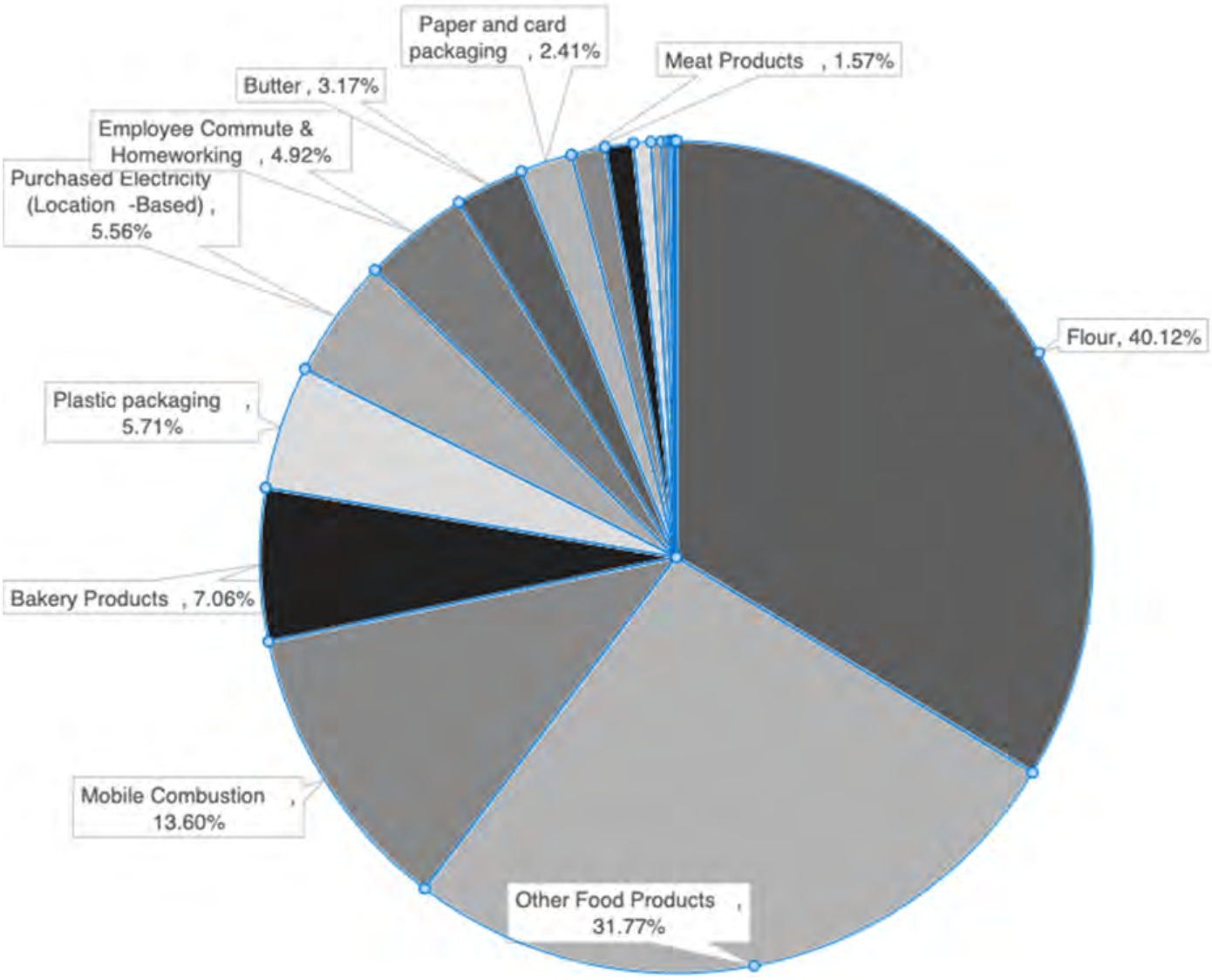
Source	Volume	Emissions (tCO2e)
Flour	1,714.95 tonnes	874.62
Other Food Products	209.50 tonnes	692.54
Bakery Products	183.88 tonnes	153.91
Plastic packaging	39.72 tonnes	124.44
Butter	6.00 tonnes	69.12
Paper & card packaging	45.04 tonnes	52.63
Meat Products	£41,953.24	34.27
Top fruit	16.99 tonnes	10.47
Vegetable oil	2,280 litres	6.70
Aluminium Packaging	0.36 tonnes	2.26
Other Vegetables	0.45 tonnes	0.20

Example bakery GHG emissions hotspots

The graphs below clearly show that 'flour' and 'other food products' are the hotspots in the 'purchased ingredients & packaging' category.



The figure below showcases the example bakery's top 10 areas of business with the highest emissions.



Step 6: Assess accuracy and uncertainty in calculations

Carbon calculations involve uncertainty due to incomplete data or generic emission factors. To acknowledge this in your footprint calculation methodology, you can assign confidence levels to each source emissions calculation, based on the activity data type. For example:

- High Confidence: Direct meter readings (±2 – 5% expected variation).
- Medium Confidence: Spend-based estimates (±15 – 20% expected variation).
- Low Confidence: Assumptions or extrapolations (no specific data, e.g. assumed continuation of trend or figure reported by similar sized business, ±20%+ expected variation).

All assumptions made during the data collection and footprint calculation process should be documented for optimum transparency in reporting.

Key Takeaway:

- Defining your organisational boundary allows for transparent reporting and ensures you don't double count or miss a source of emissions.
- You can use your internal data systems to gather activity data.
- Your carbon footprint is the total of all your scope 1, 2 and 3 emissions.
- You can use tables and graphs to highlight hotspots and prioritise actions for reducing your emissions.
- As well as reporting absolute emissions, you can calculate an intensity metric GHG emissions per £ million of turnover by relating your emissions to your turnover.



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Moving from Carbon Footprinting to a Carbon Reduction Plan

Now you have measured your carbon footprint, the next step is to report it transparently and use the data and insights to drive reductions through a robust Carbon Reduction Plan (CRP).

Read how La Crème Patisserie has used their carbon footprint and carbon reduction plan to provide manageable and actionable ways to reduce carbon emissions within the business.

It is useful to consider the following questions when you start using the data you collected from your carbon to turn it into a meaningful carbon reduction plan.

- Who will you share your plan with?
- Who will take responsibility for emission reductions actions/recommendations within the plan?
- How frequently will you review and update your footprint and plan? Good practice (and recommended by the GHG protocol) is to update your footprint and plan every year, in line with your financial year. If this is not possible, then aim to update your footprint and report every two years.
- How will you embed data recording mechanisms within your business processes such as senior management team meetings, board meetings or public reporting? (Refer to the 'Growing a Sustainable Business' training module for insight about governance and reporting.)

Your **Carbon Reduction Plan (CRP)** provides a clear roadmap for achieving emissions reduction targets.

Good to know
Once you have your carbon footprint, why not hold an internal meeting and share the footprint with your team. Encourage colleagues to identify opportunities to reduce emissions. Focus on early wins/low hanging fruit. These often come with additional cost/efficiency savings, benefitting your bottom line as well reducing your environmental impact.

A robust CRP includes:

1. **Introduction and context**
   - Purpose of the plan and its alignment with Welsh Government Net Zero targets.
   - Business background and operational scope (an overview of the business's goals for growth and evolution).
   - Your methodology: state which standards or published guidelines you followed (e.g., GHG Protocol, ISO 14064-1, the guidance outlined in this module etc.) and detail all data sources, emission factors applied, and assumptions used. Stating limitations in footprint calculation accuracy is an important part of reporting any meaningful emissions footprint calculation.

2. **Baseline carbon footprint**
   - Summary of current emissions across scopes 1, 2, and 3 (a summary of the organisation's most recently calculated carbon footprint).
   - Identification of emissions hotspots (e.g., energy use, refrigeration, transport, purchased goods).

3. **Reduction measures and roadmap**
   - Short, medium, and long-term actions to reduce emissions.
   - Prioritisation of actions / interventions based on impact and feasibility.

4. **Targets and trajectory**
   - Long-term goal (e.g., Net Zero by 2050).
   - Interim targets aligned with Welsh carbon budgets (e.g., 63% emissions reduction by 2030).
   - Reduction measures / roadmap needs to be aligned with the long-term goal (i.e. actions should be sufficient, in principle, to achieve the emissions reductions required to achieve the long-term goal).

5. **Monitoring and reporting**
   - Outline processes for tracking progress and updating the plan.
   - Understanding progress (or lack of progress) relative to the CRP is vital to ensuring it remains relevant.
   - Transparent reporting of progress to stakeholders and customers can help enhance business credibility.

6. **Quality Control**
   - Ideally, a qualified carbon assessor or energy manager is engaged to ratify a CRP and ensure its approach is likely to generate the intended emissions reductions.
   - The report should also highlight any other quality control measures, such as peer review, site visits to differentiate from 'off the shelf' reports. The Welsh Government funded support for carbon reduction plans for food and drink manufacturers ensures this level of robustness through the requirement of qualified carbon assessors, site visits and prioritised carbon reduction recommendations.

You can use this useful checklist to remind you of all the steps in preparing a CRP.

Depending on the size of your business, it may be mandatory for your CRP to comply with these standards. Even if your business is not within scope of these standards, it is good practice to be aligned with them.

Standard	
GHG Protocol Corporate Reporting Standard	For accurate emissions accounting.
SECR Requirements	For scope 1 & 2 reporting. Mandatory only for large businesses or limited liability partnerships meeting 2 of 3 criteria; £36m+ turnover, £18m+ balance sheet, 250+ employees).
PPN 06/21 Guidance (UK Government) WPPN 06/21 Guidance (Welsh Government)	Mandatory for businesses bidding for public sector contracts with an anticipated contract value of more than £5m.

Use this template to structure your Carbon Reduction Plan.

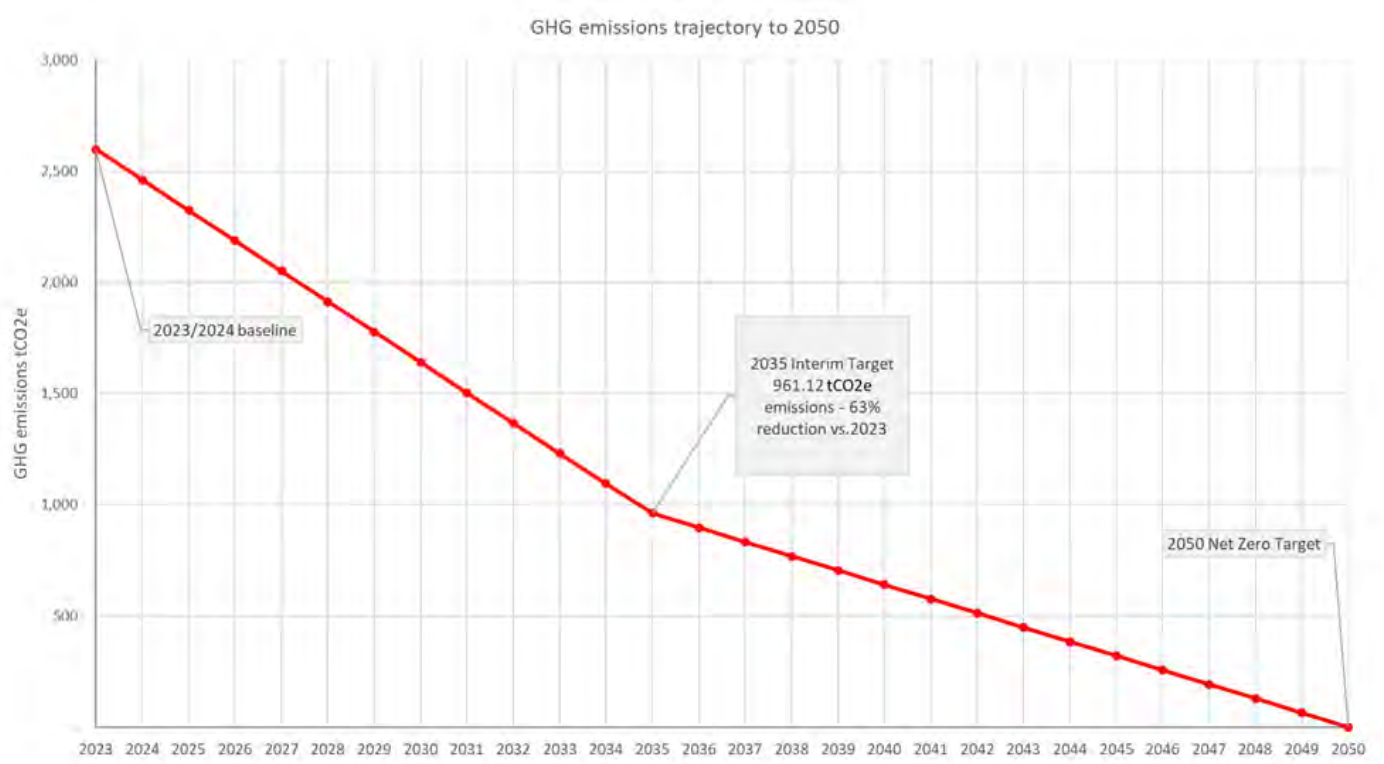
This template complies with GHG Protocol Corporate Accounting and Reporting Standard and UK Government Reporting Guidelines.

Carbon reduction targets & trajectory

Good to know
Welsh food and drink manufacturers can access free technical support to develop a CRP via the Carbon Reduction Plan Programme.

Now you know what your emissions are, you can define your targets. Your 'trajectory' shows the 'stepping stones' for reducing your emissions from your defined baseline year down to net zero (typically by 2050) and in line with national and international climate targets. The trajectory graph shows how emissions will fall over time through a combination of direct reductions across Scopes 1, 2 and 3 and includes interim milestones. This allows you to track progress over time, help with investment decisions and provides transparent accountability to customers, funders and other stakeholders.

The graph below shows an example of an emissions trajectory which aligns with national targets of achieving Net Zero by 2050, an interim target of 63% reduction in emissions by 2035.



Carbon reduction roadmap & implementation

Your roadmap builds on your targets, trajectory and the carbon footprinting work that you have done. The 'hotspots' which were identified in your carbon footprint (see section 3) are potential areas for prioritised carbon reduction interventions which will help you achieve your targets and follow the trajectory to net zero. You should focus on high-impact areas identified in your footprint and align with cost-effectiveness and operational feasibility.

Typical carbon hotspots for food and drink manufacturers are:

- Cooling, chilling, freezing and cold storage.
- Pasteurisation/heat treatment/steam/brewing/boiling/hot water processes.

- Energy-intensive processing equipment.
- Ovens and baking processes.
- Compressed air systems.
- Refrigeration systems (leaks and efficiency).
- Hot water and cleaning in place (CIP) systems.
- Ingredient/food waste, overproduction or product losses.
- By-products and waste handling.
- Refrigerated/temperature-controlled transport.
- Packaging (plastics, cartons, vacuum packs, plastic films, trays, glass, cans, PET).
- Water use and wastewater treatment.
- Distribution and transport costs.

Paying attention to these hotspots and identifying 'early wins' can often result in lower operational costs (through, for example, waste reduction strategies) as well as reduced emissions:



Scope 3 emissions are typically the biggest and the most difficult group to tackle. Engaging with suppliers of purchased goods and services should therefore be part of your decarbonisation roadmap and plan.

Use this checklist to help prepare for supplier engagement aimed at reducing scope 3 emissions.

You can use a table to identify actions, savings, approximate investment costs and priority areas. The table below shows some example actions relating to energy consumption only. Your actions will be specific to your business and based on your hotspots.

The priorities are defined as:

- Priority 1 are high impact actions which are easy to implement in a short timeframe.
- Priority 4 are lower impact measures or long-time actions with a high capital cost.

Proposed carbon reduction action	Estimated annual energy saving (kWh)	Estimated annual cost saving (£)	Estimated capital cost (£)	Emissions saving (tonnes of CO_2e/year)	Priority (1 -4)
Switch to a 100% renewable tariff	0	£0	£0	10 tCO_2e/year	1
Install daylight & motion sensors on lighting	10% reduction in lighting electricity 500 kWh	£100	Low	0.12 tCO_2e/ year	1
Install solar PV with battery storage	15,000 kWh	£2,500	High	3.5 tCO_2e/year	3

Consider how your will embed monitoring and reporting against your decarbonisation actions into your operational and management reporting processes. For example, you may allocate responsibility for reducing emissions arising from waste to your operational lead. They could report at agreed intervals against target waste reduction measures, perhaps in their weekly operational meetings or monthly to senior leadership team or board meetings. The training module, 'Growing a Sustainable Business' looks at reporting in more detail.

Key Takeaway:

- Your carbon reduction plan provides a roadmap for reducing your carbon emissions.
- Prioritise actions and assess against feasibility and investment cost – focus on quick wins.
- Build in targets so you can monitor progress against your plan.
- Engage your teams and suppliers to identify and implement carbon reduction actions.
- Make sure you know who is accountable and responsible for implementing individual actions.
- **Put monitoring processes in place – what gets measured gets managed.**

Communicating Your Carbon Reduction Plan

Having done all that good work to measure your carbon footprint and develop your CRP, you now have an excellent opportunity to communicate your sustainability investments and credentials to your key stakeholders and maximise the benefits to your business:

- Builds trust with customers and buyers.
- Supports trade customer net zero and scope 3 reporting.
- Improves staff engagement and operational buy-in.
- Strengthens public procurement and tender submissions.
- Reduces risk of inconsistent or ad-hoc responses.
- Demonstrates credible progress without over-promising.

Internal stakeholders

Starting with your internal stakeholders, planning your communication of your CRP involves answering "who, what, how and why" as shown below:



External stakeholders

Moving on to external stakeholders, first consider who they might be. The list below provides a starting point: you may have other stakeholders with whom you need to communicate:

- Trade customers: supermarkets, foodservice, wholesalers and distributors.
- Public sector buyers: local authorities, NHS boards, government departments.
- Financial auditors, regulators, reporting bodies.
- Investors and finance providers.
- Consumers of your products.
- Local communities.

Again, consider what information these stakeholders need or want to know and why they might want to know it.

Who	What	Why
Trade customers	CRP Priority actions Year on year improvements	To support scope 3 reductions Demonstrate progress to Net Zero Manage supply chain risk & resilience
Public sector buyers	PPN 06/21 aligned CRP Net zero commitment by 2050 Governance & review processes	Mandatory procurement requirements Transparency & value for money Long-term supplier compliance
Auditors, regulators	Energy & emissions data Evidence of reduction actions Governance & review processes	Compliance with relevant standards Consistent, auditable data Clear accountability
Finance providers	Carbon risks & mitigations Energy efficiency improvements Long-term resilience planning	Risk management Exposure to energy price volatility Long-term business viability
Consumers	High level commitments Evidence of action	Trust & transparency Responsible business behaviour
Local communities	Commitments/ actions benefiting local communities/ environment	Trust & transparency Responsible business behaviour

Use this **stakeholder communications checklist** to help you plan who you will communicate with, what you will share with them and why it is important for these stakeholders to be aware of your CRP.

Read this inspiring example from Ellis Eggs and how they used their Carbon Reduction Plan to help them secure listings.

Best practices

Here are some best practice tips to consider when drafting your CRP and planning your communications activities around your CRP:

- Use visuals such as charts and graphs for clarity; use plain language, not jargon to make it a document that everyone can understand, not just those with in-depth sustainability knowledge.
- Be clear about scope: what is and isn't included in your CRP.
- Include interim targets and progress updates: if you've published a footprint or CRP before, be sure to highlight how your updated plan compares, how emissions have been reduced (or not), and how you may have amended your approach to ensure better success.
- Avoid absolute claims unless these have been independently verified: you need to avoid greenwashing or being accused of greenwashing which would be reputationally damaging for your business.
- Update information annually.
- Do a final check on the information to make sure it is accurate and up to date.

To help you consider sustainability advantages of growing your business we have developed "Growing your Business Sustainably" module.

Key Takeaway:

- Communicate the good work you have done to measure your carbon footprint and plan how you will reduce emissions.
- Think about who will be interested in this information and what they would like to, or need to, know.
- Make sure you are not making unsubstantiated claims which could be classed as greenwashing.
- Plan your communications strategy: how will you communicate future progress and achievement of targets?
- Schedule your next update to your carbon footprint and reduction plan.

Key Takeaways

- Your business's carbon footprint is your business's total emissions from all its activities across scopes 1, 2 and 3.
- Emissions for individual activities are calculated using emissions factors and activity data.
- Knowing what scopes different emissions sources fall under is vital for proper reporting of your footprint and understanding the degree of control you have to reduce those emissions (typically less for scope 3).
- A footprint highlights emissions hotspots, areas responsible for a significant portion, if not the majority of, your business's total footprint.
- Knowing where these hotspots are is key to understanding and reducing your footprint.
- Make sure that the year that the data relates to matches the year that the emissions factor was published.
- Set clear, achievable targets and create a roadmap for short, medium, and long-term actions that set a path to achieving your long-term emissions reduction goal.
- Engage suppliers and stakeholders to address scope 3 emissions effectively (your CRP needs to include engagement with them in order to reduce scope 3).
- Combine quick wins (e.g., LED lighting, route optimisation) with strategic investments (e.g., renewable energy).
- Communicate progress transparently with internal and external stakeholders to build trust and meet market expectations.
- Once you've established your data collection processes and CRP, this can become part of your company's annual reporting processes – align it to your financial year to show progress towards reducing your carbon emissions.

If all this feels daunting, don't worry, there is fully funded support to technical advisors through the Food and Drink Wales Carbon Reduction Programme.

By completing this module, you should now understand:

- What a carbon footprint is.
- The terminology commonly used in carbon footprinting.
- How to measure your business's carbon footprint accurately.
- The many benefits which arise from measuring your footprint such as cost savings, efficiency improvements, and greater business resilience.
- How to turn your carbon footprint into an actionable carbon reduction plan.
- How to communicate your carbon reduction plan and your achievements in reducing your carbon emissions to internal and external stakeholders.
- How your carbon footprint and reduction plan can give you a competitive advantage in your negotiations with trade customers and a point of difference to consumers who want to buy from businesses who are focused on sustainability improvements.

Good to know

Food & Drink Wales use trade events such as Blas Cymru to showcase food or drink businesses which have a Carbon Reduction Plan in place, helping you to stand out from the crowd.

Key Resources

Helpful tools and resources

- Food and Drink Wales Carbon Reduction Plan Programme offers fully funded support to Welsh food and drink manufacturing businesses to measure their carbon emissions and develop a carbon reduction plan
- The Carbon Trust's SME Footprinting Tool
- Business Climate Hub
- Welsh Government Net Zero Wales guidance

Guidance and standards

- GHG Protocol Corporate Standard
- GHG Protocol Scope 3 Standard
- ISO 14064-1:2018
- Streamlined Energy and Carbon Reporting (SECR) Guidance
- Procurement Policy Note 06/21: Carbon Reduction Plans

Welsh Government

- Welsh Government Climate Change Targets and Carbon Budgets
- Net Zero Wales Carbon Budget 2
- Beyond Recycling Strategy 2021
- Welsh Procurement Policy Note WPPN 06/21: Decarbonisation through procurement - Taking account of Carbon Reduction Plans
- Well-being of Future Generations Act 2015

Food and Drink Wales

- Sustainability Resources

Tools and Data

- UK Government GHG Conversion Factors*:
  - Greenhouse gas reporting: conversion factors 2023
  - Greenhouse gas reporting: conversion factors 2024
  - Greenhouse gas reporting: conversion factors 2025
  - Greenhouse gas reporting: conversion factors 2026

  *Note, the year of conversion factor(s) used depends on the year usage data was collected – e.g. calculating emissions using 2024 electricity consumption data would require the usage of the 2024 conversion factor, even if the calculation was being done in 2025.
- Carbon Trust SME Guides

Glossary

Carbon Budget: A cap on the total amount of greenhouse gases that can be emitted over a specific period to meet climate targets.

Carbon Footprint: The total greenhouse gas emissions caused directly and indirectly by an organisation, expressed as number in CO_2e (carbon dioxide equivalent – see below).

Carbon Reduction Plan (CRP): A structured document outlining how a business or organisation will measure, manage, and reduce its greenhouse gas emissions (as quantified via Carbon Footprinting) over a specified period of time.

CO_2e: 'Carbon Dioxide Equivalent'; A standardised metric used to express the impact of different greenhouse gases in terms of the amount of carbon dioxide that would have the same global warming potential (GWP) over a specified time horizon. It allows the emissions impact of different gases to be aggregated into one unit.

Decarbonisation Roadmap: A strategic plan outlining steps to reduce carbon emissions over time.

DESNZ: Department for Energy Security and Net Zero; ministerial department of the UK Government established in 2023. Its role is to work towards ensuring the UK has a secure, clean and affordable energy supply.

Emission Factor: A coefficient that quantifies emissions per unit of activity (e.g., kg CO_2e per kWh).

Emission Hotspot: An area or activity within a business that contributes disproportionately to its carbon footprint.

GHG: Greenhouse Gases, including carbon dioxide (CO_2), methane (CH), nitrous oxide (NO), and others.

GHG Protocol: The globally recognised standard for measuring and reporting greenhouse gas emissions

Scopes 1, 2, and 3: Categories of emissions defined by the GHG Protocol:

- **Scope 1:** Direct emissions from owned or controlled sources (e.g., fuel combustion).
- **Scope 2:** Indirect emissions from purchased electricity, heat, or steam.
- **Scope 3:** All other indirect emissions, including supply chain, waste, and transport.

Net Zero: A state where greenhouse gas emissions are balanced by removals or offsets of those emissions.

PPN 06/21: UK Government Procurement Policy Note requiring suppliers to publish a Carbon Reduction Plan when bidding for major public contracts.

Renewable Energy: Energy from sources that are naturally replenished, such as solar, wind, and hydro.

SECR: Streamlined Energy and Carbon Reporting, a UK framework for reporting energy use and carbon emissions (though use of this framework is only mandatory for large companies meeting 2 of 3 criteria; £36m+ turnover, £18m+ balance sheet, 250+ employees).

SME: Small and Medium-sized Enterprise.

WPPN 06/21: Adopts the UK Procurement Policy Note 06/21, providing further information specifically to Welsh public sector contracting authorities to help them meet the 2030 target for a net zero public sector in Wales.

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Appendix 1: Climate Change and the Role of Carbon Footprinting

Climate science is clear, human activity has now driven up global average temperatures to between 1.2 and 1.3°C above pre-industrial levels (IPCC, 2023). The 2015 Paris Agreement (signed at COP21) set a critical goal to limit warming to 1.5°C above pre-industrial, as every fraction of a degree of warming matters for the stability of our climate and society. At 1.5°C, the world will still face more frequent heatwaves, heavier rainfall, and rising sea levels, but these impacts remain significantly less severe than at 2°C or beyond, where risks escalate sharply, bringing likely dramatic biodiversity loss, severe food insecurity, and irreversible damage to ice sheets and coastal communities (IPCC, 2023; WRI, 2023).

Recent reports show that 2024 was the first full year above 1.5°C globally, and projections suggest a high likelihood of temporary overshoot in the next five years (Royal Meteorological Society, 2025). While this does not yet breach the Paris target, based on long-term averages (over many years as supposed to a single year) remaining just below 1.5oC, it signals an urgent need for wide-reaching and accelerated action. Overshooting 1.5°C permanently, even briefly, will intensify extreme weather events, potentially strain water and food systems to breaking point, and increase economic losses globally and in Wales.

Implications for Wales.

For Wales, the implications of a world over 1.5°c are profound. With wetter winters, hotter summers, and greater flood risk, threatening infrastructure, agriculture, and supply chains (CCC, 2025) becoming the norm. Wales has legislated ambitious climate commitments: Net Zero by 2050, including interim targets of 63% emissions reduction by 2030, and five-year carbon budgets.

For further insight about the climate change risks facing Wales, please refer to Module 1 of the Climate Adaptation and Resilience Training Programme available here.

The role of footprinting and CRPs in net zero ambitions

Carbon footprinting is a strategic and business-smart tool, using scientifically sound methodology. Calculating and reporting your carbon footprint is not just a compliance exercise as footprints are increasingly required by your trade customers, finance providers and consumers, who expect businesses to be environmentally responsible, accountable and transparent. By understanding your business' emissions across Scopes 1, 2, 3, and in total, you can identify hotspots, reduce operating costs through significant efficiency gains, and align with emerging regulations and market expectations. Transparent footprinting enables informed decisions on energy use, procurement, and logistics, directly contributing to Wales's carbon budgets and global efforts to stabilise warming.

Good to know
Every tonne of COe avoided helps close the gap to 1.5°C and strengthens resilience for Welsh businesses in a low-carbon economy.