ZERO CARBON FORUM NET ZERO ROADMAP FOR BREWING

NOVEMBER, 2022

IN ASSOCIATION WITH:

CARBON ARCHITECTURE

BRITISH BEER & PUB ASSOCIATION

Carbon Intelligence

ZERO CARBON FORUM

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EXECUTIVE SUMMARY

The impacts of a warming planet are increasingly visible, dire, and close to home. We're facing an intensifying climate crisis, and an ambitious plan to net zero is imperative to the success of our businesses, our industry, our people, and our way of life.

As we look to the future, one thing is clear- we simply cannot get there alone. We must collaborate within and across sectors to transition quickly and equitably to a net zero economy.

In the UK, we serve 9 billion pints of beer every year crafted by over 2,000 breweries. Our brewers have provided a sense of warmth and connection for centuries.

Along with our contributions to culture and community, the environmental impact of our brewing operations is around 2,200 $ktCO_2e$ every year. Food and beverage systems are responsible for a third of global emissions.

It's time to rethink how we do business, explore new processes and technologies, and face the climate crisis head on, together.

In 2021, the Zero Carbon Forum launched our Net Zero Guide for Brewing and Hospitality. The first of its kind, we worked with our members to collect, aggregate, and analyse data to map 5 sub-sector decarbonisation pathways.

By addressing our shared emission hot spots, we're making action accessible and achievable for operators of all sizes and types.

This year, we're proud to launch an in-depth roadmap just for the brewing sector. We've taken a deeper dive into the actions brewers can take to decarbonise across operations, supply chains, and government. Our goals and pathways are broken down into interim milestones, and we fully expect to learn, grow, and course correct as we go.

With legacy equipment serving our breweries for centuries and processes deeply rooted in the history of the drink, the sector faces unique challenges.

We also face our own set of climate risks. Barley yield is projected to decrease 17% in the coming years with increased heat waves and droughts. Warmer winters lead to smaller, earlier harvests, decreasing the number of hop plants. And climate-related supply disruptions are projected to increase 5 times by 2030.

Our actions will secure a future for our industry, the products we craft, and healthy people to enjoy it for many generations to come. This roadmap sets the course to ensure a bright future from barley to bars and beyond.

KRISTEN FILICE
Director of Net Zero
ZERO CARBON FORUM

Co-operation and the sharing of best practice is one of the keys to enabling a commercially and technologically viable route to a sustainable future.

Our work with the BBPA and its members over the years, has realised numerous projects focusing on the decarbonisation of brewing operations, and in driving energy efficiency in the retail side of the business.

Now we are delighted to be able to share our specific insight around improving the efficiency of brewing by contributing to this sector-wide initiative.

Whilst every brewery has its own unique characteristics, the creation of this high-level guidance document will help those brewers at the start of their journey and understand the need to buy into net zero and qualify the opportunities they have to start taking meaningful action.

In coming together with BBPA members and the Zero Carbon Forum, we have all shared industry specific data and know-how from a multitude of projects, which has enabled us to draw out indicative decarbonisation pathways, showing brewers where the real opportunities for carbon reduction are.

The route to net zero in such a diverse and complex industry will always be set against an evolving backdrop of innovation. This collaborative roadmap enables the sharing of current thinking for the benefit of all brewers, as together we target net zero.

Now the challenge is for brewers to develop their roadmaps to net zero and as a whole sector to act on this imperative.

WILL TODD
CEO
CARBON ARCHITECTURE

Britain's brewing industry is one of the oldest and most revered around the world. It is innovative, ambitious and a sector fit for the future. We understand the vital moment we are in when it comes to protecting our planet and how important it is for the sector to brew world class beer in a sustainable way, to ensure our proud reputation is maintained and to meet the United Nations Sustainable Development Goals.

The numerous challenges the sector has faced – and continues to face - cannot be understated. Difficulties faced due to the pandemic, coupled with exiting the European Union and unprecedented supply chain disruptions and huge pressures to energy supply, have amplified the need to ensure there is strong resilience throughout the entire supply chain.

The importance of reducing our emissions and demonstrating as a sector the steps we are taking to achieving net-zero therefore has never been greater. In taking the steps outlined in this roadmap businesses within the sector will be able to reduce emissions and costs and continue to illustrate their commitment to achieving our environmental goals. It's good for business and good for the planet.

To date the pub and brewing sector has implemented environmental initiatives across numerous areas. From improving energy efficiency and reducing CO2, to lowering water consumption, cutting down on waste and supporting local businesses and agriculture, Britain's breweries and pubs are determined to make Britain a world leader for environmental sustainability.

When tackling environmental challenges we know how important collaboration is. Achieving the targets we have set out as a sector, and as a nation, cannot be done alone. We recognise the crucial contributions being made from the supply chain, partners and stakeholders throughout the whole sector. To reach our ambitions and establish initiatives it is vital that we continue to work with businesses and organisations as we collectively continue moving forward towards net-zero.

We appreciate the need for collaboration and the need for action, which is why alongside the Zero Carbon Forum and Carbon Architecture, and input from our members, we have produced this sector specific brewing roadmap. The roadmap outlines the distinct ambition for the brewing sector in the UK to become a net-zero carbon emitting sector in advance of the Government's own 2050 target for a carbon zero future and as part of the wider, green recovery.

EMMA MCCLARKIN
CEO
BRITISH BEER & PUB ASSOCIATION

ABOUT THE ZERO CARBON FORUM

Net zero is about more than reducing emissions; it's about transforming how we work, play, eat, drink, and do business. And we can't do it alone.

The Zero Carbon Forum (ZCF) brings businesses together from across the hospitality and brewing sectors in a non-competitive collaboration to drive and create the change we need. Our members range from global multinationals and the UK's most loved brands to independent operators.

We're united by our commitment to achieve net zero ahead of government timelines, and the recognition that we need to work together to get there.

We exist in response to strong ambition across the sector, growing concern amongst customers, and the UK government's eagerness to position itself as a world leader on climate change.

Backed by industry leaders, trade associations, and some of the world's most respected climate experts, our members collaborate in structured action groups to drive meaningful change.

OUR WORK

With radical plans for business, our actions are based on innovation, thought leadership, collaboration, and data backed by the latest climate science.

Collectively, the brewing and hospitality industries and our supply chains are among the largest employment, economic, and environmental influences in the UK. Our opportunity to be part of the solution is just as great. With our reach, influence, and ingenuity, we're working together to cut carbon from pasture to pub and from farm to front of house.

As a collective industry voice, we're able to create economies of scale, influence our supply chains, shift customer behaviour, and lobby government for the incentives and regulatory framework to enable action. We also follow, accelerate, empower the future technology on which our successful decarbonisation depends.

In addition to outlining our decarbonisation pathways in this report, we help ZCF members and brewers across the sector to build holistic, integrated strategies to decarbonise quickly, credibly, and consistently.

This roadmap sets the direction, scope, and pace for our journey, uniquely tailored to UK brewers.

JOIN US

We invite brewers of all sizes to join the forum to collaborate and accelerate the sector towards net zero.

All ZCF members have committed to setting their own net zero pathways, and many are already aligned with the strategy outlined in this roadmap.

In the coming months and years, the ZCF and our members will accelerate progress, driving deep emission reductions across the sector and beyond.

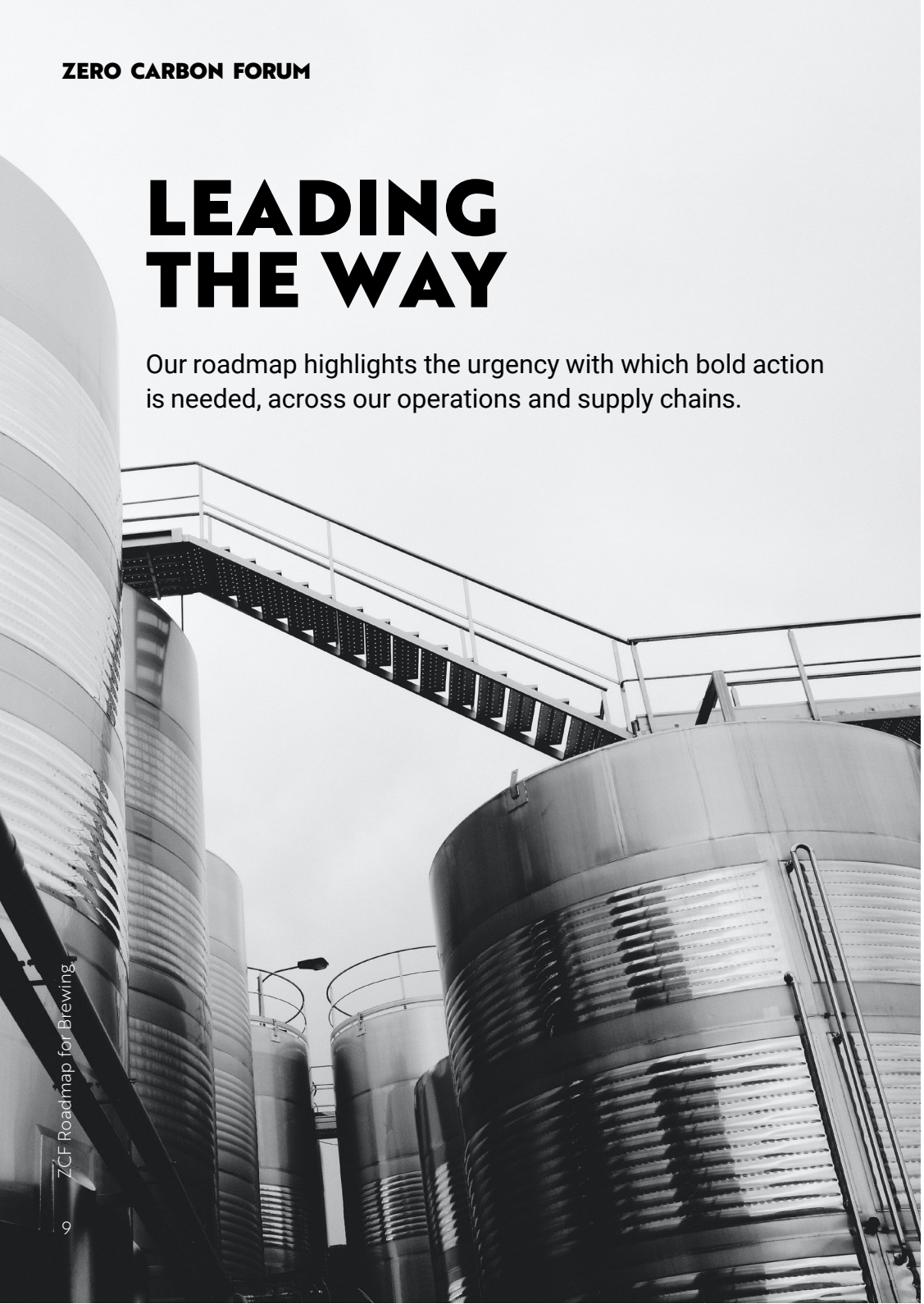
To find out more about membership, get in touch with us at
membership@zerocarbonforum.com

ZERO CARBON FORUM BREWERIES

ADNAMS SOUTHWOLD
BREWDOG
Everards of LEICESTERSHIRE
FULLER'S
GREENE KING BURY ST EDMUNDS
ROBINSONS 1838 BREWERY
1827 McMULLEN BREWING AND PUBS
HALL&WOODHOUSE
SHEPHERD NEAME BRITAIN'S OLDEST BREWER
ST AUSTELL EST. BREWERY 1851
WADWORTH

LEADING THE WAY

Our roadmap highlights the urgency with which bold action is needed, across our operations and supply chains.



We've committed to achieving net zero by 2040 across the sector, with ambitious decarbonisation targets and milestones along the way.

2030

Abating all avoidable emissions from our direct operations (scopes 1 and 2).

2040

Abating all avoidable emissions from our supply chains (scope 3) and credibly removing residuals to achieve net zero.

Working to or ahead of the pace outlined in this report, these members have already committed to achieving net zero emissions by these dates or earlier:

ADNAMS SOUTHWOLD

BREWDOG

FULLER'S

GREENE KING BURY ST EDMUNDS

1827 McMULLEN BREWING AND PUBS

SINCE 1698 SHEPHERD NEAME BRITAIN'S OLDEST BREWER

ST AUSTELL EST. BREWERY 1851

INTRODUCTION

ABOUT THIS ROADMAP

WHY WE CREATED THIS ROADMAP

As brewers, our challenges and opportunities to decarbonise are as unique as the beers we brew. This deep dive into brewing emissions quantifies our environmental impact and outlines the actions we'll need to take.

We've created this roadmap to not only map our way forward, but to make those insights accessible to brewers everywhere.

HOW WE CREATED THIS ROADMAP

This roadmap is an evolution of our 2021 Net Zero Guide for Brewing and Hospitality, developed in collaboration with Carbon Intelligence.

We created this brewing-specific roadmap through extensive consultation with BBPA, Carbon Architecture, our members, industry representatives, and other brewing specialists. We've aligned our actions with the latest climate science and the ambitions laid out in our hospitality sector roadmap.

The action we call for is consistent with limiting warming to 1.5°C and is feasible for brewers of all sizes.

We compiled insights, interviews, and data, bolstered by collaborative efforts, cross-functional thinking, and knowledge sharing in numerous thought leadership sessions and workshops.

Our research focuses specifically on brewing, outlining trends, emission hot spots, decarbonisation opportunities, and practical steps for brewers across the country to set and achieve net zero goals.

HOW TO USE THIS ROADMAP

We've outlined our shared emission areas and a joint pathway forward. Some of the actions in this roadmap are individual, and others are opportunities for collaboration, including how we work with our supply chains and government to accelerate progress.

Individual brewers will need to build on this and plot a net zero journey that works for your business model, priorities, and stakeholders.

We'll act as a lighthouse for brewers to decarbonise while driving efficiency and resilience. Together, we can maximise the economic, social, and environmental benefits of a low carbon future.

THAT'S A GOAL WE CAN ALL RAISE A GLASS TO.

BUSINESS AS THE SOLUTION, SUSTAINABILITY AS THE STANDARD

CLIMATE EMERGENCY

The climate science is indisputable: Human influence has unequivocally warmed the planet at an unprecedented rate. Climate change presents the greatest threat the modern world has ever faced to people, nature, and global stability.

In 2015, world leaders signed the Paris Climate Agreement, committing countries to transition to a lower carbon economy and limit global average temperature rise to 2°C above pre-industrial levels.

We now understand that to limit the worst impacts of climate change, we must strive to prevent warming beyond 1.5°C.

To do this, we need to drive deep reductions in greenhouse gas (GHG) emissions across all sectors of the economy. That means halving emissions by 2030 and reaching a state of net zero emissions globally no later than 2050.

The 2022 IPCC report highlighted the urgency of our current situation. At 1.5°C, we'll see disastrous consequences, including increasing heat waves, longer warm seasons, shorter cold seasons, and ruined harvests, leading to a predicted 30% decrease in agricultural yield. At 2°C, heat extremes reach critical tolerance thresholds for human health and agriculture.

If nothing changes, we'll hit a 2.9°C temperature rise by 2050. And without immediate, large-scale emission reduction, limiting warming even below 2°C will be beyond reach.*

Global temperatures have already risen 1.1°C above pre-industrial levels, and the UN has declared 'code red for humanity. We're seeing floods, droughts, wildfires, supply chain disruptions, and species extinction, not to mention widespread civil unrest, refugee crises, and dire consequences for the world's most vulnerable populations.

We're feeling the impacts of climate change here in the UK, as well as overseas. Based on our current trajectory. climate change is expected to cost the UK economy up to £20bn a year by 2050.** Climate events have already cost the world £1.24tn between 2011 and 2020, up 50% from 2001-2010. And the cost of extreme weather events is sharply on the rise- just the ten costliest disasters of 2021 exceeded £140bn in damages.***

*Intergovernmental Panel on Climate Change, 2022 | **The Times, 2021 | *** Morgan Stanley, 2021

THE BUSINESSES CASE FOR NET ZERO

BRAND REPUTATION

Businesses who don't have a plan for how to thrive in a net zero economy will fall behind their competitors and face reputational risk. Maintaining a leading position by setting a credible net zero strategy ensures that your stakeholders, employees, and clients recognise your company's contribution to the global emissions reduction challenge. In addition, improving confidence with investors by demonstrating strong sustainability credentials could attract new sources of green investment.

RISK MITIGATION

Businesses are exposed to physical and transitional climate-related risks now and in the future. Setting a net zero strategy encourages businesses to explore their emissions impact and potential sources of climate risk across the value chain. Building plans to reduce emissions and engage supply chains reduces overall risk and helps to ensure future security of supply. This is particularly relevant for the brewing sector, which has a high reliance on supply chains exposed to physical climate risks (e.g. agriculture).

CUSTOMER AND EMPLOYEE EXPECTATIONS

Increasingly, stakeholders at every level are putting pressure on businesses to take action toward reducing their waste, emissions, and environmental impact. Present and future employees expect companies to show leadership and bold action on climate change mitigation, biodiversity protection, emissions reductions, and environmental stewardship.

FORWARD-THINKING BUSINESS STRATEGY

Tackling and reducing emissions now will not only prepare your business for the transition to a zero carbon economy. Decarbonising also helps minimise future climate- related disruptions, while allowing you to take full advantage of technical innovations and cost-saving opportunities. Companies also have the opportunity to explore new revenue streams and commercial offerings, improve business performance, and reduce costs associated with carbon taxes in the future.

RESPONSE FROM UK GOVERNMENT AND BUSINESSES

In 2019, the UK became the first major economy to legislate and commit to achieving net zero carbon emissions by 2050. To support this long-term commitment, in 2021 the government set a new target to reduce national emissions 78% by 2035 compared to 1990 levels.

These ambitious targets will inform the direction of government policy and business over the coming decades. Businesses of all sizes and across all sectors will play a crucial role in the transition to net zero. For many it will present significant challenges, but with that comes opportunity, and the possibility of developing new business models, driving new technologies, and creating efficiencies.

Some progress has been made, with over 40% of our electricity coming from renewable sources. The government has also put £6bn into making homes and buildings more energy efficient and is investing in a phase out of petrol and diesel vehicles leading to a full ban on sales in 2030.

However, many, including the Climate Change Committee, have voiced concerns about the level of ambition and ability of current policies to deliver on our net zero commitments. And businesses are rising to the challenge. Across sectors, organisations are driving action and accountability by setting ambitious corporate-level net zero commitments.

To remain credible and aligned to the latest climate science, net zero commitments are increasingly backed by science-based emission reduction targets. This is to focus efforts on ambitious decarbonisation to stop the accumulation of emissions in the atmosphere.

Alongside individual efforts, there's widespread recognition across the business community that collaboration is key to tackling the interconnected challenges around climate change and reaching net zero. In addition to the ZCF, some examples of UK sectoral initiatives relevant to brewing value chains include:

BRITISH RETAIL CONSORTIUM

Developed a roadmap and key milestones for the British retail industry to reach net zero.

FOOD AND DRINK FEDERATION

Developed commitments to deliver absolute emission reductions from UK manufacturing operations.

NATIONAL FARMERS UNION

Developed an agricultural sector commitment laying out plans to reach net zero emissions by 2040.

APPROACH AND METHODOLOGY

GREENHOUSE GAS SCOPES FOR BREWERIES

METHODOLOGY: BREWING SECTOR EMISSION PROFILE

We've mapped an emission profile focusing on the decarbonisation initiatives most relevant specifically to brewers. This has allowed us to account for differences in business type, while also uncovering similarities, shared challenges, and opportunities.

We started by gathering scopes 1-3 emissions data from sources including ZCF members, BBPA, Carbon Architecture, and the Carbon Disclosure Project.

To allow for comparison between breweries of different sizes, we converted emissions data into intensity figures using revenue data (tCO_2e / £m revenue and tCO_2e/ hectolitre of beer).

To contextualise our findings, we held workshops with ZCF brewers to explore reduction opportunities across scopes 1, 2, and 3 emission sources. We combined the feedback from these sessions with desk-based research to develop a comprehensive list of potential emission reduction projects for brewers.

The final intensity figures are averages to help brewers understand potential emission hotspots and decarbonisation opportunities, and to understand the impact of our activities. Individual brewers' emissions will vary depending on specific processes, location, age of equipment, sourcing practices, and other emission-related activities.

We've included more details about our methodology in the appendix of this report, and an overview of greenhouse gas scopes as they apply to breweries on the next pages.

CARBON ARCHITECTURE

BRITISH BEER & PUB ASSOCIATION

Carbon Intelligence

OUR APPROACH TO EMISSION SCOPES

At the ZCF, our net zero pathways, approach, and methodology are aligned with both the Science-Based Targets Initiative (SBTi) and the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard. We break emissions reporting down into 3 scopes, as recognised by these leading bodies in climate change.

SCOPE 1 EMISSIONS FOR BREWERIES

Scope 1 covers all direct emissions produced by a reporting company, including brewing processes and operations.

Direct emissions produced in a brewery are composed of:

- Emissions from stationary fuel combustion for heat
- Emissions from mobile combustion from vehicles
- Fugitive emissions from cooling and refrigerants

The main contributor is the combustion of fossil fuels like natural gas, fuel oil, or propane, used to generate heat for brewing and space heating.

The second is emissions from the combustion of fuels like petrol, LPG, or diesel, in commercial vehicles and forklift trucks owned by the brewery.

The third is emissions from the refrigeration plant and cold storage warehouses. Leakages occur from equipment deterioration and servicing over its operational life and disposal at the end of the equipment's life.

SCOPE 2 EMISSIONS FOR BREWERIES

Scope 2 covers the indirect emissions from purchased electricity, steam, heating, or cooling a company uses across its facilities. These emissions are considered indirect, because they're generated off-site to produce energy that's then consumed by the reporting company.

Scope 2 indirect emissions for a brewery are composed of:

- Indirect emissions associated with purchased electricity
- Indirect emissions associated with purchased steam, heating, or cooling

In a typical brewery where the heating equipment is directly owned by the brewery, the main contributor of scope 2 emissions will be electricity. If the brewery's heating equipment is owned and operated by a third party, the main contributor of emissions will be purchased heat and cooling.

TARGETING SCOPES 1 AND 2 EMISSIONS

Our target is to abate all avoidable scopes 1 and 2 emissions by 2030.

Scopes 1 and 2 emissions can be relatively straightforward to measure, and present a key priority area for brewers. With most of this in our direct control, we can start tackling these emissions now. Our target to abate all avoidable scopes 1-2 emissions is 2030.

In addition to our individual and collaborative actions, to close the gap to net zero we'll need to work together to accelerate emerging technology and lobby government for funding and the right regulatory framework to incentivise action.

SCOPE 3 EMISSIONS FOR BREWERIES

Scope 3 covers indirect emissions from sources not owned or directly controlled by the organisation. These are the result of activities that occur in a brewery's value chain.

The main contributors of scope 3 emissions for a brewery are typically:

- Agricultural activities to produce hops and other ingredients

  Around 15 - 20% of a brewery's footprint is associated with agriculture. The main contributors are within the production and use of nitrogen fertilisers and fossil fuels used in farming machinery.

- Processing of raw materials, e.g. malting

  The processing of raw materials, like malting barley, contributes ~5% of a brewery's footprint. Most emissions are produced during the energy intensive kilning process, which uses fossil fuels as a heat source.

- Packaging production and waste/ disposal

  15-40% of a brewery's total footprint is associated with packaging, depending on the product mix. Single-use cans and bottles have relatively high emissions compared to kegs and casks, which are re-used.

- Upstream and downstream transportation, distribution, and logistics

  Upstream transportation relates to raw material deliveries, and can sometimes be difficult to disaggregate from material supply. Downstream covers the distribution of products to retail and on-trade. Combined, these contribute around 10% of total emissions.

- Use of sold products

  Emissions from the refrigeration of sold products is part of breweries' scope 3. This contributes around 10-20% of the total footprint, and includes chilling in pubs' beer cellars, shop fridges, and homes.

TARGETING SCOPE 3 EMISSIONS

Our target to abate all avoidable scope 3 emissions and achieve net zero is 2040.

Scope 3 emissions present a greater challenge across all sectors and represent 60% to over 90% of a brewery's total emissions.

In order to build credible net zero strategies, it's crucial that we fully understand our scope 3 impact and include these emission sources in our decarbonisation roadmap.

The SBTi is publishing guidance to clarify the absolute reduction targets needed for emissions from our purchased goods and services. That includes categories with emission factors that are influenced by forestry, land-use and agricultural activities.

The most influential factors for achieving scope 3 emission reductions are the extent of our supply chain influence, customer engagement, transport and distribution decarbonisation, and government action.

WHAT DO WE MEAN BY NET ZERO?

Net zero involves first reducing emissions as much as possible, in line with a science-based pathway to keep global temperature rise below 1.5°C.

That means a 90% reduction across scopes 1 and 2 and, for breweries, a minimum 60% reduction across scope 3.

To be net zero, a business must:

- Calculate emissions across all 3 scopes
- Reduce and eliminate all avoidable emissions
- Neutralise the impact of unavoidable emissions

A credible net zero strategy is led by deep reductions. Removals balance emissions that can't be eliminated by investing in projects to permanently remove greenhouse gases from the atmosphere.

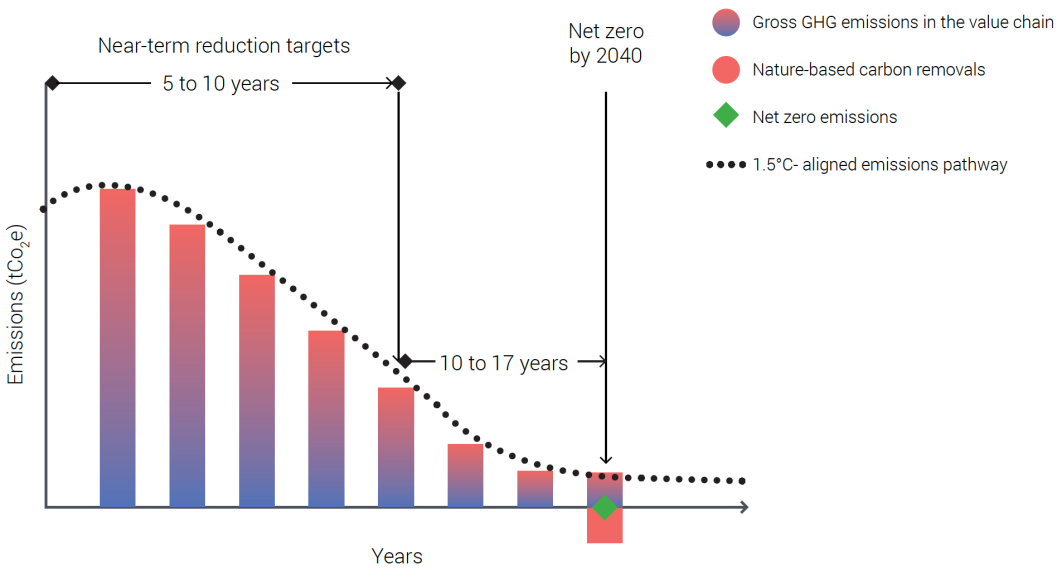
Our approach to net zero is in line with the Science Based Targets Initiative (SBTi) corporate guidance, including setting near-term and long-term targets, and transparently reporting progress.

It's important not to confuse net zero with carbon neutrality.

To be carbon neutral, a business must:

- Calculate emissions across all 3 scopes
- Purchase offsets equal to those emissions.

Achieving net zero emissions



Near-term science based target: Action to reduce emissions at a pace consistent with keeping global warming below 1.5•C.

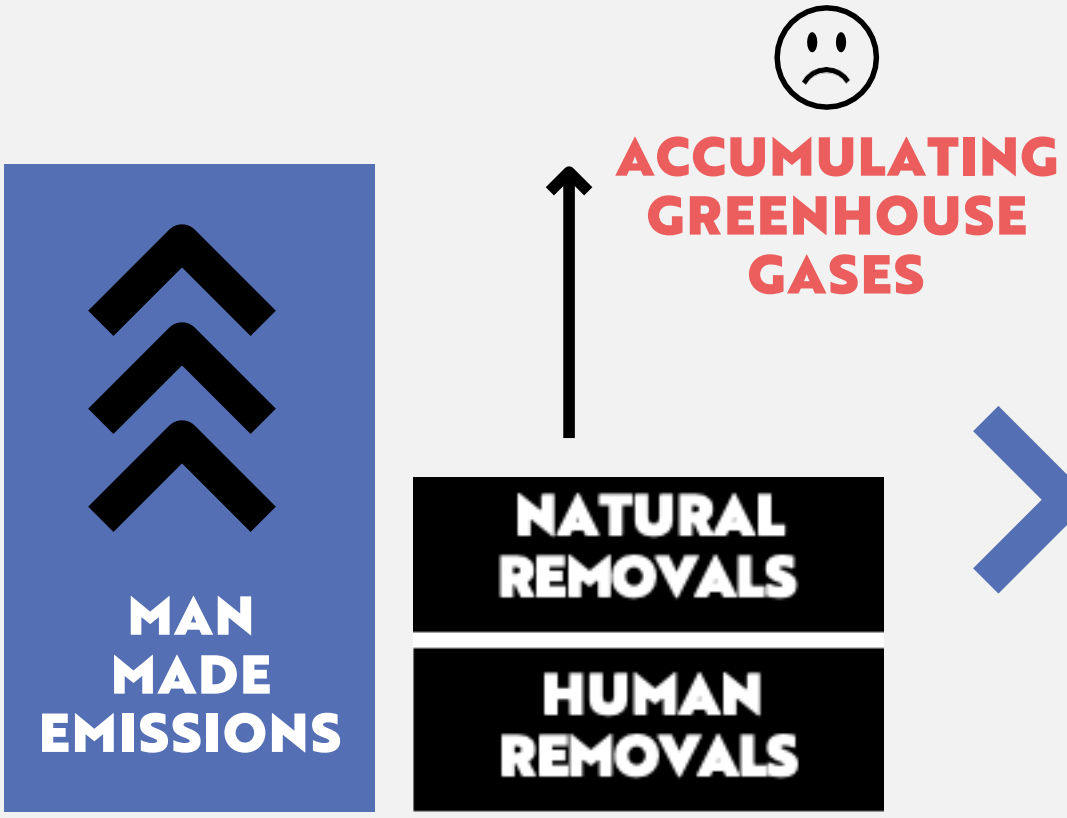
Long-term net zero target: North star for long-term strategic and investment decisions, providing clarity around direction.

Annual disclosure:
Transparency around implementation and progress against targets.

Carbon neutral means removing or avoiding as many greenhouse gases as you put into the atmosphere. It doesn't require a plan or action to reduce the gases you're emitting. Offsets can be avoidance or removal, and short or long-term.

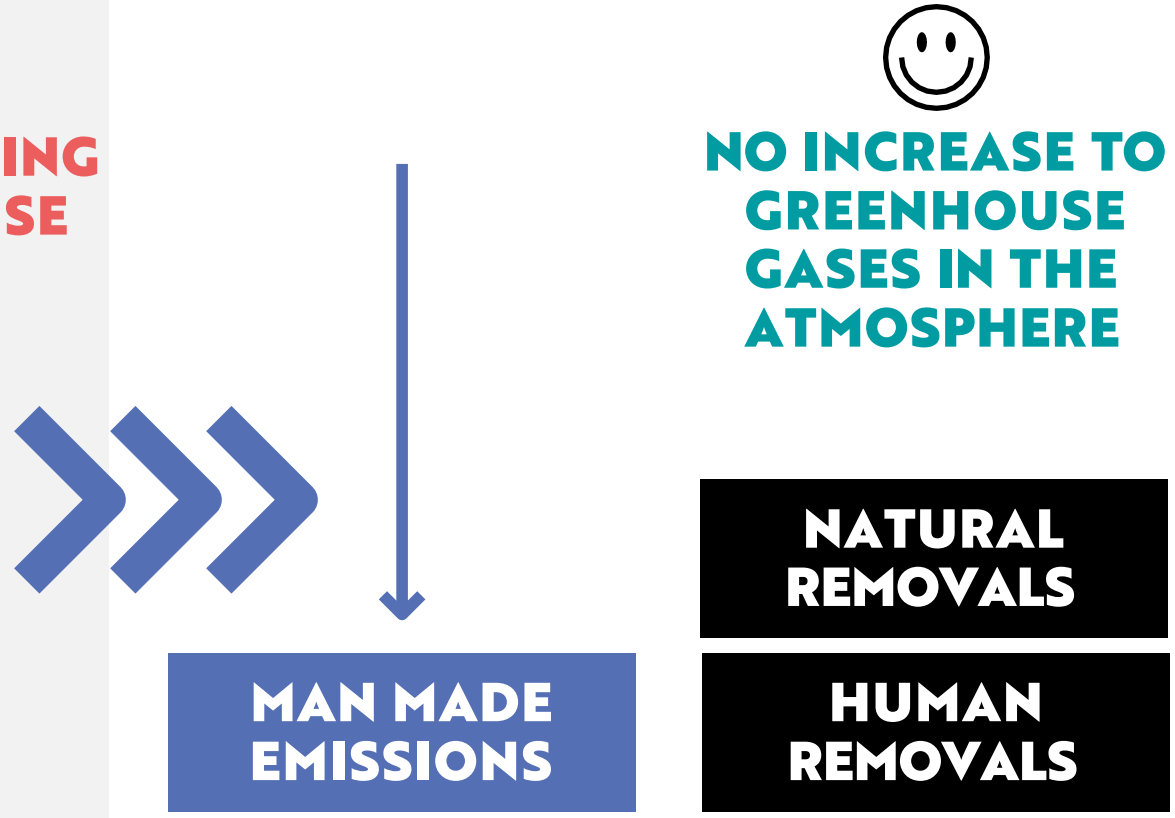
The ZCF does not advocate carbon neutrality on the route to net zero, unless it can be done without detracting budget or resource from driving deep reductions. We believe that the right time to neutralise emissions is at the end of a net zero pathway, after all possible reductions have been achieved, through long-term removals.

THE WORLD TODAY



We emit way more than Earth (or we) can remove. Greenhouse gases accumulate in the atmosphere.

THE FUTURE WE WANT



We emit only what we have to. We remove emissions that we can't reduce. That balance is **net zero.**

NET ZERO COMMITMENTS

There are two elements to a net zero strategy: A **reductions** pathway and a **removals** pathway. These pathways can be delivered in parallel, but the priority should be on reductions first.

A reductions pathway defines the rate of decarbonisation in line with science-based trajectories.

A removals pathway provides further mitigation to neutralise unavoidable residual emissions where reductions aren't sufficient to meet Paris-aligned climate goals.

Companies should take a phased approach to build net zero pathways:

1. ESTABLISH A BASELINE

Calculate a full value chain (scopes 1, 2, and 3) emissions baseline.

2. START YOUR REDUCTION PATHWAY

Set targets approved by the Science-Based Targets Initiative (SBTi) to deliver reductions across scopes 1, 2, and 3 emissions, and get started right away driving deep reductions across your full value chain.

3. PLAN A REMOVAL PATHWAY

Develop a credible removal strategy to offset unavoidable emissions.

SCIENCE-BASED TARGETS

Science-based targets translate the level of climate action needed globally down to a corporate level. A greenhouse gas emissions target can be considered science-based if the emissions reductions it requires are in line with keeping global temperature increase below 1.5°C compared to pre-industrial temperatures. This includes near- and long-term targets.

A science-based target must cover company-wide scopes 1 and 2 greenhouse gas emissions, as defined by the GHG Protocol Corporate Standard. If scope 3 emissions make up over 40% of total emissions, then at least two-thirds of your scope 3 emissions must be included in your short-term target (5 - 10 years), with this increasing to 95% in the long term.

The SBTi defines and promotes best practice in corporate science-based target setting. They independently assess and approve companies' targets in line with strict criteria. In 2021, the SBTi developed the first global net zero standard for businesses. We've used insights from this standard to develop the ZCF Net Zero Roadmap for Brewing, and we'll continue to stay up to date as net zero resources and guidance develop.

BREWING DECARBONISATION PATHWAYS

BREWING INDUSTRY DECARBONISATION PATHWAYS

The charts on the following pages include a high-level break down of emission reduction potential by key activity. We've included an overview chart, as well as a further break down by scopes 1 and 2 operational emissions, and scope 3 supply chain emissions.

The initiatives in our decarbonisation pathway waterfall charts demonstrate potential reductions across each key emission area. It's important to note that most areas can't be reduced by 100%, but together will bring us to our net zero reduction targets.

We've included more information about carbon reduction potential across each area, broken down into specific initiatives later in this report. This is supported by the relative investment cost for each reduction initiative.

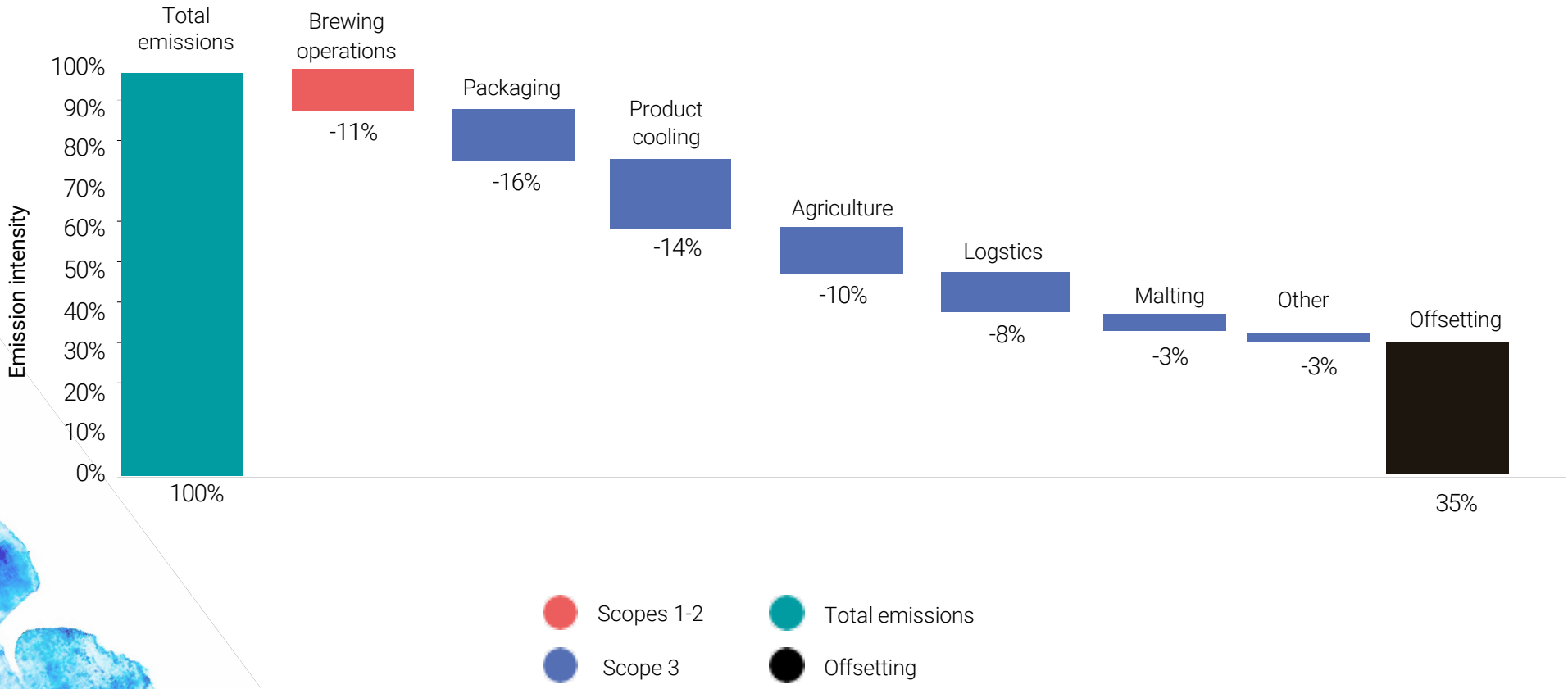
The initiatives build upon each other but don't have to be done in the sequence displayed. It's best to consider the combined carbon reduction from projects together, rather than in isolation.

Our analysis is based on our in-depth estimation of the full UK brewing industry carbon footprint.

UK BREWING INDUSTRY CARBON FOOTPRINT

SCOPES 1 AND 2	SCOPE 3
≈ 220 $ktCO_2e$	≈ 2,000 $ktCO_2e$

BREWING DECARBONISATION PATHWAY: ALL SCOPES



BREWERY DECARBONISATION PATHWAY:
SCOPES 1 AND 2 (MARKET BASED)

This pathway aligns with SBTi net zero guidance by achieving a 90% reduction in scopes 1 and 2 emissions without the use of carbon removal offsets. The most influential factor for achieving these reductions is the extent to which renewable gas tariffs can be secured to cover the thermal energy demands of the brewing process. To reach net zero after achieving these reductions, 10% of the scopes 1 and 2 footprint must be removed.

The £ symbols indicate relative low, medium, and high investment.

An alternative 'all-electric' technology pathway is possible by serving high-temperature heat loads with a 2-stage heat pump (10.0% savings). In this case there would be no need for an AD plant to recover biogas from effluent (3.3% savings) or boiler house optimisation (2.4%) savings. Instead the 2-stage heat pump and associated green power procurement would result in a 97% reduction in scopes 1 and 2 emissions (rather than 90% in the biogas scenario). To reach net zero after achieving these reductions, only 3% of the scopes 1 and 2 footprint would need to be removed.

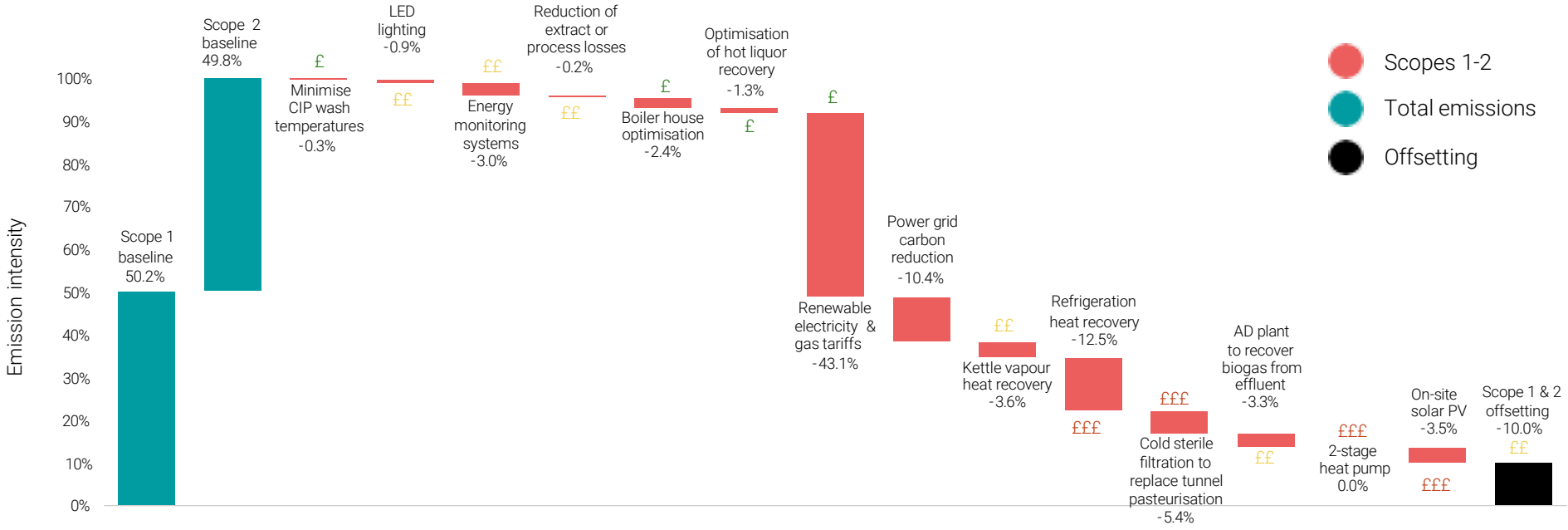
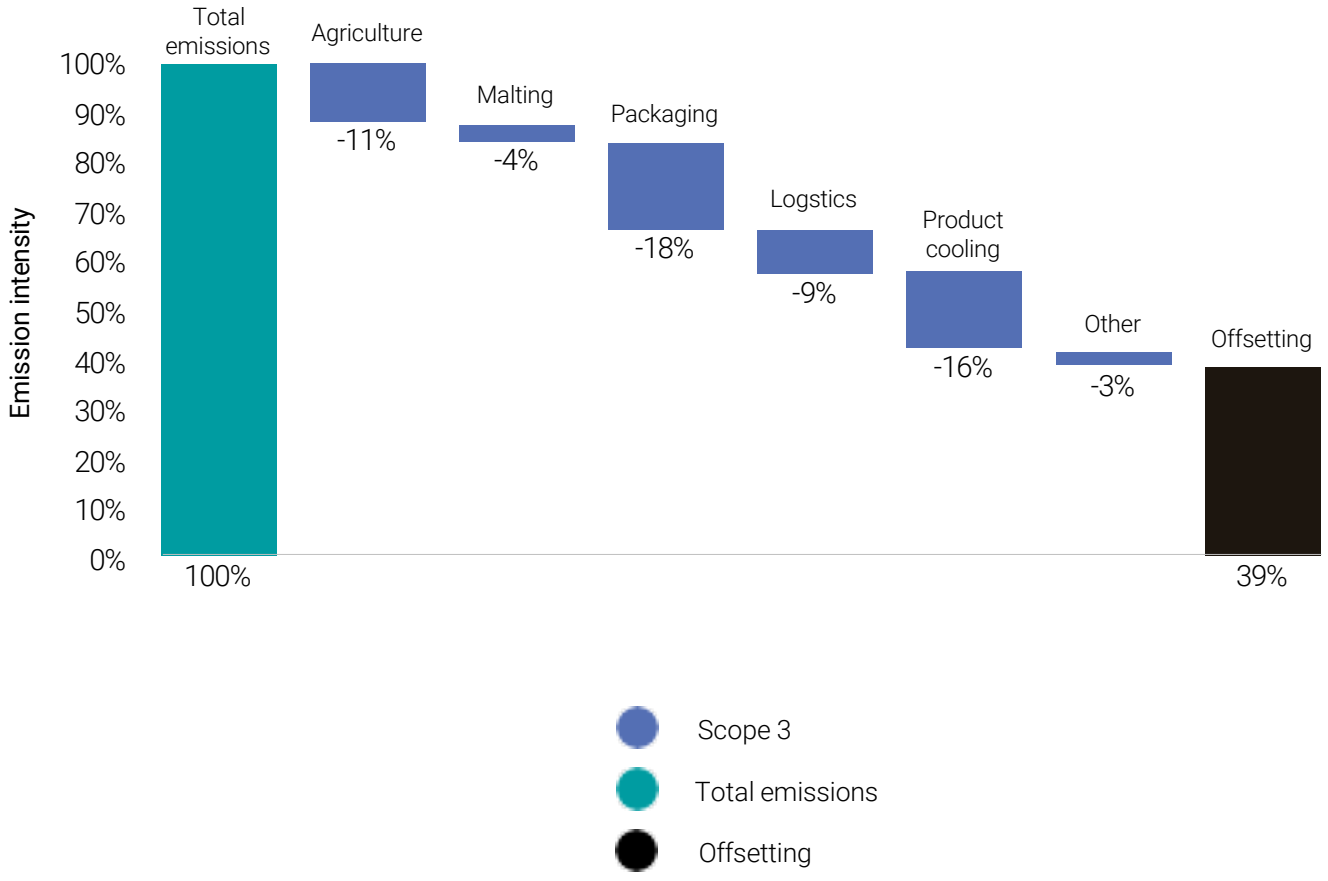


Image source: 2021 Zero Carbon Forum Net Zero Guide for Brewing and Hospitality

BREWING DECARBONISATION PATHWAY: SCOPE 3



A high ambition net zero pathway for breweries achieves a minimum 60% reduction in scope 3 emissions, without the use of carbon removal offsets. In general, breweries should aim for a 60-90% reduction in scope 3 emissions from the measures proposed above.

The extent to which we can decarbonise our supply chains is largely dependent on our ability to influence and accelerate the decarbonisation of adjacent industries like agriculture, pubs and restaurants, and our packaging suppliers.

To reach net zero after achieving these reductions, we'll need to remove 10-40% of our scope 3 footprint.

NET ZERO MILESTONES

NET ZERO

90% reduction Scopes 1-2

60-90% reduction Scope 3

	2023	2025	2028	2030	2035	2040
Strategy & data	Baseline across scopes 1, 2, and 3 Approved SBTs Commit to net zero Commit to RE100 Emissions reporting platform	Update ZCF every 3-5 years Publicly report scopes 1, 2, and 3 Update baseline to align with best practice guidelines, e.g. the World Resources Institute (WRI) Forest, Land, and Agriculture accounting guidance	Adopt internal carbon price Completion of all long-term projects (Brewhouse thermal integration, biogas generation, refrigeration waste heat recovery, clean filling and solar PV)	Update ZCF Roadmap to 2040 90% decarbonisation of low-temperature heat.	Update ZCF Roadmap to 2040 90% decarbonisation of low-temperature heat.	
Brewing operations	Net zero plan for all breweries	100% renewable electricity across all operations Completion of short-term projects (Extract losses reduction, process control optimisations, energy monitoring and optimisation of hot liquor & CIP wash temperature reduction)	Completion of all long-term projects (Brewhouse thermal integration, biogas generation, refrigeration waste heat recovery, clean filling and solar PV)	90% decarbonisation of low-temperature heat	90% decarbonisation of high-temperature heat	
Renewable energy	Renewable energy sourcing strategy	100% renewable electricity Completion of short-term projects (Reducing extract losses and hot liquor/ CIP wash temperatures, optimising process control, energy monitoring)	On-site generation & battery storage where feasible	Franchises source 100% renewable electricity		
Agriculture & processing of raw materials	Supplier engagement plan Low CO_2agriculture strategy Deforestation policy Annual supply chain risk assessment Supplier engagement around SBTs	Zero deforestation from high risk commodity groups Collaboration to decarbonise meat and dairy production, for example, engaging with key industry initiatives and suppliers.	Prioritise (by emissions, spend, and risk) suppliers with SBTs	95% suppliers by emissions with SBTs Verified priority supplier emission reductions	Verified supplier emission reductions for 95% of suppliers	Net zero suppliers
Packaging & product cooling	Supplier engagement plan Explore optimised packaging materials > 30% recycled plastic	LCAs on all packaging Packaging from low carbon suppliers	Prioritise (by emissions, spend, and risk) suppliers with SBTs	95% suppliers by emissions with SBTs Verified priority supplier emission reductions	Verified supplier emission reductions for 95% of suppliers	Net zero suppliers
Logistics	Fuel efficiency for owned fleets (e.g. more sustainable fuel types or fleet optimisation tools / techniques such as route optimisation) GHG reporting on all logistics	100% electric company cars	100% zero carbon light commercial vehicles		100% HGVs zero carbon 100% upstream logistics zero carbon 100% zero carbon deliveries from engagement with delivery companies	
Carbon removals	Carbon removal quality criteria and principles agreed	Set up investment model	Projects identified and volumes secured	Residual scopes 1 and 2 emissions neutralised with carbon removals		Residual scope 3 emissions neutralised with long-term, credible carbon removals

BREWERY SUMMARY

Scopes 1, 2, and 3 intensity (market based)	Scopes 1 and 2 contribution	Scope 3 contribution	Key emission hotspots
50 - 90 kg CO_2e/hl 250 tCO_2e/£m turn-over (market based)	12%	88%	Agriculture Processing of raw materials Brewing operations Packaging Logistics Product cooling

BREWERY EMISSION HOT SPOTS

We've compiled an overview of a typical full-value chain carbon footprint of a large brewery, and of a cask or keg focused brewery.

Key emission sources fall into seven major categories, covering the full lifecycle emissions of beer.

AGRICULTURE

Accounts for the scope 3 emissions associated with the growing of raw ingredients used in brewing, such as barley and hops.

PROCESSING OF RAW MATERIALS

The most significant is the processing of barley into malt as part of a brewery's scope 3 emissions. We call out malting separately throughout this report.

BREWING OPERATIONS

Brewhouse heat, electricity, and packing processes account for most of a brewery's scopes 1 and 2 emissions.

PACKAGING

Defined as the manufacturing and disposal of packaging items such as glass bottles, aluminium cans, casks, kegs, and secondary and tertiary packaging. Packaging emissions fall mostly into scope 3 and contribute significantly to a brewery's overall carbon footprint.

LOGISTICS

Can account for scopes 1 and 3 emissions, depending on the brewery's mode of operation. Upstream and downstream transportation and distribution of materials and products are the main contributors.

COOLING

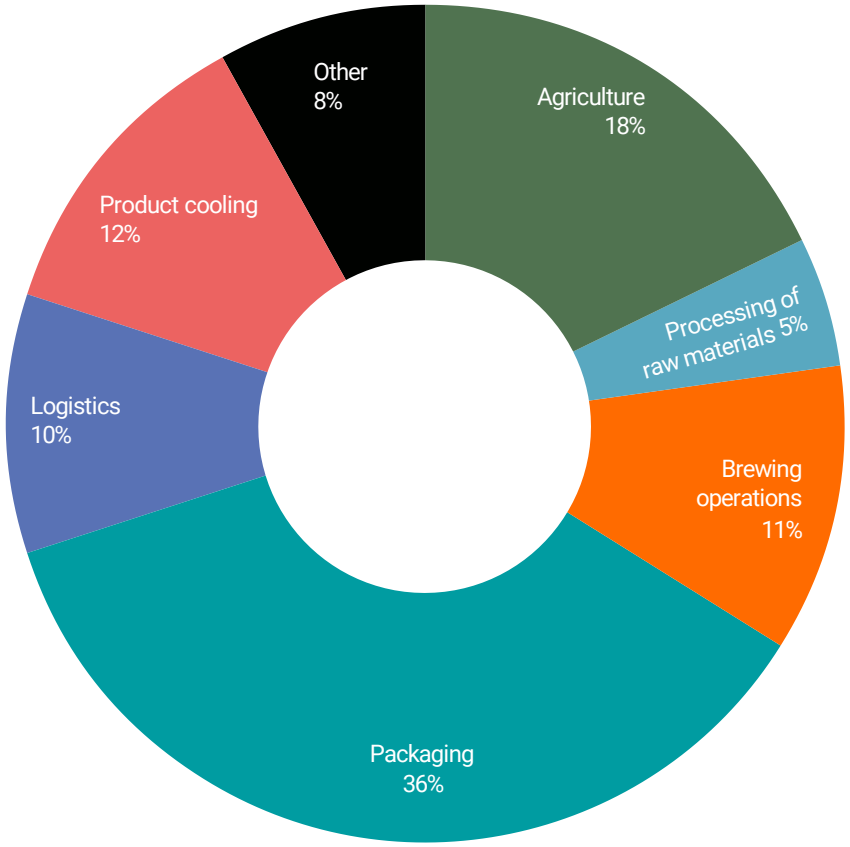
The use of sold products, contributing to scope 3 emissions. Products are usually refrigerated on-trade, in fridges in a customer's house, or kept refrigerated in a cellar for the on-trade.

OTHER

All other business-related activities required to operate a brewery.

These emission profiles are only indicative and can be impacted significantly by factors such as location, building age, mode of operation, and packaging format.

BREWERY EMISSION HOT SPOTS



TYPICAL LARGE BREWERY FOOTPRINT

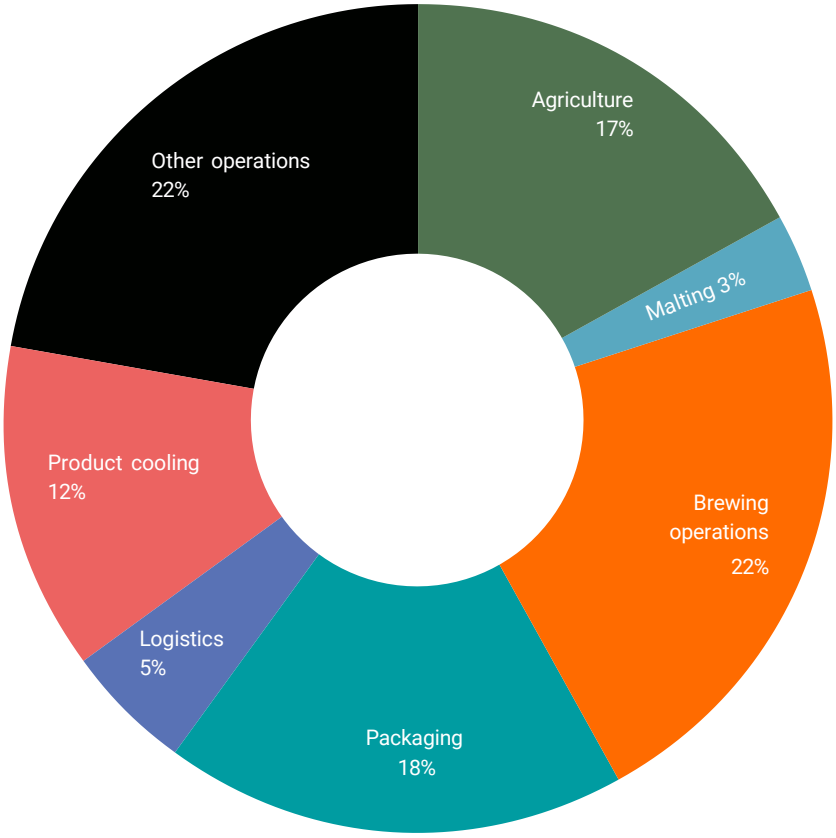
We consider a large brewery to have a production volume of over 100,000 hectolitres.

The carbon emission contribution of brewing operations is smaller for a large brewery than a cask focused brewery due to higher operational efficiency through economies of scale.

The large packaging footprint is due to a bigger mixture of packaging types where a greater proportion of product is typically bottled or canned.

Sources www.carlsberggroup.com/media/42556/carlsberg-sustainability-report-2020_final.pdf | www.ab-inbev.com/assets/pdfs/Net%20Zero%20Executive%20Summary_FINAL%2012pm.pdf
www.theheinekencompany.com/sites/theheinekencompany/files/Downloads/PDF/sustainability%20and%20responsibility/heineken-on-the-path-to-net-zero-2021.pdf | Carbon Architecture 2022

BREWERY EMISSION HOT SPOTS



TYPICAL CASK/KEG FOCUSED BREWERY FOOTPRINT

We consider smaller cask or keg focused breweries to be those with a production volume from about 30,000 hectolitres up to 100,000 hectolitres.

The impact of packaging is lower for a smaller ale brewery, since a greater proportion of product is casked or kegged. This has a lower carbon impact compared to single use bottles and cans.

Brewing and other operations are typically larger contributors to a brewery's overall footprint due to lower operational efficiencies.

Logistics contributions to the overall carbon footprint are lower due to the smaller scale of operations.

Sources www.carlsberggroup.com/media/42556/carlsberg-sustainability-report-2020_final.pdf | www.ab-inbev.com/assets/pdfs/Net%20Zero%20Executive%20Summary_FINAL%2012pm.pdf
www.theheinekencompany.com/sites/theheinekencompany/files/Downloads/PDF/sustainability%20and%20responsibility/heineken-on-the-path-to-net-zero-2021.pdf | Carbon Architecture 2022

KEY DECARBONISATION ACTIONS FOR BREWERS

FOCUS AREAS FOR BREWERS

This roadmap is designed to provide brewers with guidance on the steps they can take to decarbonise their businesses and set net zero strategies. Within the roadmap, there are 7 key areas to focus on: strategy and data, buildings, renewable energy, sourcing - food and beverage, sourcing - other, transport, and carbon removals.

DECARBONISATION PRIORITIES

While the opportunities and challenhes vary across sub-sectors, there are several cross cutting priorities that the sector needs to tackle collectively. These priorities have been summarised into 7 workstreams.

STRATEGY AND DATA

Ambitious and science-based carbon targets, with reliable and granular data across scopes 1-3, used to track progress.

BREWERIES

Optimising processes and driving low carbon technologies to deliver efficiency and direct carbon reduction.

RENEWABLE ENERGY

Sourcing 100% renewable energy across all breweries and offices.

AGRICULTURE AND RAW MATERIAL PROCESSING

Collaborating with suppliers to accelerate sustainable agriculture, malting, and low-carbon production of ingredients and materials.

PACKAGING

Collaborating with suppliers to reduce emissions from purchased goods and services and capital goods.

LOGISTICS

Transitioning to low and zero carbon transport throughout the value chain.

CARBON REMOVALS

Investing in high quality projects that remove CO_2 from the atmosphere, to neutralise residual emissions at the end of a net zero pathway.

DECARBONISATION OPPORTUNITIES

The tables on the following pages outline decarbonisation opportunities for brewers, grouped under each of these pillars.

We've assessed each initiative to determine:

- Its relevance to brewing
- Carbon reduction potential
- Whether it's a short- or long-term priority
- Challenges to consider
- Implementation year– when in your journey you should begin each initiative
- Indicative cost
- Alignment with other initiatives and organisations

Brewers can use these tables as a checklist to help build your own decarbonisation strategy.

Cost assumptions are indicative, and relative to each initiative to allow high-level comparison. Specific costs and payback periods will vary by business, process, location, age, and project.

For example, moving to renewable electricity is relatively low cost (£)- it's quick and cheap to purchase renewable energy certificates, particularly with rising energy costs.

By comparison, engaging your suppliers is a relatively medium cost (££) which requires more internal resources in the long term, and may mean paying more to work with suppliers with high environmental performance.

Investing in major capital projects to replace natural gas boilers with heat pumps would be a relatively high cost (£££).

We haven't applied relative investment to scope 3 decarbonisation initiatives as they're often dependent on supplier or customer engagement, making them more difficult to quantify at this time.

We've categorised initiatives as 'short-term' - initiatives that breweries should target over the next 1-2 years – and 'long-term' – those that should considered beyond that timeframe due to their complexity or dependence on process efficiency.

Some reductions have interactive effects. We've accounted for these interactions to avoid any double counting.

STRATEGY AND DATA

Initiative	Description	Scope	Project type	Challenges	Year	Cost	Alignment
Baseline GHG data across all scopes	Establish baseline across scopes 1, 2 and 3 to understand emission hotpots and prepare for SBT.	All	Short-term	Sources and quality of data.	2023	£	SBTi
Publicly report GHG emissions across all scopes	Disclose emissions in external reporting documents (annual report, sustainable business report, online).	All	Short-term	Adding GHG reporting into regular reporting cycle. Deciding where and how to disclose data.	2025	£	Streamlined energy and carbon reporting (SECR)
Net zero plan for all brewing operations and supply chain	Create a decarbonisation strategy and update at least every 5 years at both an individual and a company level.	All	Long-term	Keeping across political, environmental, and technological changes to ensure optimal strategy.	Every 5 years	£	SBTi
Reporting platform	A reporting platform enables you to collect, store, and analyse sustainability data to understand hot spots and prioritise decarbonisation actions. Collecting data from suppliers to track and report scope 3 data will be critical. The ability to accurately track and report scope 3 emissions will be critical given their contribution to overall emissions, particularly the ability to collect data from suppliers.	All	Long-term	Selecting an appropriate reporting platform. Assigning roles and responsibilities to internal stakeholders. Internal training and upskilling.	2023	£	Streamlined energy and carbon reporting (SECR)

STRATEGY AND DATA

Initiative	Description	Scope	Project type	Challenges	Year	Cost	Alignment
Commit to net zero	Agree to emission reduction and removal targets to achieve net zero in line with SBT requirements.	All	Long-term	Implications of achieving net zero for your business. Long term challenges in areas which are difficult to decarbonise. Implementing a removal strategy.	2023	£	SBTi
Adopt an internal carbon price	Implement an internal carbon price to manage transition risk, improve investment decision making, and support sustainability initiatives. Guidance on setting an internal carbon price on page 72.	All	Long-term	Selecting an appropriate carbon price for your business. Effectively implementing carbon pricing into business decision making.	2023	£	
Approved Science Based Target	Submit GHG emission reduction targets to SBTi for approval to provide the credibility that your strategy is aligned to the latest climate science.	2, 3	Long-term	Engagement and buy-in from key stakeholders. Understanding requirements to be approved by SBTi. Understanding key steps required to accomplish targets once approved.	2023	£	SBTi

BREWERIES

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Year	Cost	Ownership	Alignment
Reductions in extract losses	Optimisation of process to reduce extract losses and product wastage.	1, 2	Medium	Short-term	Implementation depends on level of process automation.	2023	££	Individual action	
Process control optimisation	Process/ Scada monitoring analytics, optimisation, and reporting.	1, 2	Medium	Short-term	Positive changes can be overridden or reverted if not managed properly.	Ongoing	££	Individual action	
Energy monitoring systems	Monitoring and analytics of key performance indicators.	1, 2	Medium	Short-term	Connectivity across siloed data systems; IoT security considerations.	2023	££	Individual action	
Optimisation of hot liquor use	Ensure no hot liquor is wasted and that hot liquor is recovered at a usable temperature.	1	Low	Short-term	May require modifications to process control or wort cooler.	2023	£	Individual action	
CIP wash temperature	Reduction of CIP wash temperatures and use of cold CIP where possible.	1	Low	Short-term	Correct validation to ensure zero quality impacts.	2023	£	Individual action	

BREWERIES

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Year	Cost	Ownership	Alignment
Staff training and awareness	Training and awareness programmes that focus on areas where all levels of staff influence energy use.	1, 2	Low	Short-term	Staff turnover, competing priorities e.g. customer service.	Ongoing	£	Individual action	BRC Climate Action Roadmap
Brewhouse thermal integration	Recovery of heat from kettle boil-off. Ideally recovered into a closed loop system and used to preheat wort entering the kettle.	1	Medium	Long-term	Requires space in the brewhouse and modifications to brew stream.	2025	££	Individual action	
Anaerobic digestor biogas	Treatment of effluent and or spent grains to produce biogas.	1	Medium/ High	Long-term	Needs significant amount of space. Will be impacted by waste reduction optimisation.	2023	££ / £££	Individual action, collaborative	
Heat pump for refrigeration heat waste	Use of a heat pump to raise low temperature hot water from the refrigeration waste heat. This can be used for a variety of heat loads including CIP and pasteurisation.	1, 2	High	Long-term	Requires significant electrical capacity. Will require some changes to process and installation of a heat network.	2025	£££	Individual action, lobbying	

BREWERIES

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Year	Cost	Ownership	Alignment
Clean filling	Switching from tunnel pasteurisation to clean filling.	1	High	Long-term	Significant process changes and large capital requirement.	2030	£££	Individual action	
Solar PV	On-site solar installation, with battery storage if beneficial.	1	Medium	Long-term	Roof condition, space, slope, shading.	2025	££	Individual action	RE100, BRC Climate Action Roadmap
Insulation and fabric	Fabric and / or insulation upgrades to reduce heat loss.	1	Low	Long-term	Disruption to operations, potentially long payback.	2025	£-££*	Individual action	RE100, BRC Climate Action Roadmap
Low global warming potential (GWP) refrigerants	Systems with GWP < 150.	1	Medium	Long-term	Ammonia (R717) toxicity, Co_2 (R744) high pressure.	2030	£££	Individual action	RE100, BRC Climate Action Roadmap

*depending on ownership model

RENEWABLE ENERGY

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Year	Cost	Alignment
RE100	Commit to using 100% renewable electricity across your business.	2, 3	High	Long-term	Cost and availability of renewable electricity to business.	2023	£	SBTi
Other green energy sources	Longer term, explore the feasibility of biomass, biogas, and hydrogen solutions for low carbon energy within business.	1,3	High	Long-term	Origin and reliable supply of biomass sources. Limited supply of biogas. Hydrogen solutions are unproven, and speculative, and are 10-15 years away from commercialisation.	2030 -2035	££	
Indirectly source 100% renewable electricity with your energy provider	Purchase renewable energy tariffs from your energy provider at head office, owned and franchise locations.	2	High	Short-term	Longer term challenges and availability of renewable electricity certificates.	2023 Franchises - 2030	£	RE100
Directly source 100% renewable electricity via a power purchase agreement (PPA)	Consider a PPA and/or onsite generation and storage to increase credibility, and business resilience.	2, 3	High	Long-term	Longer term contracts for PPA and cost. Uncertainty in market energy prices.	2028	££	RE100
Power grid	Reduction in grid emission factor due to use of renewables.	2	High	Long-term	Depends on government meeting grid decarbonisation commitments.	2023-35	N/A	Ten Point Plan for a Green Industrial Revolution

AGRICULTURE AND RAW MATERIAL

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Year	Cost	Ownership	Alignment
Sustainable agriculture	Work with suppliers to identify reduction and removal opportunities, e.g. controlled release fertilisers and precision/ low-carbon farming practices.	3	High	Long-term	Supplier maturity on sustainability initiatives.	2023	£	Supply chain, collaborative, lobbying	
Malting	Engage with malt suppliers to improve energy efficiency and low carbon energy use in the malting process.	3	High	Long-term	Supplier maturity on sustainability initiatives. Significant process changes and large capital requirement for supplier.	2023	£	Supply chain, collaborative, lobbying	
Supplier engagement programme	Develop a supplier engagement programme to: • Embed sustainability metrics into procurement processes and decision making. • Engage with key suppliers to set their own SBTs. See appendix for example letter to share with suppliers.	All	High	Long-term	Supplier data quality and management. Supplier maturity on sustainability initiatives. Tracking supplier progress once programme begins.	2023	££	Supply chain, collaborative, lobbying	
Zero deforestation commitments in supply chains for key commodities	Work with suppliers to eliminate deforestation from the supply chain for commodities at highest risk of deforestation (barley, wheat, hops, etc.)	3	Low	Long-term	Supplier maturity on sustainability initiatives.	2025	££	Supply chain, collaborative, lobbying	

PACKAGING AND PRODUCT COOLING

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Year	Cost	Ownership	Alignment
Life cycle analysis (LCA) on packaging	Conduct LCAs on all packaging options and work with packaging suppliers to source low carbon options.	3	High	Long-term	LCAs are complex and would likely require external support to complete.	2025	££	Supply chain, collaborative	WRAP, UK Plastics Pact
Product cooling	Engage with direct consumers, traders, and suppliers to implement energy efficient practices and renewable energy for cooling products.	3	High	Long-term	Customer engagement.	2023	££	Individual action, collaborative	
Source plastic products with 30% or more recycled content	Incorporating recycled content can reduce your carbon footprint and waste, while avoiding hte UK plastic tax	3	Med	Long-term	Possible challenge for all suppliers to incorporate recycled content into plastic packaging due to cost and availability.	2025	££	Individual action, Supply chain	Ellen Macarthur Foundation WRAP

PACKAGING AND PRODUCT COOLING

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Implementation year	Cost	Ownership	Alignment
Reduce packaging materials use and waste	Eliminating secondary packaging at the design stage, light weighting and material substitutions for drink containers.	3	Med	Long-term	Supplier maturity and willingness to invest in innovative, new materials. Maturity of current recycling / composting capacity and alignment of retailer's materials with the current capacity.	2030	£££	Supply chain, collaborative	Designing packaging optimised for the circular economy.
Design for reusability e.g. remove single use plastics Design for recyclability e.g. compostable and biode-gradable packaging	Eliminate plastic drinks carrier and replace with renewable and biodegradable cardboard alternatives. Deposit return scheme to promote recycling. Engage with customers to promote increased use of larger re-usable pack formats (keg / cask)	3	Med	Long-term	Supplier maturity and willingness to invest in innovative, new materials. Maturity of current recycling / composting capacity and alignment of retailer's materials with the current capacity. Consumer engagement required.	2030	££	Supply chain, collaborative, lobbying	WRAP, The UK Plastics Pact , Global Plastics Pacts, Ellen MacArthur Foundation, Deposit Return Scheme

LOGISTICS

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Implementation year	Cost	Alignment
100% deliveries are zero carbon	Zero emission deliveries can be achieved through a gradual transition to electric and hydrogen transportation alternatives.	1,3	Medium	Long-term	All new L-Category vehicles to be fully zero emissions at the tailpipe by 2035.	2040	£	
100% zero emission HGVs	HGVs account for 18% of road transport emissions in the UK.	1,3	High	Long-term	Government policy and technological development of zero carbon transport options for HGVs. Time to retire existing HGVs. UK government ban of all non-zero emission HGVs in 2040.	2040	£££	
100% deliveries are zero carbon	Light vehicles account for 17% of transport emissions in the UK. Implementing a plan to transition to zero emissions LCVs is key to removing tailpipe emissions and decarbonising transport.	1,3	Medium	Long-term	Government policy and the chronological development of zero carbon transport options. Time to retire existing fleet of fossil fuel LCVs. Sale ban of new petrol and diesel vans in 2030.	2035	££	

LOGISTICS

Initiative	Desription	Scope	Carbon reduction	Project type	Challenges	Implementation year	Cost	Alignment
Transition company cars to 100% electric or other low/ zero carbon options at end of life.	Encourage and/or incentivise employees to drive electric vehicles. Make charging infrastructure available onsite. Consider where cycling or public transport could be further utilised.	1	Medium	Long-term	Time to retire existing fleet of fossil fuel cars. Space for charging infra-structure.	2023 - 2025	££	EV100
Improved fuel efficiency for owned fleet	Implement a programme to reduce GHG emissions from owned fleet through: Eco driving training programmes and staff engagement; Collecting fuel data such as MPGs; Setting efficiency targets.	1,3	High	Long-term	Mapping entire logistic network. Establishing sources of data and how to collect and analyse. How/where to disclose.	2023	£	
GHG reporting on all logistics	As part of capturing and reporting on scope 3 emis-sions, ensure inclusion of all GHG reporting for all compa-ny logistics.	1,3	High	Long-term	Mapping entire logistic network. Establishing sources of data and how to collect and analyse. How/where to disclose.	2023	£	

For more information: https://energysavingtrust.org.uk/service/maximise-fuel-economy-and-encourage-efficient-driving/
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/509972/efficient-driving-rapid-evidence-assessment.pdf
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009448/decarbonising-transport-a-better-greener-britain.pdf
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/984685/transport-and-environment-statistics-2021.pdf

CARBON REMOVALS

Initiative	Description	Scope	Carbon reduction	Project type	Challenges	Year	Cost	Ownership	Alignment
Agree strategy and quality criteria for use of carbon removals	Alignment of company values to project criteria and importance of location.	1,2,3	High	Long-term	Implementation costs. Availability of projects. Time taken for projects to sequester carbon (10 years plus).	2023	£		WeForest REDD REDD+
Choose project developer	Select a project developer aligned to criteria.	1,2,3	High	Long-term	Credibility and verification of projects.	2025	N/A		Alignment of projects to SDGs
Explore afforestation, agroforestry, and restoring peatlands	Engage suppliers on increasing woodlands, planting trees on existing agricultural land, and restoring peatlands.	3	High	Long-term	Supplier maturity on sustainability initiatives. Establishing clear requirements with suppliers and measuring.	2025	£		WeForest REDD REDD+
Identify and secure removal projects	Choose projects based on criteria and certification by Carbon Registries (e.g. Gold Standard, VCS).	1,2,3	High	Long-term	Availability of projects.	2030	££		Alignment of projects to SDGs
Retiring of credits from registry to neutralise your scopes 1, 2, and 3 emissions	To ensure no double counting on projects.	1,2,3	High	Long-term	Physical risk of project's lifespan.	2040	££		

DEEP DIVE

DEEP DIVE: SCOPES 1 AND 2 DECARBONISATION OPPORTUNITIES

In 2021, the UK government committed to decarbonise electricity systems and transition away from its reliance on fossil fuels by 2035. They indicated plans to invest and deploy a new generation of home-grown, green technologies such as offshore wind, hydrogen, and nuclear energy. Assuming this will happen as planned, the main challenges for the brewing sector will be the decarbonisation of heat and optimisation of electricity consumption.

We've outlined in this section some of the key energy-related scopes 1 and 2 decarbonisation initiatives for brewers, along with Examples from ZCF and BBPA members.

CIP WASH TEMPERATURE

Clean-in-place (CIP) is an automated process of cleaning interior surfaces of pipes, tanks and other equipment in the brewery with heated detergents and fresh water. Typically, CIP cycles are triggered by either product change, elapsed time, or operator discretion.

The optimum control of CIP is to achieve the desired microbial levels and physical cleanliness within process equipment without cleaning more than needed. Reviewing existing CIP process to identify opportunities to reduce the temperature or volume of cleaning fluid can result in a quick win for the brewery. Brewers can optimise CIP temperature or implement cold CIP through incremental monitoring, adjustments, and testing.

Implementing real time cleaning verification systems that track and fine-tune cleaning cycles can significantly reduce water loss, detergent usage, and overall energy consumption. Correct validation is essential to ensure quality isn't impacted and may require redesigning your existing CIP process.

CASE STUDY

In 2020, ZCF member Shepherd Neame reduced the temperature of a range of CIP cycles from 70°C to 50°C. This resulted in a significant reduction in heat demand, saving approximately 116 MWh of gas and 21 tCO_2e per year.

REDUCING EXTRACT LOSSES

Extract losses and product wastage are unavoidable in the brewing process. The challenge is to minimise losses to avoid excess energy, water, and raw material consumption.

UK brewers have end-to-end product losses in the range of 5% - 10%. This is significant compared to, for example, the dairy industry which operates around 1% loss. Losses and wastage can occur across all stages of the brewing process –in the brewhouse, product transfer lines, packaging processes, or finished goods write off. Much of it can be avoided relatively easily.

Brewers can reduce losses and wastage by systematically reviewing existing processes and equipment. This starts by carrying out a comprehensive waste mass balance to identify hot spots.

Examples of opportunities include:

- Optimising product transfers between processes at the beginning and end of batch runs
- Increasing filtration cycles
- Correcting leaks to minimise unintended losses

For many brewers, automation can increase repeatability and significantly reduce losses. Depending on the existing level of process automation, optimisation opportunities can quickly reduce a brewery's overall energy demand and raw material consumption.

OPTIMISING HOT LIQUOR SYSTEMS

After the kettle boiling process, solids are separated from the wort in a whirlpool or hop back and the wort is then cooled ready for fermentation.

Cold liquor (cold brewing water) is passed through a heat exchanger called the wort cooler, counter current to the hot wort exiting the kettle. Through this process the wort is cooled to its fermentation temperature (typically 12 – 17°C), and hot liquor is recovered to the hot liquor tanks at 75 – 85°C. This is the key heat recovery process in the brewhouse, and this hot liquor is subsequently used to mash the next batch of product.

There are frequent issues with the design and operation of the wort cooler, mostly as a result of the heat exchanger being required to operate outside of its original design parameters. This can lead to an excess generation of hot liquor at temperatures which are lower than desirable. The net effect of this is that hot water is overflowed to drain, and additional heat is used to bring the remaining liquor up to the desired temperature.

Optimising hot and cold liquor systems for the brewhouse to ensure thermal balance can lead to considerable heat savings.

BREWHOUSE THERMAL INTEGRATION

A significant proportion of a brewery's heat demand is in the brewhouse, where heat is used to raise the temperature of and boil wort at different stages of the process. The wort kettle is one of the major users of heat in the process and is a valuable source of waste heat. The main purpose of the kettle is to boil the wort. The process is used to isomerise the hops, sterilise the wort, and remove unwanted volatile compounds.

Optimising the boil off (or evaporation) rates and control for each recipe if not already done can deliver significant thermal energy savings. Incorporating an energy recovery system for the kettle can deliver additional significant reduction in heat consumption.

Technology involves capturing the water vapour from the kettle during boil-off, condensing it using a heat exchanger, and capturing the heat in a thermal energy store (hot water storage tank). Recovered heat is then typically used in a closed loop system to pre-heat the wort feed before entering the kettle. This can significantly reduce a brewhouse's overall heat demand.

CASE STUDY

ZCF members Brewdog and Adnams have reduced emissions using vapour heat recovery systems in their brewhouses.

Brewdog's vapour heat recovery system has saved 507 tCO_2e since its installation in 2021, by reducing electricity and natural gas consumption.

Adnams has been using a vapour heat recovery system for their kettle since 2007, reducing overall gas consumption (and associated emissions) by 30%.

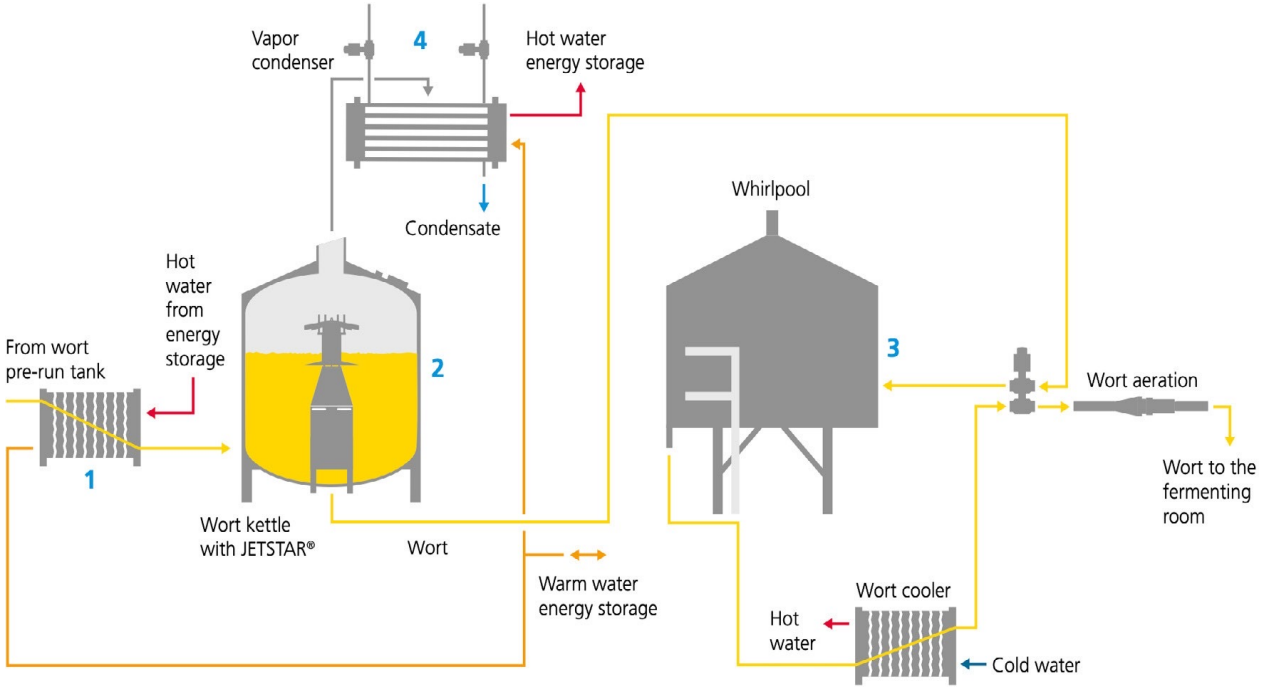


Image source: www.gea.com/en/binaries/jetstar-boiling-technology-brochure_tcm11-63879.pdf

HEAT PUMP FOR REFRIGERATION WASTE HEAT

Alternative heat sources can often be identified in a brewery in the form of waste heat. One example is the waste heat expelled from a refrigeration plant, which can be utilised to decarbonise heat in a brewery when combined with a Low Temperature Hot Water (LTHW) heat pump system. Heat pumps often utilise ammonia (which has zero global warming potential (GWP)) as a refrigerant. These systems can be designed to recover waste heat and generate hot water up to ~90°C without using fossil fuels.

The major advantage heat pumps have over alternative heating systems such as gas fired boilers or electric boilers is efficiency. The efficiency of a heat pump is referred to as its coefficient of performance (COP). A typical boiler system will yield an efficiency of 85% (COP of 0.85) or less. For a heat pump system, the COP is typically in the range of 2.5 – 4. Therefore, for every 1kW of electricity input, heat pumps will deliver between 2.5-4kW output.

Brewers can use the LTHW generated for a variety of heat loads such as CIP, pasteurisation, or pre-heating of wort.

Although brewers can achieve significant energy and carbon savings with refrigeration waste heat pumps, there are several major barriers. These include a requirement for additional electrical capacity, modifications to the existing brewing process to use an alternate heat source, and the installation of a LTHW heat distribution system.

CLEAN FILLING

In-pack (or tunnel) pasteurisation of canned and bottled product is another major contributor to many breweries' thermal energy consumption. The objective of the process is to reduce dangerous and potentially spoiling microbes from within the product to a level that will extend the shelf life and ensure safe consumption within the best before dates.

This process utilises thermal energy to heat the product and its packaging to around 60°C before reducing the temperature down to near or below ambient to prevent thermal flavour spoilage.

An increasing number of brewers are turning to clean filling technology, which involves flash pasteurising or sterile filtering the product before filling. This leads to a significant saving in thermal and electrical energy over tunnel pasteurisation. Cold sterile filtration is also becoming more popular as an alternative to traditional pasteurisation methods. This is due to advantages such as retaining unique and desirable characteristics of product, low water consumption, and most importantly, low consumption of energy. The process involves passing the product through fine membranes which can completely remove any undesirable microorganisms without the use of heat.

Image source: www.alfalaval.co.uk/products/process-solutions/brewery-solutions/sterile-filtration-module

ANAEROBIC DIGESTION – BIOGAS

Spent grains, spent yeast, and liquid effluent are by-products from the brewing process and are the main sources of brewing waste. Typically, UK breweries partner with the farming industry to export spent grains as animal feed and the food industry to export spent yeast as a food ingredient.

Before being sent to the trade effluent outlet, brewers can treat liquid effluent in an onsite anaerobic digester to generate biomethane. This can usually be used directly as a renewable gas source in the brewery boilers, or a combined heat and power (CHP) generator. The amount of heat raised this way can typically equate to 5% - 15% of the brewery's total heat requirement, depending on how much product is lost to the drain. In addition to low carbon energy production, the brewery may benefit from reduced wastewater treatment costs.

Due to the removal of government incentives and reducing grid electricity emissions in the UK, brewers can now typically achieve the greatest carbon impact by burning this biomethane for heat, rather than using it for power generation.

An alternative use for spent grains is to export them to an offsite anaerobic digestion facility. These plants tend to be large custom-built facilities, which are already common means of disposal for draff (spent grains) from the Scottish whiskey industry. They're much less used to date by the brewing industry. Ethical arguments surrounding redirecting an animal feed source to energy are complex: feedstock is diverted from consumption, but that also means taking support away from the environmentally detrimental meat industry.

Brewers typically enrich biogas generated in larger offsite plants and inject it into the natural gas grid. This can generate green gas certificates such as RGGOs (Renewable Gas Guarantees of Origin). RGGOs can be purchased and subsequently retired by the consumer to reduce their natural gas related emissions.

CASE STUDY:

In 2018, ZCF member St. Austell Brewery invested in a wastewater recycling and management plant, saving the business up to 65% in monthly wastewater charges. The plant is designed to treat the final heavy effluent from brewing processes which were previously removed by a road tanker, avoiding 100 tanker movements and saving ~£30,000 per year.

Heineken's sends waste apple pulp from its Hereford ciderie to a nearby anaerobic digestion facility to produce biogas, which is subsequently used to produce green electricity.

With anaerobic digestion technology, Tennents have improved their wastewater discharge quality by 90% and produced nearly 650,000 m^3 of biogas which is used directly in the brewery.

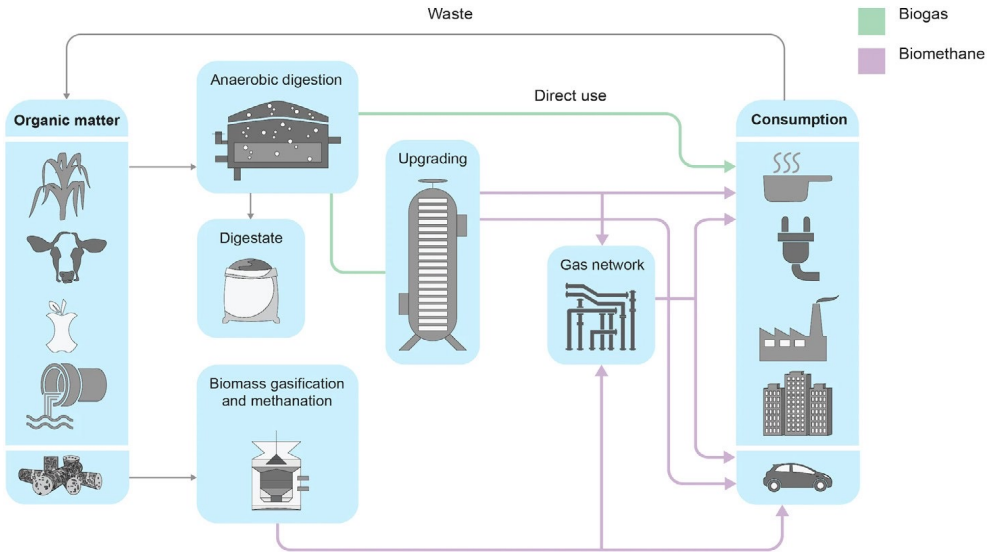


Image source: www.iea.org/reports/outlook-for-biogas-and-biomethane-prospects-for-organic-growth/an-introduction-to-biogas-and-biomethane

DEEP DIVE: SCOPE 3 DECARBONISATION OPPORTUNITIES

Emissions in a brewery's supply chain are inherently out of the brewer's direct control. However, you can limit the environmental impact of your supply chain through sustainable sourcing and supplier engagement.

Sustainable sourcing involves choosing suppliers with sustainability commitments and embedding sustainability metrics into the procurement process and decision making.

Supplier engagement is a method of influencing emissions in your supply chain by working with suppliers to identify opportunities to reduce their carbon impact. If you engage with a supplier to set their own science-based targets, then you can factor their net zero projections into your roadmap, helping you achieve your own targets.

Supplier engagement can be applied to all purchased goods and services, although the biggest impact will come from cooperation with farmers, maltsters, and packaging producers. The following sections reflect some of the key initiatives that these sectors can implement.

AGRICULTURE

As with any cereal crop, farming operations for barley production include cultivating and fertiliser application, both of which have inherent greenhouse gas emissions.

The manufacture of nitrogen fertiliser itself consumes large amounts of energy. Release of N_2O, a powerful greenhouse gas, then occurs in the field. These emissions are difficult to control, but can be limited by controlled release fertiliser, which aims to apply nitrogen to the soil gradually. Substituting industrial nitrogen fertilisers with recycled organic materials such as compost and anaerobic digestate can also help eliminate these emissions.

Precision farming is an agricultural practice based on observing, measuring, and responding to variability in crops in near real-time. These practices can be used to optimise the efficiency of both fertiliser and farm machinery use.

Anaerobic digestion of spent organic material can be used to produce biogas, which can in turn be used as a fuel substitute in farming processes, or even for electricity generation. Other ways to decarbonise electricity usage include purchasing green electricity or onsite renewable generation.

Cereal farming can become net zero or even carbon negative through a process known as 'carbon farming' or 'regenerative farming'.

This is the capture and sequestration of atmospheric carbon into soil and plants through:

- Afforestation or reforestation
- Use of specific crops to conserve soil and enhance organic carbon
- Stopping sowing in targeted fields for a few years, allowing them to recover and store organic matter
- Restoring peatlands and wetlands.

To maximise engagement in agricultural initiatives, it's essential to communicate the agricultural and sustainability benefits alongside opportunities to earn financial reward.

How excess fertilizer causes nitrous oxide emissions

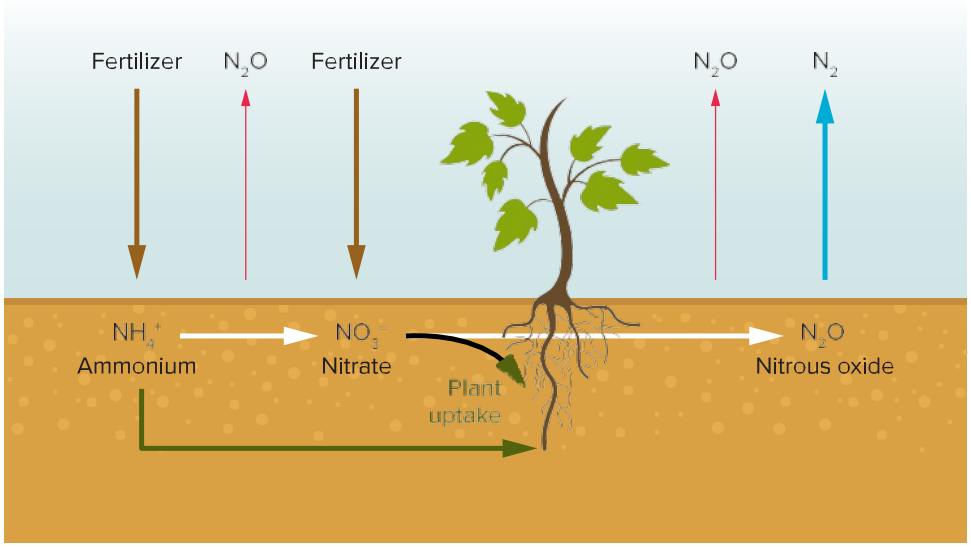


Image source: https://knowablemagazine.org/article/food-environment/2021/nitrous-oxide-greenhouse-gas-agriculture

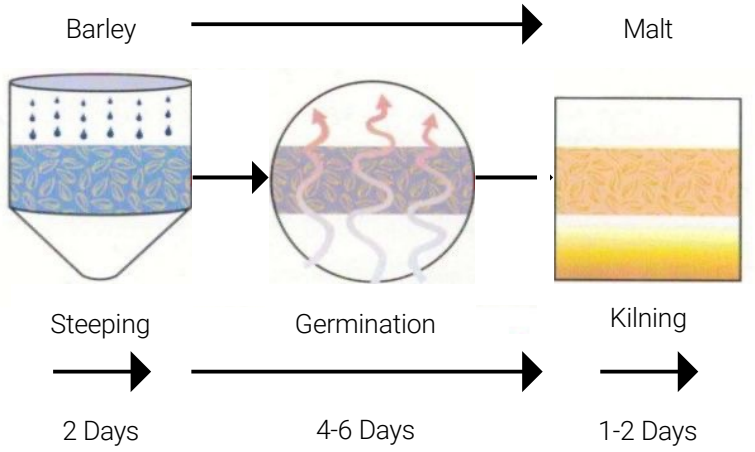
MALTING

Malting is the process by which barley is prepared so it can be used in the brewing process. The barley is steeped in water and then allowed to rest to encourage germination. The germinated grain is then dried in a kiln before it's shipped off to breweries.

The UK malting sector produces around 300,000 tCO_2e annually, the majority of which are a direct product of the kilning process - the dominant user of heat and electricity. The Carbon Trust outlined opportunities to make the malting process more energy efficient in their report "Industrial Energy Efficiency Accelerator - Guide to the Malting Sector." The report evaluates different technologies, including heat pumps and biomass boilers.

Heat pump technology can be used to increase the temperature of low-grade heat energy recovered from kiln products. Energy recovery using a closed cycle heat pump can achieve total energy recovery of 64%. Another opportunity is substituting fossil fuels for biomass through the addition of a suitable burner or boiler and associated fuel storage and handling equipment. The report also evaluates the implementation of a dedicated energy efficient drying system to dry the malt before entering the kiln.

THE MALTING PROCESS



Source: Industrial Energy Efficiency Accelerator - Guide to the maltings sector, Carbon Trust I www.slideshare.net/BeerCoAu/crisp-malt-craft-distilling-seminar

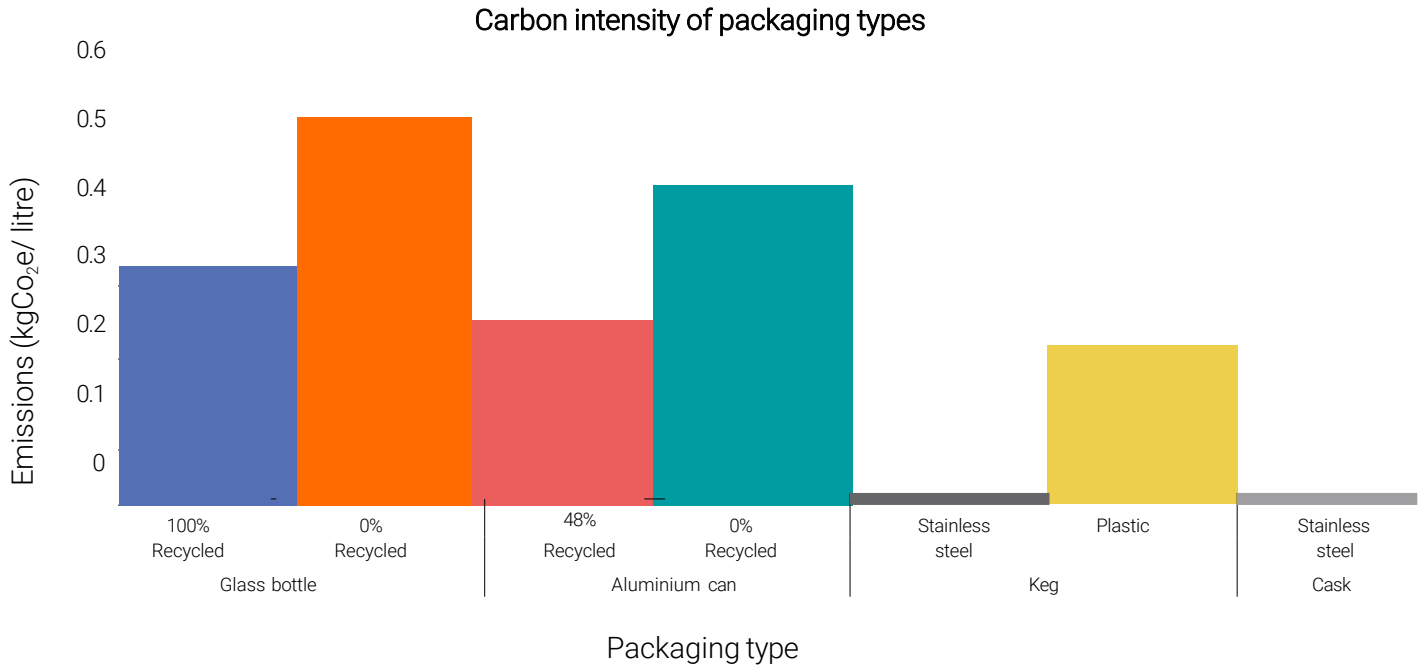
PACKAGING

Packaging is typically the biggest source of supply chain emissions for brewers, so initiatives should be high priority.

Some manufacturers have started producing lighter beer bottles using less glass to produce fewer emissions. AB InBev has reduced the weight of its standard longneck beer bottle from 180 to 150 grams, reducing emissions per bottle by 17%.

Due to the energy-intensive nature of glass manufacturing, increasing the circularity of glass bottles can significantly reduce their footprint. The same is true of aluminium cans, which are also energy intensive to manufacture.

The figure below compares the relative carbon intensity of glass bottles, aluminium cans, kegs, and casks. The data is normalised to $kgCO_2e$/ litre of product, assuming that stainless steel kegs and casks are reused 80 times over their lifetime.



Source: https://info.thielmann.com/hubfs/Knowledge%20Base/201801-THIELMANN-whitepaper-Carbon-FootPrint.pdf
https://link.springer.com/content/pdf/10.1007/s43615-021-00142-w.pdf
https://ab-inbev.eu/news/ab-inbev-develops-lightest-beer-bottle-in-the-world/#:~:text=7th%20June%202021%20%E2%80%93%20AB,cars%20off%20the%20road%20annually.

The most obvious way for the brewing industry to reduce packaging emissions is of course to engage customers and encourage much greater use of larger reusable containers like kegs and casks.

Eliminating single use plastic packaging, reducing excess packaging, and transitioning to fully renewable cardboard or bio-based plastic alternatives are examples of packaging initiatives that will help the brewing industry meet their scope 3 reduction targets.

One way to incentivise reuse of single use drink containers is by introducing a Deposit Return Scheme (DRS). In a DRS, customers pay a deposit fee when they purchase a drink in a single use container. They can then redeem their deposit if they return the empty container to selected return points. DEFRA announced plans for the UK to introduce a DRS in 2018 to help move from a linear economy towards a circular economy. This is expected to be implemented in England and Wales in late 2024 at the earliest.

Brewers can also reduce emissions from packaging manufacturing by using renewable energy sources to provide heat and electric power requirements. Powering glass-melting furnaces with biofuels and using renewable electricity for aluminium electrolysis have massive carbon reduction potential.

CASE STUDIES

ZCF member Robinsons conducted site audits to understand and promote more energy efficient behaviours. This has reduced emissions across sites by 18% by taking actions like turning off electrical space heaters over the weekends in the bottling plant, saving 247 MWh of electricity and 57.6 tCO_2e per year.

Heineken is involved in a revolutionary project to radically reduce the production of carbon in glass manufacturing. The trial involves using up to 100% recycled glass and substituting natural gas for low carbon biofuel. If successful, they'll reduce the carbon footprint of each glass bottle by up to 90%.

Asahi UK replaced plastic can carriers with cardboard alterative packaging, reducing emissions by 36% compared with new plastic and 16% compared with recycled plastic carriers.

Image source: https://depositreturnscheme.zerowastescotland.org.uk

EFFICIENT USE OF SOLD PRODUCTS

Product cooling can account for a substantial proportion of a brewery's carbon footprint due to the impact of temperature on product experience. Fridges and beer coolers are used in bars, restaurants, retail stores, and consumers' homes. In 2015, a study of the life cycle environmental impact of beer consumption in the UK found retail refrigeration can contribute 15-18% of a beer's total carbon emissions, depending on its packaging.*

Commonly used refrigerants like hydrochlorofluorocarbons (HCFCs), can have a high environmental impact - with some over 1,000x more potent than carbon. Alternatives without a global warming potential, like CO_2 refrigeration or ammonia gas, are increasingly common in commercial environments. When used safely, they provide a much more environmentally friendly alternative to traditional refrigerant gases. We also recommend using refrigeration systems with a global warming potential of less than 150.

To reach net zero in product cooling, the brewing industry will need to engage with direct consumers, traders, and suppliers to reduce energy consumption and implement energy efficient practices. Initiatives such as energy efficient fridges, cellar cooling and insulation improvements, operational practice optimisation, and renewably sourced electricity will be essential to reduce emissions associated with product cooling.

CASE STUDIES

ZCF member Adnams has been using low charge ammonia to chill beer since 2017. This has eliminated their scope 1 emissions from refrigerant gases.

In 2021, Heineken committed to transition to all energy-efficient fridges to cool their beverages by 2027.

* Source: Life cycle environmental impacts and costs of beer production and consumption in the UK

TRANSPORTATION AND DISTRIBUTION FLEET DECARBONISATION

Upstream and downstream logistics typically use fossil fuel vehicles. Related emissions can account for ~10% of a brewery's overall footprint. A brewery may own a fleet of vehicles for a portion of its transport and distribution (T&D), but most logistics are normally outsourced to third parties.

Decarbonising logistics involves operational initiatives and adopting alternative sources of low carbon fuels for upstream and downstream transportation. Examples of operational initiatives include sourcing raw materials locally where possible to reduce transport mileage, optimising transportation routes to minimise excessive fuel consumption, and optimising vehicle utilisation to maximise product loading per vehicle journey. Switching to alternative sources of low carbon fuels such as biodiesel, hydrotreated vegetable oil (HVO), and electro-fuels (fuels generated using renewable electricity) will have the most significant impact in decreasing logistics-related emissions in the short to medium term.

In the current market, it's unrealistic to fully implement electrification and biofuels across a brewery's network, due to limitations such as infrastructure and range of electric vehicles. Therefore, it's crucial for the brewing industry to work closely with logistics companies and other relevant industries to optimise and coordinate processes.

Garnering incentives from the government to invest in and develop technologies in this area will be crucial to eliminating significant barriers for the brewing industry to decarbonise its upstream and downstream logistics.

CASE STUDIES

ZCF member Wadworth is in the process of installing a food grade Nitrogen generator in their new site, removing heavy road mileage from bulk deliveries. Since it's on-demand, this also sharply reduces per unit costs of N_2, saves space, and improves safety over bulk storage

In 2022, Budweiser Brewing Group partnered with a logistics provider to transition half of the HGV delivery fleet at one of its breweries from diesel fuel to HVO. The project will deliver 92% reduction in greenhouse gas emissions per kilometre driven compared to diesel.

Image source: www.business-live.co.uk/manufacturing/budweiser-investing-greener-fuel-south-23773545

COLLABORATIVE INITIATIVES FOR BREWERS

KEY COLLABORATIVE INITIATIVES FOR BREWERS

One thing is clear - we can't achieve net zero alone. Collaboration will be crucial. We need to work with our peers, industry experts, policy makers, suppliers, and customers to innovate and drive change. Together, we can revolutionise brewing and make net zero a reality.

In addition to the wide range of individual actions we'll need to take across our direct operations and supply chains, there are a number of key opportunities for us to work together. The ZCF is based in sector collaboration and accelerating action to net zero as a united industry. This section includes some of the collaborative initiatives we'll be driving within the brewing sector.

GRID ELECTRICITY DECARBONISATION

Minimum of 440 $ktCO_2e$ impact. Necessary to completely reduce brewery scope 2 and product cooling emissions.

Make sure government sticks to their 2035 net zero pledge, including infrastructure to support the electric transition of heat and transport.

This doesn't consider the emission impact of electricity decarbonisation on other scope 3 areas, which requires further understanding.

GOVERNMENT INTERVENTION TO DECARBONISE BREWING HEAT

Minimum of 120 $ktCO_2e$ impact. Without alternatives for raising high temperature heat, it's estimated that the industry can only reach around 70 $ktCO_2e$ of this reduction.

We'll work together to accelerate the:

- Deployment of low temperature heat pumps
- Commercialisation of steam raising heat pumps
- Availability of alternative low carbon fuels e.g., hydrogen

To reach net zero, we'll need to achieve a 90% reduction in fuel-related emissions.

MALTING INDUSTRY

Minimum of 70 $ktCO_2e$ impact (estimated brewing share of malting industry).

We'll engage the malting industry to commit to heat decarbonisation. Reaching net zero requires an 80% reduction in emissions, based on brewing industry's figures showing the proportion of heat utilisation from malting operations.

LOW CARBON FARMING

Minimum of 210 $ktCO_2e$ impact of total 490 $ktCO_2e$ contribution.

We'll collaborate with the NFU and government to support a realistic decarbonisation roadmap for the agricultural sector. This requires necessary incentives from the government. Achieving net zero assumes a 45% reduction in sector emissions based on the NFU's net zero roadmap. This excludes bioenergy with carbon capture and storage (BECCS), as technology is currently unlikely to be available in time.

ZERO EMISSION TRANSPORT

Minimum of 160 $ktCO_2e$ impact with 90% decarbonisation eventually feasible as technology matures.

Achieving zero emission transportation requires clarity from the government around expected decarbonisation pathways for heavy goods vehicles (HGVs). In the meantime, we'll continue to work toward low emission transportation options and overall fleet decarbonisation.

PACKAGING

Minimum of 350 $ktCO_2e$ impact of total 700 $ktCO_2e$ contribution.

Decarbonising packaging and related processes requires legislation to influence packaging usage, e.g. discouraging and disincentivising the use of one-way packaging. We'll engage in cross-industry consumer engagement and lobbying to inentivise greater adoption of bulk pack products and reusable packaging in both trade and retail. To achieve net zero, we'll need to reduce packaging emissions by at least 50%.

COLLABORATIVE INITIATIVES: HOW TO GET STARTED...

1. JOIN

the Zero Carbon Forum.

2. SHARE

learnings, successes and challenges with peers.

3. COLLABORATE

to innovate and act on key shared emission hot spots.

4. MAP EMISSIONS

to understand your full carbon footprint.

5. COMMITMENT TO NET ZERO

aligned with the industry and backed by near- and long-term science based targets.

6. BE AN ADVOCATE FOR CHANGE

within your business, industry, country, and beyond.

OUR CALLS TO GOVERNMENT

The brewing and pub sectors have made clear our ambition to achieve net zero. Through the development of this roadmap and examples highlighted in the British Beer and Pub Association's Brewing Green report, it's evident the sector understands the impact of the climate emergency, and is taking action to address it.

We also understand that we can't achieve meaningful, lasting impact alone. As well as action at sectoral level, the collaborative initiatives in this section demonstrate specific areas where we require government support and intervention to meet our decarbonisation ambitions.

To continue toward net zero at pace, we're calling upon the government to:

- Provide funding opportunities and incentives, notably for smaller producers.
- Invest in the development and maturation of technologies, ensuring availability and suitability across different levels of production, and incentivising their use.
- Reduce the complex regulatory framework and burden surrounding operators to enable them to flexibly deliver on net-zero ambitions.

GETTING STARTED ON YOUR NET ZERO JOURNEY

THE SIX DIMENSIONS OF A NET ZERO STRATEGY

Much of our journey is collaborative. It's also important for each brewer to understand your unique emissions and hot spots, and to devise a plan of action to decarbonise. When it comes to individual net zero strategies, we recommend brewers use these six dimensions as the building blocks of your net zero journey.

DIRECTION

Ambitious and science-based greenhouse gas emission targets and milestones set the direction for a net zero strategy. Your plans must include a strong business case for change that's aligned with and informs your wider business objectives.

ENGAGEMENT

Net zero is a transition, and change management is a core part of the process that's often overlooked. A range of stakeholders from inside and outside your business will be essential to your success.

GOVERNANCE

Strategic programmes require a strong governance structure to oversee their execution. The climate related risks and opportunities that your organisation faces need to be understood and quantified, including accountability and ownership for dealing with them.

REPORTING

As your net zero programme begins to deliver results, it's important that you improve disclosure on climate related risks and opportunities. Leading companies will embrace transparency and use it to enhance their reputation and drive engagement with customers, investors, and employees.

DATA

Net zero programmes rely on data for evidence-based decision making. The collection, aggregation, and analysis of complex data sets should be automated wherever possible. This will free up time for stakeholders to act on data insights.

PERFORMANCE

At the heart of your net zero programme will be the changes you need to make to decarbonise your business. These carbon performance improvements must be integrated into the other dimensions of your programme for it to be a success.

Source: Carbon Intelligence

PHASES OF A NET ZERO JOURNEY

The insights from the ZCF's Net Zero Roadmap for Brewing can be used by individual businesses to plot your own net zero journey. The next section of the guide provides practical steps and guidance for how to get started. We've split the approach into six phases, outlined in more detail on the following pages.

1. MEASURING YOUR EMISSIONS

Determine your emission boundary and calculate scopes 1, 2, and 3.

2. SETTING YOUR AMBITION

Set an ambitious science-based decarbonisation target, aligned to 1.5°C, with short- and long-term targets, milestones, and measures.

3. BUILDING AND FINANCING YOUR ROADMAP

Use the ZCF net zero roadmap and customised ZCF member action plans to identify initiatives to achieve your target.

4. COLLABORATING

Work together across the sector to drive change at scale, share best practice, and collaborate to achieve greater impact and reach net zero faster.

5. APPROVING, VALIDATING, AND LAUNCHING YOUR PLAN

Engage your stakeholders to announce your net zero commitment and roadmap, and make sure they're aligned with and involved in the journey forward.

6. DEVELOPING A CREDIBLE REMOVAL STRATEGY

Once you've abated all avoidable emissions, you'll need to invest in credible, long-term removals to balance your unavoidable emissions and achieve net zero.

PHASE 1: MEASURING YOUR EMISSIONS

The first step in developing your net zero strategy is to measure your emissions and understand the initiatives to reach to your targets. Your net zero boundary should be ambitious and aligned with established standards, like the SBTi. Standards and requirements for corporate net zero targets are evolving along with climate science to increase ambition and reflect the urgency of the climate crisis.

Your net zero boundary should include 100% of your material scopes 1, 2, and 3 emissions, with reasonable confidence in data quality. At a minimum, you'll need to include 100% of your scopes 1-2 emissions, and 67-95% of your scope 3 emissions, in line with the current criteria for science-based targets.

In addition to driving action with ZCF, individual breweries will need to further tailor and implement your own strategies. It's important to agree on a methdology and operational boundary that works for your unique business. Working with Zero Carbon Services or another carbon accounting consultancy for your baseline footprint helps ensure you get this right the first time around, setting you up for consistency and future action. Whichever route you take to calculate your emissions, here are some steps to get started.

HOW TO GET STARTED...

DEFINE your organisational emission boundary. A screening exercise will determine which of the 15 scope 3 categories apply to you, based on size of emissions, your influence, risk, stakeholder interest, and sector guidance.

GATHER DATA engaging stakeholders throughout your business and supply chain.

CALCULATE your scopes 1-3 emissions across all greenhouse gases.

UNDERSTAND your hot spots and emission contributions.

STREAMLINE data collection with a data management system for annual tracking and reporting.

OVERCOMING DATA BARRIERS

Many businesses who are starting on their net zero journey may lack the data needed in order to build a robust emissions footprint. Some of the common challenges to overcome include:

- Knowledge gaps on emissions reporting internally and across the supply chain;
- Lack of resources internally to manage data collection;
- Heavy reliance on estimates for scope 3 emissions.

Emissions accounting is relatively new, and will be something most organisations haven't done before. We expect high levels of estimation initially, particularly in scope 3, as awareness and data processes include. When compiling your baseline footprint, it's important to communicate to the teams and data owners involved that this will be an annual exercise. Small changes can be made in how data is collected and stored that will make your footprint more robust, and the processes to collect data less laborious. Make sure to capture any estimations, extrapolations, or missing data the first time around, so you can improve and refine data quality every year. This also ensures your footprints are comparable.

When embarking on calculating your company's emissions footprint, we recommend prioritising categories you know to be relevant for your sector.

This net zero roadmap can help you identify probable emission hotspots so you can build data collection and calculation processes to improve the coverage and accuracy of data in these areas.

PHASE 2: SETTING YOUR AMBITION

Once you have a robust emission baseline, the priority is to reduce your direct emissions (scopes 1 and 2) as quickly and comprehensively as possible. This part of your footprint is in your direct control. You'll also want to begin the process of engaging with your supply chain and customers to reduce scope 3 emissions.

The level of decarbonisation recommended in this report for the brewing sector is a 90% absolute reduction in scopes 1 and 2 emissions by 2030, and a 60% absolute reduction in scope 3 emissions by 2040. The lower reduction required in scope 3 emissions reflects the complexities of reducing value chain emissions.

You may choose to split these targets into short-term milestones to create momentum and internal accountability - for example, splitting the 90% scope 1 and 2 reduction into a goal of ~10% absolute reduction year-on- year. Short-term milestones can vary depending on your business plans and timing of decarbonisation initiatives.

The reduction targets outlined in this roadmap are aligned with the latest net zero corporate guidance from the Science Based Targets Initiative. The brewing sector can use them as a guide for the level and speed of decarbonisation required to set ambitious net zero strategies.

To continue to stay aligned with the latest climate science, we recommend that individual businesses across the sector set corporate level science-based decarbonisation targets, aligned with a 1.5°C trajectory, including short-term and long-term milestones.

HOW TO GET STARTED...

SELECT an appropriate baseline year, making sure to avoid data where business was impacted by the pandemic.

CHOOSE the right SBTi methodology based on your business model and size.

MAP a science-based emissions trajectory to 1.5°C.

MODEL near and long-term decarbonisation targets.

COMMUNICATE your targets to internal and external stakeholders, and report regularly for transparency and engagement.

PHASE 3: BUILDING AND FINANCING A DECARBONISATION STRATEGY

After setting your ambition and the level of decarbonisation required, the next step is to build a roadmap of initiatives to target your hot spots. That includes planning for how to fund your net zero journey.

FINANCING NET ZERO

Achieving net zero through investments in emission reduction projects can present significant costs to a business. Setting an internal carbon price is becoming the new normal for businesses to help fund the transition to net zero. In 2020, more than 2000 companies were using an internal carbon price, an increase of 80% in the last 5 years. An internal carbon price can act as a useful decision making tool to help companies realise cost savings, manage risks, drive innovation, and demonstrate readiness for net zero.

EXAMPLE OF INTERNAL CARBON PRICING

Unilever implemented an internal carbon price which acts as a tax on each business division. It holds them financially responsible for reducing corporate carbon emissions.

The internal carbon fee has risen from $30 to $50 per tCO_2e over the past few years. The tax is applied to manufacturing operations and subtracted from the capital budgets allocated to each business division at the start of the year. That money goes towards a Clean Technology Fund - worth about €50 million - which is used to support installation of clean technologies at Unilever sites.

Business divisions can bid for projects that meet defined emission reduction criteria, and the best projects go ahead. Unilever has found that by applying the internal carbon tax and engaging teams around applying for funding, they've uncovered new technologies they hadn't previously considered or weren't aware of. Examples of clean technology innovation for brewing could include a new type of biomass boiler or advanced refrigeration technology.

HOW TO GET STARTED...

REVIEW the ZCF Net Zero Roadmap for Brewing.

ACCESS current and potential emission reduction projects.

COLLABORATE across and between sectors to lobby, influence, and create efficiencies and economies of scale.

BUILD a short- and long-term financing plan for your journey.

ASSIGN responsibility for reductions across the business and create governance to oversee progress and carbon management.

PHASE 4: COLLABORATING

We've established throughout this report that collaboration is crucial to achieving net zero. We need to work with our peers, industry experts, policy makers, suppliers, and customers to innovate and drive change at scale.

Together, we can revolutionise brewing and achieve net zero.

HOW TO GET STARTED...

JOIN the Zero Carbon Forum.

SHARE learnings, successes, and best practice with peers.

COLLABORATE to innovate and tackle shared emission areas.

PHASE 5: APPROVING, VALIDATING, AND LAUNCHING YOUR PLAN

The final steps in developing a credible net zero strategy are to:

OBTAIN

internal approval from senior management for your proposed net zero ambition and decarbonisation roadmap.

EXPLORE

external validation of your net zero targets, for example from the SBTi. More guidance on how to do this is available from the SBTi website.

PUBLICLY

announce your net zero strategy to investors, suppliers, customers, and employees.

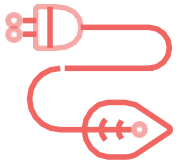
PHASE 6: DEVELOPING A CREDIBLE REMOVAL STRATEGY

Once you've mapped your pathways, you'll understand the extent of the carbon removals you'll require to reach net zero at the end of your emission reduction pathway. It's vital that companies first aim for deep decarbonisation across scopes 1, 2, and 3 before turning to carbon removals. Ideally all resource and effort will go toward reductions until you've abated all avoidable emissions across each scope.

When you're ready to build your own credible removal strategy, here are 4 areas to consider:

GEOGRAPHY

- Local or international
- Areas of operation or location of key suppliers
- Developing or developed countries



PROJECT TYPE

- Removal or avoidance/ reduction projects
- Verification standard

CO-BENEFITS

- Alignment to the UN Sustainable Development Goals (SDGs)
- Societal or environmental benefits
- Promoting innovation
- Mitigation and adaptation against climate change

COST

- Current prices
- Funding options
- Setting an internal carbon price

CARBON REMOVAL V CARBON AVOIDANCE

Project type	Project category	Activity	Description	Current average price (USD $/tCO$_2$e)[1]	Alignment
Carbon removal	Nature-based	Nature-based Solutions (NBS)	Activities that naturally sequester carbon, such as tree planting through afforestation or reforestation. Most widely available and commonly used in corporate strategies.	$10 - $30 - depending on location	To achieve net zero, businesses must neutralise residual emissions with equivalent carbon removals.
	Technology based	Direct Air Carbon Capture (DACCS)	Harvesting the carbon and storing it geologically by burning the plants to produce bioenergy combined with carbon capture and storage.	$600 - $1000 - technology is in early stages. It is expected that this cost will come down to $100-300 in the future.	
		Direct Air Carbon Capture (DACCS)	Direct Air Capture is a technology that captures carbon dioxide directly from the air with an engineered, mechanical system.	$600 - $1000 - technology is in early stages. It is expected that this cost will come down to $100-300 in the future.	
Carbon avoidance / reduction	Nature-based	Avoided deforestation (REDD+)	Protect and conserve existing forest land threatened by deforestation.	~$4	On the journey towards net zero, businesses can choose to compensate for residual emissions by investing in offsetting projects that help avoid or reduce emissions outside the company's value chain.
		Other nature-based such as blue carbon	Conservation and restoration of coastal ecosystems.	~$4	
	Technology based	Energy efficiency or fuel switching	Implement energy saving measures and replace fossil fuels with sustainable energy sources.	~$3.5	
		Renewable energy generation	Renewable power infrastructure that contributes to decarbonise the local power grid, avoiding GHGs.	~$2	
		Land or waste management	Reduction in landfill gas or methane through interventions.	~$4	

CARBON REMOVAL V. CARBON AVOIDANCE OR REDUCTION OFFSETTING CREDITS

We mentioned earlier in this report that a net zero plan involves first a reduction pathway, then a removals pathway.

Once you've reduced all avoidable emissions, you'll need to neutralise the impact of residual or unavoidable emissions by permanently removing an equivalent volume of atmospheric carbon. This is your **removals pathway.**

This table outlines carbon removal measures available to brewers to achieve net zero. The second half of the table describes carbon avoidance and reduction offsetting measures that businesses can use to compensate for emissions on their net zero journey, as long as the funding to do so doesn't detract from your reductions.

Source: www.greenpeace.org.uk/wp-content/uploads/2021/01/Net-Expectations-Greenpeace-CDR-Briefing-updated2.pdf
www.forest-trends.org/wp-content/uploads/2019/12/SOVCM2019.pdf

INSETTING SOLUTIONS

Insetting is the term used to describe a carbon reduction project, verified by an offset standard, which occurs within a company's supply chain.* Companies who choose to invest in insetting within their supply chains are able to capture carbon and drive other socio-economic and environmental benefits that can improve supply chain resilience. However, project set-up and ongoing verification can require significant investment.

The definitions of insetting vary, as do the accounting approaches, making it difficult for businesses to understand how to incorporate insetting within their net zero strategies. Because of this, the SBTi recommends businesses take a conservative approach in relation to insetting while work is going on to standardise the definition and develop clear accounting methodologies.

The SBTi recommends to only include emission reductions or removals from insetting projects that use a corporate accounting approach and are wholly contained within the reporting company's supply chain.

* www.icroa.org/Insetting

CREDIBLE OFFSETTING

The principles defined by the University of Oxford, GHG Management Institute, SBTi, and WWF help ensure a credible approach to offsetting.

SUMMARY OF KEY CREDIBILITY PRINCIPLES

- A robust determination of impact on the project.

The project can prove that the mitigation activity wouldn't have taken place in the absence of carbon credits and the added incentive created by the carbon credits led to implementation of the mitigation activity.

Robust quantification to a internationally recognised standard e.g. Verified Carbon Standard or Gold Standard.

- Strong institutional arrangements and processes of the crediting program.
- Good overall programme governance with transparent processes.

Robust third party auditing.

Stakeholder consultations to ensure transparent decision making.

- Avoiding that the same emission reduction or removal is used more than once to achieve climate targets or goals (double counting).
- Addressing non-permanence.

Avoiding or compensating for a situation where the emissions reductions or removals generated by the project activity are later reversed, for example due to a natural disaster or project mismanagement.

Ensuring risk assessments and established liability for reversal will stop non-permanence.

- Engaging positive environmental and social impacts.

Projects that avoid adverse environmental or social impacts on local stakeholders and communities, such as violations of human rights, and generate benefits beyond reducing emissions, such as reducing air pollution or contributing to education.

Projects will ensure adaptation and resilience to support the poorest and most vulnerable.

THE PRICE OF CARBON OFFSETS

Offsetting projects have a range of attributes that influence their price. Since the current market pricing is extremely opaque, the average price of an offset on the voluntary market is only visible on an annual basis. In 2019, carbon prices on the voluntary market ranged from $\$1/tCO_2e$ to over $\$70/tCO_2e$, with an average price of \$3-6 tCO_2e for all offsets including reduction and avoidance projects.*

The current price of offsets are unsustainably low, due to an excess of supply built up over several years, and need to increase significantly to encourage greater investment in new projects that remove carbon from the atmosphere.**

*Voluntary Carbon Market Insights: 2018 Outlook and First-Quarter Trends - Forest Trends (forest-trends.org) The Only Constant is Change, State of the Voluntary Carbon Markets 2020, December 2020, Ecosystem Marketplace I ** https://trove-research.com/wp-content/uploads/2021/06/Trove-Research-Carbon-Credit-Demand-Supply-and-Prices-1-June-2021.pdf

ATTRIBUTES THAT AFFECT OFFSETTING PRICES

In the future, the price of offsetting is expected to increase significantly due to increased demand for removal offsets from businesses looking to meet their net zero commitments.

This will help incentivise investment in climate action to support the protection of existing forests and restore degraded habitats, while scaling up other technologies that can remove carbon from the atmosphere.

Brewers should plan for substantially higher carbon offsetting prices in the future and therefore double down on efforts to reduce absolute emissions to near zero as a priority.

Value beyond carbon	Prices of projects that contribute to a broader range of sustainable development goals can be higher to allow for additional certification investment. For example, the Gold Standard Fairtrade Scheme.
Size and location	Size and location play a role in project pricing. For example, smaller projects may be more expensive to implement per tCO_2e. In addition, some countries may also find it more difficult to implement projects, resulting in higher prices.
Quality	High quality offsets certified to credible standards tend to be more expensive due to extra costs for robust validation checks.
Economies of scale	Purchasing large quantities of carbon credits in one go can reduce prices, as project developers are able to sell at a discounted price.
Partner fee	Procuring offsets through a partner or broker will impact price. For example, some partner companies charge higher % admin fees.

HOW TO GET STARTED

CONFIRM
the volume of emissions that you'll need to offset at the end of your reductions pathway to achieve net zero.

AGREE
on the timelines for investing in carbon removals.

IDENTIFY
the potential for insetting in your value chain.

USE
the considerations listed above to establish criteria to assess and prioritise carbon removal options.

IMPLEMENT
a carbon pricing mechanism to help fund carbon offsetting or insetting activities.

"THE FUTURE WILL BE GREEN, OR NOT AT ALL."

SIR JONATHON ESPIE PORRITT

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APPENDIX

GLOSSARY

For a condensed guide on the terms used throughout this document, plus applicable terms that will be encountered on your net zero journey, we recommend the UN's Race to Zero glossary.

The UN Race To Zero is a global campaign to rally leadership and support from businesses, cities, regions, and investors towards net zero. The glossary has been developed by the Race to Zero Expert Peer Review Group, which comprises scientific and technical net zero experts and practitioners from around the world.

METHODOLOGY
EMISSION PROFILES

DATA COLLECTION

We used bespoke brewing data collection templates to capture data across scopes 1, 2, and 3 emission sources. We then held follow up calls with ZCF members to answer questions and support the data gathering process.

SECTOR EMISSION CALCULATIONS

All emission calculations follow the GHG Protocol Corporate Standard, which is the most widely used international standard for GHG reporting. We applied the best available emission factors based on the activity data provided to calculate scopes 1, 2, and 3. The team at Carbon Architecture used a combination of raw data based on HMRC's "TABLE A9 - BEER: UK STATISTICS IN METRIC UNITS" for UK beer volume, BBPA data, and our own calculations of specific carbon emissions of a typical cask or keg focused brewery and a large brewery.

We then calculated a weighted average to understand sector-wide emissions. The quality and coverage of the data provided by contributing breweries varied considerably, which was expected. We identified and queried any significant anomalies in the data.

AGGREGATED SECTOR AVERAGES

To allow for comparisons between different types and sizes of breweries, we calculated a weighted emissions intensity based on revenue for scopes 1, 2, and 3. The intensity metrics we chose for this report are tCO_2e per million pounds turnover, and tCO_2e per hectolitre of beer.

We used a combination of ZCF member emissions data and CDP emission data sets. CDP emission data provides intensities by company, specific to brewing, and has been cleaned by CDP for accuracy and reliability. By supplementing member data with CDP data, we're able to increase the sample size of reported emissions, and provide a more representative view of emissions unique to the UK brewing sector.

EMISSION PROFILES

Scopes 1 and 2	
Scope 1	UK Government GHG Conversion Factors
Scope 2 - Location Based	UK Government GHG Conversion Factors
Scope 2 - Market Based	Supplier specific emission factors
Scope 3	
Category 1 Purchased Goods and Services	Multiple sources depending on emission source and activity data provided Spend data - scope 3 Evaluator / Quantis Quantity data - Ecoinvent 3.7.1, WRI Cool Food Tool, UK Government GHG Conversion Factors, 3rd party research
Category 2 - Capital goods	Scope 3 Evaluator / Quantis
Category 3 - Fuel and energy-related activities	UK Government GHG Conversion Factors
Category 4 - Upstream transportation and distribution	UK Government GHG Conversion Factors
Category 5 - Waste generated in operations	UK Government GHG Conversion Factors
Category 6 - Business travel	UK Government GHG Conversion Factors
Category 7 - Employee commuting	UK Government GHG Conversion Factors
Category 8 - Upstream leased assets	Not applicable for members
Category 9 - Downstream transportation and distribution	UK Government GHG Conversion Factors
Category 10 - Processing of sold products	Not applicable for members
Category 11 - Use of sold products	UK Government GHG Conversion Factors
Category 12 - End-of-life treatment of sold products	UK Government GHG Conversion Factors
Category 13 - Downstream leased assets	UK Government GHG Conversion Factors
Category 14 - Franchises	UK Government GHG Conversion Factors
Category 15 - Investments	Not applicable for members

DECARBONISATION PROJECTS AND SUB-SECTOR PATHWAYS:

We held workshops with ZCF brewers to explore reduction opportunities across scopes 1, 2, and 3 emission sources. We combined the feedback from these sessions with desk-based research to develop a comprehensive list of potential emission reduction projects for brewers.

We grouped reductions into short-term projects that you can implement relatively quickly or are in your direct control, and longer-term initiatives that require more planning and effort. Each initiative includes a relative investment indication, shown as low (£), medium (££), or high (£££).

Some reductions have interactive effects. We've accounted for these interactions to avoid any double counting.

WASTE RECOVERY HIERARCHY FOR BREWERS

1 AVOID

Avoid waste at source, within the design stage. That includes avoiding the need to source virgin raw materials by incorporating recycled materials and principles of circularity.

2 REDUCE

Incorporate 'Design for Longevity' guidelines, remove packaging where possible, reduce packaging where needed, and optimise materials according to collection capabilities and end-of-life options.

3 REUSE

Re-distribute used goods to other businesses. Incorporate 'Design for Refillability' principles for drink containers. Re-think business models. Re-distribute spent grains or other products for food or animal feed where reuse isn't possible.

4 RECYCLE

Recycle packaging and materials that are suitable adn economically viable for collection and recycling. Aim for mono-materiality and simplified material choices to remove recycling barriers.

5 RECOVER

Recover and retain as much waste and as many nutrients as possible, also reducing loss of energy and economic value. For example, AD or composting helps maintain nutrients, incorporating spent grains and effluent with principles of circularity. Recovered biogas can be used as energy. For inorganic or impossible impossible to treat waste streams, consider incineration with energy recovery. Waste can also be used as fertiliser in agricultural applications, or sold to be used as non-virgin raw materials by other businesses,.

6 TREAT

Anaerobic Digestion (AD) is a waste treatment method suitable for food or drink waste. Textile materials downcycled via mechanical recycling can be used in industrial applications.

7 DISPOSE

Landfill should be the last resort, when all other waste treatment and reduction strategies have been tried and failed. Accountability over where waste gets landfilled should sit within the due diligence of the company producing landfill waste.

References: EPA Food Hierarchy www.epa.gov/sustainable-management-food/food-recovery-hierarchy
Applying the waste hierarchy: A guide to Business, WRAP, 2017: www.wmba.co.uk/app/uploads/2017/06/wrap-applying-wastehierarchy.pdf 'Upstream Innovation: a guide to packaging solutions': Ellen MacArthur Foundation: https://plastics.ellenmacarthurfoundation.org/upstream

EXAMPLE LETTER FOR APPROACHING SUPPLIERS ABOUT NET ZERO

If you're just starting your net zero supplier engagement journey, you may wish to use this example template. This will help to make the connection with your suppliers, inform them of your plans, and help them understand which information your business needs.

Dear [Supplier],

We're delighted to inform you that at [brewery name], we've committed to reducing our in-house (scopes 1 and 2) and supply-chain (scope 3) emissions. Our goal is to reach net zero in line with SBTi best practice and the Greenhouse Gas Protocol.

To achieve our commitment, we'll need to reduce our overall environmental impact, improve stakeholder satisfaction, and build a more resilient, sustainable, and efficient business model. We believe this approach will lead to better outcomes for our employees, customers, and the environment.

We've found that most of our emission sources originate from our supply chain activities. We'd like to work with [Supplier] to understand how we can collaborate to tackle our shared emissions, reducing your operational footprint as well.

We see a mutual benefit for both parties and feel confident that this collaboration will result in more sustainable practices and strong relationships between our companies.

Specifically, we'd like to better understand:

- Has your company taken any action to reduce waste or emissions?
- Are you willing to collaborate with us on our emission reduction journey?
- Has your company ever calculated its greenhouse gas (GHG) emissions?
    - If so, are you able to provide us with your scopes 1 and 2 emissions data?
    - Are you able to provide us with any of your scope 3 emissions data?
    - Have you committed to a Science-Based Target to reduce your GHG emissions?
    - Do you participate in any mandatory or voluntary emission or environmental impact reporting?
    - Have you reviewed your environmental risks and opportunities as a business?'

If you'd like to join us on this journey, we'd be happy to speak with you about this mutually beneficial opportunity.

Thanks so much for helping us reduce our environmental impact. We look forward to hearing from you and working with you on this important project.

As always, please do get in contact if you have any questions.

Sincerely,

[Company/contact name]