



NET ZERO
BREWERY

Climate Action Playbook

With development partners:

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INITIATIVE

TOAST
HERE'S TO CHANGE



Introduction.

The UK government has made a commitment to becoming Net Zero by 2050¹ and with the brewery sector adding £7bn to the UK economy, it is essential that breweries engage with the challenge of measuring and reducing their carbon footprints, across their entire value chain.

At Net Zero Now, we have launched the Net Zero Brewery initiative. This will seek to provide the brewing industry with the tools to calculate and reduce greenhouse gas emissions from across the value chain.

This document aims to provide the guidance and support required to help mitigate and reduce emissions in breweries simply, effectively and affordably. Brewing is a challenging industry, often with slim profit margins, so all recommendations in this guide are designed to be achievable. Breweries are also well known for being innovative, creative and ready to take on a challenge - this guide aims to provide the tools to allow these attributes to flourish.

The disruption caused by the pandemic has been exceedingly challenging for hospitality businesses and by extension their key suppliers, and this has resulted in exceptional demand challenges for breweries across the UK and around the world. The uncertainty caused by repeated lockdowns has meant that addressing issues like carbon emissions may have been put on the back burner. Similarly, many businesses have been hesitant to engage with Net Zero activities as solutions can seem complex and challenging.

As we enter a post-pandemic world, this provides great opportunities to rethink the way we do business in order to benefit our customers, the economy and the planet alike.

A renewed focus on efficiency is not only great for cutting emissions, but also improves the bottom line – by cutting core expenses you can increase profitability without increasing sales revenue – this is a win-win.

Likewise, building environmental criteria into supplier selection can bring new suppliers and products to your attention, while promoting low carbon staff travel can improve employee welfare.

The first step towards net zero success is working out how carbon intensive your brewery currently is. By calculating the Greenhouse gas emissions associated with your brewery, you will understand where your highest sources of emissions are coming from. You will know which areas of your brewery you need to target in order to reduce your emissions.

From there, it is possible to implement mitigation strategies that target specific areas that need improvement. By understanding where we can improve the most, we can take actions that generate the most significant reductions.

This guidance document will help you to take simple and affordable steps to reduce your emissions, saving you money and helping you work towards becoming a Net Zero operation.

If you are interested in taking the next step for your breweries climate strategy journey, then one of the Net Zero Now team will be happy to give some advice. Contact us for more information, including a free walk through of the Net Zero Brewery Platform – which seeks to make credible carbon footprinting a simple process.

Contact us now: go@netzeronow.org

1. <https://www.gov.uk/government/news/uk-becomes-first-major-economy-to-pass-net-zero-emissions-law>

Why should I care?

With all the time-sensitive challenges that come with operating a brewery, it is easy to understand how addressing Net Zero can move down on your list of priorities.

Between balancing your budget, sourcing & maintaining staff, managing your inventory and the multitude of other administrative tasks, it is worth asking the question: Why should I care about becoming Net Zero?

The UK Government has made it not only a goal, but a requirement. Making a strong commitment to Net Zero, the UK will be looking for every industry to do their part. That means that breweries will be required to reduce their emissions, initially voluntarily but in time through reacting to government policies that seek to incentivise action. The Department for Business, Energy and Industrial Strategy (BEIS) have created a Net Zero SME working group that aims to raise awareness of Net Zero targets and encourage action following COP26 in November 2021.²

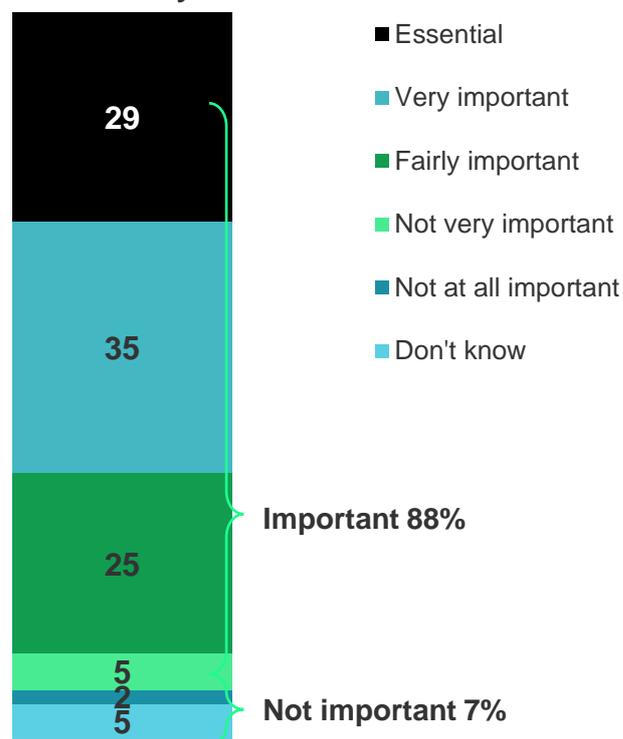
Similarly, the government implemented key assistance during the pandemic to help businesses survive, but also to play a central part in positive economic revival, bouncing back stronger and greener.³

On top of this, becoming Net Zero can improve your business. There is now a wealth of information, research and anecdotal evidence that has found that reducing your carbon footprint can save your business money. Between reducing your energy bill, getting more from your equipment & appliances, and

attracting new environmentally-conscious customers, working towards Net Zero can improve your bottom line while contributing positively.

Consumers are demanding it. Of people who have heard of Net Zero, 88% think that it is essential that the UK meet this target.⁴ We are seeing more customer demand for Net Zero information, such as carbon labelling on food and beverages.⁵ Younger generations in particular see reducing the impacts of climate change as a significant and important challenge, and see Net Zero as a key part of that strategy.⁶

How important is it for the UK to reach Net Zero by 2050?



Source: https://energysavingtrust.org.uk/wp-content/uploads/2021/05/Net-Zero-Consumer-Research_Energy-Saving-Trust.pdf

2. <https://www.ukhospitality.org.uk/page/sustainability/>

3. <https://www.foodmadegood.org/hospitality-central-to-helping-uk-reach-net-zero-targets-says-minister/>

4. <https://energysavingtrust.org.uk/what-do-your-customers-think-about-net-zero/>

5. <https://www.forbes.com/sites/briankateman/2020/07/20/carbon-labels-are-finally-coming-to-the-food-and-beverage-industry/?sh=4354f6767c03>

6. https://energysavingtrust.org.uk/wp-content/uploads/2021/05/Net-Zero-Consumer-Research_Energy-Saving-Trust.pdf

Addressing the breweries.

While we know many breweries would like to become more sustainable, there may be a range of limitations to achieving your Net Zero goals. These include:

Financial - hospitality businesses can have slim profit margins, which means choosing where to invest your time and money is important. Without clear return on investment, investing in emission saving technologies and techniques can be difficult.

Time - owners and managers of breweries are often time-poor. With so many moving parts to running a business, it can be challenging to find the time to research and implement emission saving strategies.

Lack of expertise - while hospitality professionals are well known for being jack-of-all-trades, most people have not had any training on how to reduce carbon emissions. While considering the environmental impact of business is becoming more mainstream, it is still not commonplace to receive formal or on-site education in this area.

Limited awareness - many breweries have not fully realised the importance of becoming Net Zero, and therefore have not sought to engage with the topic. With the plethora of details that hospitality owners need to have awareness over, it is understandable that Net Zero has not been front and centre for many.

Doing enough - while many hospitality businesses do make positive steps towards sustainable practices, it is easy to overestimate the impact. For example, while recycling is admirable, it will not make a huge difference if other parts of the business are carbon intensive. It is easy to assume that doing something small is enough, but in order for us to reach Net Zero we need to dig deeper and find bigger solutions.

Existing assets - the government wants the UK to become Net Zero by 2050, but 80% of the buildings that will around in 2050 have already been built⁷. It does not make good economic or environmental sense to remove existing buildings in favour of more energy efficient ones, so we must seek to work to decarbonise what we currently have in place.

It is important to acknowledge and address these challenges head on, and that the solutions and strategies proposed take them into consideration. It is not helpful to propose an entire venue retrofit without considering the financial implications, and deciding to scrap existing assets may cause more carbon emissions than save them.

As mentioned above, the next most important step after considering challenges is to understand how well your venue is doing with energy efficiency and identifying opportunities for improvement. All of that comes through measurement and calculation.

7. https://gb.gleeds.com/globalassets/news--media/brewerylications/net-zero-hotels/gleeds_nzc-existing-hotels_final.pdf

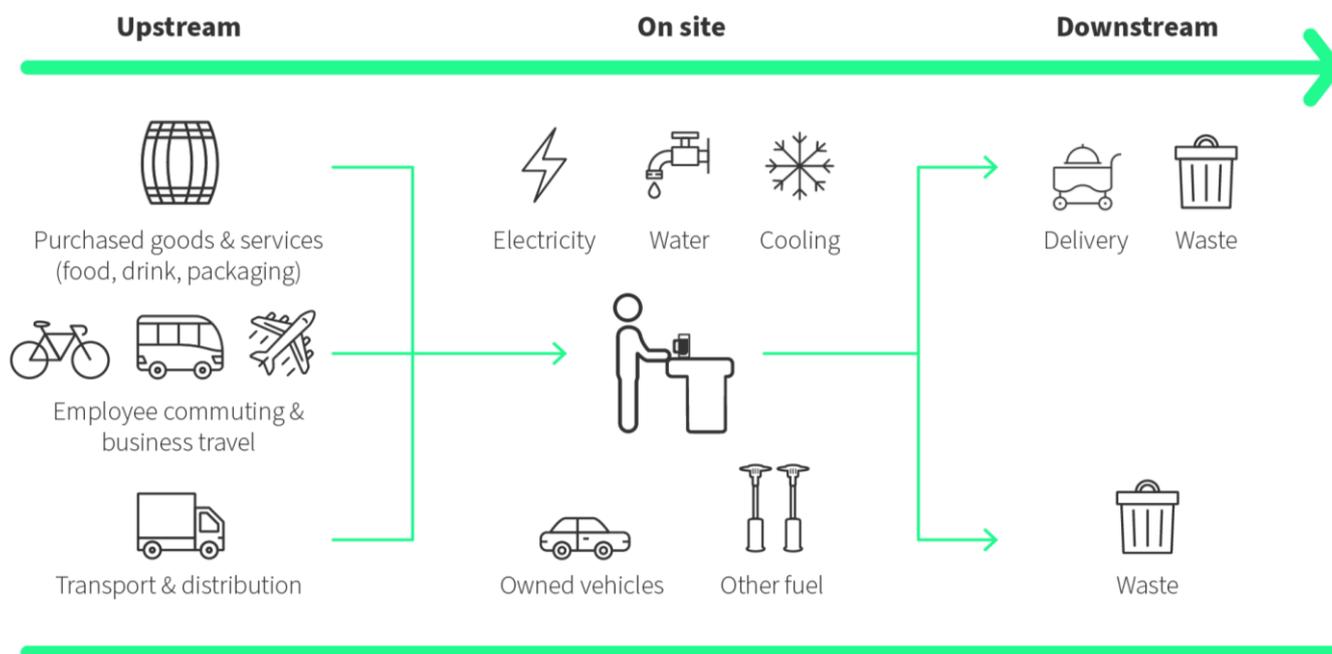
Measuring for success.

As experts in climate strategy, we recommend that reduction activities are **evidence-based**, using insights derived from robust and effective best practice measures.

Without a clear understanding of which parts of your businesses have the greatest climate impact, it is difficult to know where to focus attention or whether action you've already taken has been effective.

Calculating emissions may seem like a daunting task at first, but the team at Net Zero have created a practical tool to help you which can be found at www.netzeronow.org/breweries. When considering the emissions of your venue, it is important to take into account not just your on-site impact, but also upstream and downstream emissions. The diagram below demonstrates the different types of emissions a typical brewery might create.

It is only through effective measurement that a proper plan can be established, priorities identified, targets set and progress towards meeting them tracked.



Key recommendations.

This document will present practical actions for multiple themes relevant to brewery operations, but there are three high level recommendations that cut across all themes. The actions below are a great place to start to lay the foundation for an effective net zero strategy.

1. Start with data

It can be tempting to leap straight into taking action to reduce your emissions but in our experience, this often leads to short lived enthusiasm and confusion about whether the action taken has been effective.

The choice of reduction activities you take should always be evidence-based; using insights derived from robust and effective assessment of climate impact. This will provide a clear understanding of which parts of your businesses have the greatest climate impact, and where the greatest opportunities for reduction therefore exist.

Regular collection of data will also allow you to set reduction goals and track progress towards achieving them. This is essential to ensure action being taken is effective and to provide a sense of progress and achievement to the team.

2. Share enthusiasm and systematize processes

Employees take their cues from management and need to know that this is an important part of the values of your brewery and a key focus area. By sharing your enthusiasm for addressing the climate challenge with all staff, you can empower them with the license to see their job through the climate lens.

Building climate impact considerations into everyday processes systematizes this approach. Your management team are the ones that will enforce policies and evidence shows that engaged and well trained management is essential for sustainability implementation. A study of 112 hospitality founders and managing directors found that staff were not powering down the venues properly, costing the owners more money than necessary⁸. Providing on site training will see managers and senior staff engage more with Net Zero which will naturally trickle down to all staff. Providing information as part of all employee induction packs will ensure that everyone has the right tools to contribute and demonstrate your commitment to becoming Net Zero. Encouraging and reward staff by revealing their energy-saving achievements can also be an effective tool.

8. <https://www.bighospitality.co.uk/Article/2013/11/13/Hospitality-bosses-cite-energy-waste-as-top-irritation>

Key recommendations.

3. Maximise value

While some activities will improve efficiency and cut costs, there may be some investment required for others. Look out for government and council initiatives & discounts; with the UK Government committing to become Net Zero by 2050, there are a range of funding opportunities that will help industries reduce their emissions⁹. Getting funding for infrastructure like on-site solar can help offset initial costs while saving your business money in the long term.

Leverage customer engagement by communicating with them about your Net Zero initiatives.

Customers are being more carbon-savvy and are not only looking to consume carbon-conscious products, they also want to increase their knowledge. Beer in cans, for example, act as a more sustainable packaging alternative to beer within glass bottles. Offering sustainable alternatives to customers, actions that are tangible and familiar, can lead to more significant behaviour change in the future. When they see your brewery making efforts in these areas, they know that you are taking steps to reduce your carbon footprint and becoming environmentally conscious. Small steps can have significant knock-on benefits on future behaviour change, which demonstrate your commitment to Net Zero.

Engage with the community and collaborate with other Net Zero breweries.

By communicating with other breweries on the same sustainability journey, you can share ideas, trial solutions and develop supply chains together. It is very difficult for one single person or venue to have all the answers, so collaborating with others is a fantastic way to get the best information and practices.



9. <https://www.gov.uk/guidance/find-funding-to-help-your-business-become-greener>

Guidance by theme.

This guide covers five core operational themes of setting up and running a brewery:

-  1. Building materials and fitouts
-  2. Operations & Utilities
-  3. Packaging
-  4. Purchased goods and services
-  5. Transportation

Across each of these themes, this guide will provide you with an overview of the theme and why it's important, practical actions that can be taken, and case studies of best practice in the industry.

All aspects, practical actions and case studies have been researched with breweries to implementing energy efficiency in mind. Our goal is to avoid lofty aspirational thinking, but instead to consider common breweries and provide sensible and achievable actions that can be taken by standard breweries in the UK.

Guidance by theme.



1. Building materials and fitouts

What your building is made from has a significant impact on how energy efficient your venue is.

It is estimated that up to 60% of heat in a typical building is lost through walls, floors, roofs and windows⁹. Many older buildings have a high U-value, a measurement that describes how effective a material is as an insulator¹⁰. That means that buildings are not very well insulated and can become overly hot in the summer and cold in the winter, meaning more energy is required to create comfortable conditions for guests.

Investment in improving your building's use of energy and resources can not only help to reduce operating costs and improve comfort for staff, but also increase the value of the building itself and make it more attractive to future investors.

Similarly, how you choose to fit out your brewery will have implications for carbon emissions¹¹. **Selecting low carbon and reused furniture and building materials means less waste and contributes to the circular embedded carbon cycle.**

Practical Actions:

- When building or remodelling, using materials that are already on site will reduce landfill and recapture embedded carbon. Similarly, adding insulation at fit-out is far more cost effective than retro-fitting
- Select furniture made from recycled or low carbon materials
- Another growing trend is to lease furniture instead of purchasing directly - this means that furniture is built to last and is less likely to end up in landfill. This 'product-as-a-service' model means that products are refurbished instead of thrown away.
- Choose building materials that are highly insulating - this will help lower energy costs and also create a more consistent and comfortable temperature range in your venue
- Room design can also affect carbon footprint - if kettles and other heat sources are placed next to coolers or freezers, they will need to work harder to do their job. Consider the placement of equipment and appliances so they are not being overworked.

9. <https://www.yuenergy.co.uk/news/energy-saving-hospitality-business-guide#ventilation-%20air-conditioning>

10. <https://www.thenbs.com/knowledge/what-is-a-u-value-heat-loss-thermal-mass-and-online-calculators-explained>

11. <https://www.morningadvertiser.co.uk/Article/2020/02/14/How-to-reduce-your-brewery-s-carbon-footprint>

Guidance by theme.



2. Operations & Utilities

Brewing beer involves quite a bit of heating, cooling and ventilation – all of which use energy. Knowing and understanding how this energy is used and where the largest usage resides will provide the first step in managing energy costs. This leads to improved efficiency that will allow for long-term cost savings, lower GHG emissions and an improved competitive position. The sections below are broken up to provide specific insights for heating, cooling, lighting, water use and the brewing process itself.

Heating

The greatest heat requirement within breweries is the fermentation process. Heat generated via natural gas or propane combustion within boilers or electric systems is essential for hot water heating and the brewing process.

Thermal energy in the form of natural gas is used to generate hot water and steam, which is then used in brewing, packaging and general building heating.

A brewery could reduce energy demand by 20% through updating and improving insulation and basic heat recovery systems, whilst also achieving a buyback period of around 1.3 years.¹²

There are also methods of capturing heat from other brewing processes. Brewing water has the potential to be heated from steam generated by high efficiency LPG boilers, as well as through heat capture from brew kettles during the cooling process. This heat then can be redirected to hot water tanks ready for the next brew.

Another small but simple addition to your heat recovery is implementing the use of electronic timer switches. This is a great way to have your heating systems switch on and off only when you need them.

Practical Actions

- Implement heat exchangers to avoid single pass water and to recover as much energy as possible from the wort and waste vapour streams.
- Connect to sources of district heating if possible. This helps to utilise neighbouring building's waste heat.
- Schedule brewing to use hot water immediately rather than storing it for long periods of time.
- Encourage energy-smart habits like closing doors when needed, replacing windows, performing maintenance, and regularly shutting down equipment when not in use.

Case Study:

At Heineken's brewery in Austria, 40% of the brewery's heat requirements comes from surplus heat discharged from a neighbouring sawmill. 90% of the waste heat generated in the brewing process is used in turn to heat their water. Heineken's industry roadmap has more information.¹³

12. B. Sturm, S. Hugenschmidt, S. Joyce and W. Hofacker, "Opportunities and barriers for efficient energy use in a medium-sized brewery," *Applied Thermal Engineering*, vol. 53, no. 2, pp. 397 - 404, 2013.

13. https://www.theheinekencompany.com/sites/theheinekencompany/files/Downloads/PDF/sustainability%20and%20responsibility/heineken-on-the-path-to-net-zero-2021.pdf?_ga=2.266982669.221521746.1646207698-395498714.1646207698

Guidance by theme.



2. Operations & Utilities

Cooling & Refrigerant

You can't brew beer without temperature control and post-production refrigeration. With heat being expelled as a by-product in most stages of the brewing process, it is important to have cooling systems in place, not only for the brew itself but also within the building for your employees.

One method to facilitate airflow in your brew house is **putting in place regular maintenance of your ventilation systems**. These systems can work up to 25% more efficiently when they are cleaned and maintained often. The energy savings far outstrip the costs, so it is worth the regular investment - plus your equipment will last longer and will not need to be replaced as quickly.

For the AC systems you might have in place, it is important to note that the coolant gases used have a very powerful impact on the climate. 1kg of R134A, a common refrigerant gas in AC units, is 1,300 times more damaging to the climate than the same amount of carbon dioxide. However, there is a less carbon intense coolant, [R-410A](#), that can be used to replace your current coolants. Although this product still involves harsh chemicals, this will help your system work efficiently with less environmental impact. And again, regular maintenance of these systems can identify leaks early and avoid large scale topping up to replace lost gas.

A second alternative would be to **use ammonia as a coolant**. Ammonia has a zero global warming potential (aka zero greenhouse gas emissions) and a zero ozone depletion potential, double win. It is however incredibly toxic in high concentrations and extreme caution must be used if implemented at your brewery.

Emissions associated with cooling at the brewery may be large, it is possible however that retail and domestic refrigeration creates the largest electrical and energy load. A very thorough carbon footprint assessment of Fat Tire Amber Ale brewed by New Belgium Brewing Company found retail refrigeration—inclusive of energy use and fugitive refrigerant emissions—to contribute 28% to the total carbon footprint. Refrigeration in the home contributed an additional 8.2%. It is important to note that these numbers are dependent on how long the beer is cooled in the product chain. ¹⁴

Some small alterations in your process chain can make big differences. Like heating systems in the section above, **using electronic timer switches is a great way to have your cooling systems switch on and off where needed**.

Technologies like [Aerofoil](#) are also useful in refrigeration so that when cold air tries to escape, it is directed back into the fridge avoiding some energy loss. ^{14 15}

14. The Climate Conservancy, "The Carbon Footprint of Fat Tire® Amber Ale," 2018. [Online]. Available: https://www.ess.uci.edu/~sjdavis/pubs/Fat_Tire_2008.pdf. [Accessed 2022].
15. https://www.fdf.org.uk/globalassets/resources/publications/guidance/compressed_fdf-net-zero-handbook-final-111021.pdf

Guidance by theme.



2. Operations & Utilities

Lighting & Electricity Efficiency

In an [energy manual](#) from the Brewer's Association, they estimate that an average craft brewery will use between 50 and 66 kWh to produce a single barrel of beer (50 litres). If, for example, energy prices cost between £0.20 and £0.35 kWh (electricity and gas respectively), the cost for each barrel would be between £10.00 and £23.10. There are two major components that dictate this cost, roughly 30% of which is thermal energy and the latter 70% is electric energy. In this section we'll discuss the latter.

Electric energy is shared between numerous aspects of the brewing process and the brewery itself. A brewery needs to be well-lit, but that doesn't mean you have to waste energy costs here. [A simple step is to add natural light through additional windows, which will reduce the electricity you need to maintain a good working atmosphere.](#)

An easy method of reducing total energy costs could be to [replace all lighting fixtures with energy-efficient alternatives](#), e.g. LED lights. This solution could result in a reduction of up to 90% of your total light energy costs.¹⁶

Heineken's Royal Brewery in Krušovice, Czech Republic recorded savings in several of the plant buildings by replacing hundreds of old lightbulbs with energy-saving LED bulbs. The result provided 66% lower electricity consumption and a saving of more than CZK 3 million (about £100,000) over a period of 10 years for Heineken.¹⁷

The Carbon Trust guide demonstrates that LED lighting has a vastly longer life than other lighting alternatives, and a higher efficacy rate which describes the ratio of light emitted to power consumed.¹⁸

	Lamp Life	Colour Temperature	Colour Rendering	Efficacy
Standard Incandescent	2,000 - 3,000 Hours	2,500 - 3,000K	100 Ra	5 - 20 lm/W
Tungsten Halogen	2,000 Hours	3,200K	100 Ra	15 - 24 lm/W
Tubular Fluorescent	10,000 - 12,000 Hours	2,700 - 6,500K	>85 Ra	60 - 105 lm/W
Compact Fluorescent	6,000 - 15,000 Hours	2,700 - 4000K	> 85 Ra	45 - 80 lm /W
High pressure sodium	12,000 - 30,000 Hours	2,000 - 2,700K	25 - 85 Ra	25 - 85 lm/W
Metal Halide	6,000 - 20,000 Hours	3,000 - 6,000K	65 - 93 Ra	50 - 113 lm/W
LED	25,000 - 75,000+ Hours	2,700 - 8,000K	65 - 97 Ra	70 - 150+ lm/W

Source: <https://www.carbontrust.com/resources/lighting-overview-guide>

16. Evergreen Energy, "LED Lights," [Online]. Available: <https://www.evergreenenergy.co.uk/led-lights/why-you-should-make-the-switch-to-led/>. [Accessed 2022].

17. Veolia, "how veolia helps one oldest breweries reduce its environmental-footprint," [Online]. Available: <https://www.livingcircular.veolia.com/en/industry/how-veolia-helps-one-oldest-breweries-reduce-its-environmental-footprint>.

18. www.carbontrust.com/resources/lighting-overview-guide

Guidance by theme.



2. Operations & Utilities

Smart meters on electrical appliances help breweries track their energy consumption and understand where any excess usage might occur. Once recognised, tools like timer switches can be installed to turn off appliances when not in use.

Another emissions reduction venture from Heineken in Austria saw energy generated from brewery residues used to generate steam. The excess volumes are then converted into electric current and used within the brewhouse.

Other on-site assets can include tools that supply electricity from wind, solar and hydro-power, helping breweries become self-sustainable for their electric energy demand.

Off-site assets can also be incorporated to decrease your brewery's energy dependence. Horse & Dragon brewery, has been receiving 100% of its energy usage since 2016 by purchasing wind power from Arcadia Power.

Practical Actions:

- The first and simplest way to reduce lighting costs and emissions is to establish a 'lights off' policy for your staff to follow. If lights don't need to be on at certain times of the day, for example during set up and prep, leave them off. This alone can save up to 20% on your energy bill. Of course, a venue must always consider health and safety so it is important to keep emergency exit lights and high-risk areas such as staircases well lit for both staff and guests.
- Switching light bulbs to LED lights is a great way to reduce your carbon emissions and energy bills. Research has found that LED lights are 80% more efficient and last much longer than incandescent bulbs.

- Security lights are designed to provide a lot of light and can be very high energy consumers: A single 500W halogen light used for 6 hours per night will produce around 230 kgCO₂e per year and cost over £438 in electricity. An LED light of equivalent brightness would cost £44 to run and produce 23kg of CO₂e.
- Putting lighting on a motion-sensor in places like bathrooms is a great way to ensure lights are only on when being used. This won't work in all spaces, as you wouldn't want a flickering light to distract from customer experience, but makes sense for places like bathrooms, walk-in fridges, store rooms, offices or wine cellars.

Case Studies:

At the time of the case study, The Carbon Trust predicted cost savings of £2,818 per year, with a payback period of just over 4 years. With the recent rise in electricity costs (2022 compared with 2021), it's likely the cost of savings will increase to approximately £6,000 per year with a payback period of close to two years. ¹⁸

Guidance by theme.



2. Operations & Utilities

Brewing, fermentation and CO₂ capture

The brewing process itself, from malt preparation through to filtration, can make up to 15% of a breweries' carbon footprint—roughly 5% of this involves the processing of raw materials and about 10% is involved in the actual brewing.¹⁹

As beer ferments, it releases CO₂. For as many moles of ethanol (alcohol) produced via fermentation, the same amount in moles of CO₂ is produced. **This by-product of fermentation can be captured and reused later in the brewing process.** By reusing this CO₂, it reduces each brewery's reliance on carbon dioxide sold on the open market for the food and beverage industry, while also reducing overall emissions.

When CO₂ is captured during fermentation, it can be transferred within the brewery, then purified and compressed into a liquid for storage. From there it's turned back into gas to be used in the packaging process where it's injected into the fermented product.

Alongside, or as an alternative to reducing your dependence on market-sourced CO₂, another action to consider is emissions released from malting. **One way to accomplish this is through the use of brewing enzymes.** These allow for 100% barley brewing, or adjunct brewing, which is the switch from using malted to un-malted brewing grains, allowing brewers to use precious raw materials more efficiently.

Adjunct brewing involves any non-malt source of fermentable sugars, inclusive of unmalted wheat, barley, rye, oats, maize, and other grains as well as honey, maple syrup, agave nectar, and other sugars. 100% barley brewing provides the

enzymes that are usually developed by malting barley and are needed to complement the enzymes naturally present in the barley crop.

As the typical malting process can account for between 7-15% of a brewery's overall carbon footprint and is known to be extremely water and energy intensive, **it can be useful to utilise an adjunct brewing process using 100% unmalted barley.** This method can reduce your carbon footprint by over 60kg of CO₂ per tonne of barley. It also provides a sustainable and economical solution whilst allowing for an increase in brewing capacity up to 25% and reduction of the mash cycle time by up to 20%.¹⁹

Case Studies:

DuPont Nutrition and Biosciences performed an LCA assessing the footprint of malted vs unmalted brewing processes. The latter process included lab-grown enzymes to mimic the process of malting, but without the environmental costs.

What they found in the unmalted batch was a 57% reduction in energy use during the brewing process, a reduction of 32% in CO₂ emissions, a 29% decrease in water usage and a 10% decrease in land usage.²⁰

19. Craft Brewing Business, "The case for enzymes as a key to sustainable brewing," 30 November 2021. [Online]. Available: <https://www.craftbrewingbusiness.com/featured/the-case-for-enzymes-as-a-key-to-sustainable-brewing/>. [Accessed 2022].

20. M. Scott, "Hold My Beer - Now Climate Change Is Coming For Your Favorite Brew," 10 September 2020. [Online]. Available: <https://www.forbes.com/sites/mikescott/2020/09/10/hold-my-beer-now-climate-change-is-coming-for-your-favourite-brew/?sh=2fb0d6eb7e91>. [Accessed 2022].

Guidance by theme.



2. Operations & Utilities

Water use, recycling & conservation

Although water is not often associated with carbon, the way water is used and served can have significant implications for emissions.

The first thing to understand is that even tap water has embedded carbon. Waste-water treatment facilities use large amounts of energy to provide clean drinking water to the UK. Luckily, the water industry in the UK is one of the most progressive for carbon reduction targets and has made a commitment to become Net Zero by 2030. The water industry has already taken significant steps and reduced industry emissions by [43% since 2011](#).

When beer is produced, it is an extremely water-intensive process, having an average water-to-beer ratio of 3 to 1²¹. So when brewing beer, it is important to know what water you're taking in and how it's being used. 75% of this water is used for cleaning, cooling and packaging, leaving the remaining [25%](#) for the final product, while the remaining is used for cleaning, cooling, and packaging. On top of this, an [estimated 672 gallons of water](#) per gallon of beer is used in the rest of the supply chain before the raw materials and other inputs arrive at the brewery.

In the brewing process, water usage can be reduced at numerous steps. Through methods of treating and recycling water, up to 65% of a brewery's water waste can be processed and reused, reducing water volume loss by 50%.²²

Technology for reverse osmosis and ultrafiltration (a membrane separation method that increases the volume of treated, and therefore reusable, water) can be installed to reduce raw water consumption.

In 2013, Westons Cider brewery was able to save £42,000 in costs through implementing this technique into their brewing process.²²

Some breweries have implemented other water-saving techniques. Dreadhop Brewery for example has benefitted from collecting rainwater, storing up to 50,000 gallons at a time.²³

The volume of water stored is used in the washing and cleaning of brewhouse tools and equipment, which makes up the majority of water used in these processes and ultimately leads to a reduction in the overall water intake of the brewery.

Much water can also be lost throughout a brewery though due to its vast consumption. Leaks and excess use can lead to over consumption.

The Brewer's Association have identified the following areas as main sources of waste water generation.²¹

Main Areas Of Wastewater Generation

SOURCE	OPERATION
Mash Tun	Rinsing
Lauter Tun	Rinsing
Spent Grain	Last running and washing
Boil Kettle	Dewatering
Whirlpool	Rinsing spent hops and hot trub
Fermenters	Rinsing
Storage tanks	Rinsing
Filtration	Cleaning, start up, end of filtration, leaks during filtration
Beer spills	Waste, flushing etc
Bottle washer	Discharges from bottle washer operation
Keg washer	Discharges from keg washing operations
Miscellaneous	Discharged cleaning and sanitation materials. Floor washing, flushing water, boiler blow-down etc.

21. Brewers Association, "brewersassociation.org," [Online]. Available: https://www.brewersassociation.org/attachments/0001/1517/Sustainability_-_Water_Wastewater.pdf. [Accessed 2022].

22. Culligan, "Advanced water treatment reduces brewing water ratios," 9 May 2019. [Online]. Available: <https://www.culligan.co.uk/advanced-water-treatment-reduces-brewing-water-ratios/>. [Accessed 2022].

23. DreadHop, "Sustainability," [Online]. Available: <https://www.dreadhop.com/sustainability/>. [Accessed 2022].

Guidance by theme.



2. Operations & Utilities

Water use, recycling & conservation

Practical Actions:

- » Become more conservative with water usage. Check for leaks (conduct waste water walks), use efficient appliances and turn the water off when not in use.
- » Install water meters at key points within the brewery to track consumption and identify irregularities caused by leaks, faulty equipment, or loose process controls.
- » Put in place low-flow nozzles and fixtures for cleaning hoses, faucets, toilets, and other appliances.
- » Implement sensors and precision-control methods to achieve better process optimisation.
- » Reuse water by recycling rinses during cleaning or by condensing hot vapour from the brew kettle.
- » Collect rainwater to be used for washing and cleaning cycles.

Case Studies:

An on-site wastewater treatment plant was installed at Lagunitas Brewing Company in California to eliminate the need to transport 50,000 gallons of water per day to a treatment facility 50 miles away. The financial cost of the wastewater disposal and treatment were estimated to be \$180,000 per month, making up 87% of the brewery's water costs.²⁴

The installation of Toray's membrane bioreactor and reverse osmosis technologies allowed for the removal of 99% of the wastewater contaminants in their on-site plant and created more reuse opportunities for the reclaimed water within the brewing process. Overall, 70% of the wastewater now processed on-site recycles back into the brewing process.²⁴

24. Toray Membrane, "www.thembrsite.com," [Online]. Available: https://www.thembrsite.com/uploads/documents/case_lagunitas_pdf.pdf. [Accessed 2022].

Guidance by theme.



2. Operations & Utilities

Brewery Waste

From the brewing process, there will always be waste. However, spent grains do not necessarily need to be seen as such. Waste output from the raw materials can be converted into a useful by-product.

An example of this is seen in Heineken's brewery in Austria, which produces biogas from the brewery's waste via an on-site grain fermentation plant. The establishment converts 18,000 tons of brewery grains, whilst filtering residues and other by-products from the beer-making process, into biogas to be reused for its own energy demand²⁵. Any residues produced in the process are utilised to make fertiliser, which reduces the brewery's carbon output pre-planting.

Another champion of waste reduction is BrewDog, where they have recently repurposed their leftover beer and turned this into a vodka²⁶ and the by-product spent grains are used to make dog treats.²⁷ Ventures like these can not only reduce the waste output from your brewery but they can also be handy assets for your business.

Spent grains also work well as animal feed. Sending spent grains to farmers is a great way to reduce their downstream emissions. In general, the majority of your organic waste can be repurposed as a useful product and shouldn't be sent to landfill.

Practical Actions:

- The first and simplest way to reduce lighting
- Send spent grain to farms (for animal feed) or to organic waste recycling facilities (e.g., composting or anaerobic digestion).
- Reuse yeast multiple times before disposal.

Case Studies:

Heineken Ireland repurposed over 5,000 tonnes of beer collected from bars during lockdown and sent it to anaerobic digestion plants. Those 5,000 tonnes, the equivalent of nine million pints, created 480kWh of electricity and heat. Heineken calculated this to be as much energy as powering [48,000 houses for one day](#), based on an average household's annual electricity consumption.

If the beer wasn't going towards creating electricity and heat, it was instead used as agricultural fertiliser

25. EcoWatch, "World's First Large-Scale Carbon-Neutral Brewery Now in Operation," 10 June 2016. [Online]. Available: <https://www.ecowatch.com/worlds-first-large-scale-carbon-neutral-brewery-now-in-operation-1891169851.html>. [Accessed 2022].

26. R. Sanchez, "BrewDog CEO Promises Vodka Made From Bad Beer In A Paper Bottle," 11 February 2022. [Online]. Available: <https://thedieline.com/blog/2022/2/11/brewdog-ceo-promises-vodka-made-from-bad-beer-in-a-paper-bottle?>. [Accessed 2022].

27. BrewDog, "BREWSKI'S X BREWDOG PUNK IPA DOG BISCUITS," 2022. [Online]. Available: <https://www.brewdog.com/uk/brewdog-punk-ipa-dog-biscuits>. [Accessed 2022].

Guidance by theme.



3. Packaging

Packaging, using materials such as bags, boxes, pallets, shrink wrap, bottles, cans, kegs, barrels and a whole lot more, are all essential to the business of brewing.

Packaging makes up between 35 & 50% of a brewery's footprint, leaving plenty of room for emission reduction strategies to be implemented.

The most sustainable packaging type is often said to be the metal keg, due to the efficiency achieved through high liquid storage capacity, long life expectancy and the ecosystem of return and reuse that exists.

New technologies from companies such as [Smart Container](#) makes monitoring of kegs simple with real time sensors attached to the containers in order to eliminate supply chain inefficiencies and track excess waste.

Steel kegs are perfect for delivering your product to pubs, bars and other establishments, however not so practical for retail and domestic buyers. For this, glass bottles and cans are the only reasonable solution. Glass may appear to provide the end user the preferred experience, however **there is a significant carbon benefit to using metal cans over glass bottles**. A glass bottle (330 ml) has over four times the GHG emissions attributed to it when compared to a steel can (330 ml)^{28 29}. To produce one tonne of CO₂e, requires either 2,443 glass bottles or 10,753 cans.

Utilising cans over glass for retail and domestic use is an excellent method to reduce the Scope 3 emissions of your brewery.

However, there have been some innovations in canning and bottling in the last few years. One recent champion is AB InBev, who has been reducing the weight of their containers to limit their emissions. By reducing their standard longneck beer bottle from 180 to 150 grams, this has reportedly cut CO₂ emissions by [17% per bottle](#).

Along with reducing glass used, increasing the quantity of recycled glass in the mix is becoming more common to reduce overall input of raw materials. Heineken recently explored the metrics of this by partnering with Glass Futures and found that for every [10% increase in recycled glass](#) they used, emissions can be reduced by 5%.

Plastic has become less popular as a packaging material in recent years. This is largely due to plastic pollution. While this may not have large carbon savings, the wider sustainability benefits of doing so are significant. Some simple switches away from single-use plastics can go a long way. Carlsberg moved to reduce their plastic ring usage and instead have implemented a new glue technology. This will reduce the amount of plastic up to 76% (1,200 tonnes of plastic per year) when this technique is fully implemented.³⁰

28. D. Turner, I. Williams and S. Kemp, "Greenhouse gas emission factors for recycling of source-segregated waste materials," Resources, Conservation and Recycling, vol. 105, pp. 186-197, 2015.

29. DEFRA, "Greenhouse gas reporting: conversion factors 2021," 24 January 2022. [Online]. Available: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021>. [Accessed 2022].

30. Carlsberg, "carlsberggroup.com/newsroom," [Online]. Available: <https://www.carlsberggroup.com/newsroom/carlsberg-launches-ground-breaking-innovations-to-reduce-plastic-waste/>.

Guidance by theme.



3. Packaging

Figure 1 is an example of a waste mitigation hierarchy. Best practice is to attempt to reduce your packaging as much as feasibly possible, before utilising packaging which can be reused.

As a brewery you have the opportunity to influence what happens to your packaging waste for both trade and domestic customers.



Figure 1:
https://www.fdf.org.uk/globalassets/resources/publications/guidance/compressed_fdf-net-zero-handbook-final-111021.pdf

Practical Actions:

- Utilise reusable steel kegs as much as possible
- Utilise packaging which would be easy to recycle. By using cans over glass, you'd be selecting a packing solution which reduces the amount of packaging material, reduces emissions from your packaging and more easy to be recycled.
- Offer glass bottle collection to your trade customers for reuse and prevent the need for the bottles to go to recycling or landfill.
- Ensure there is no / minimal plastic used for freighting products, focus on cardboard and paper solutions
- For domestic customers, focus on utilising cans and cardboard with clear labelling that they can be recycled.

Guidance by theme.



3. Packaging

Case Studies:

Scotland is introducing a deposit return scheme (DRS). This means when you buy a drink in a single-use container you will pay a 20 pence deposit, which you get back when you return your un-damaged empty bottle or can. The scheme is designed to encourage the return of empty single-use containers for collection for reuse and recycling. It will help to tackle climate change, increase quantity and quality of materials collected for recycling, and decrease litter.

The Deposit and Return Scheme for Scotland Regulations 2020 set out the legal requirements of the scheme. They apply to drink producers, drink importers and anyone marketing or offering drinks in Scotland packaged in a single-use container made from PET plastic, glass, steel or aluminium sized between 50ml and 3 litres. In the regulations these are called scheme articles. You may also see them being referred to as scheme containers or scheme packaging.

If you produce or import drinks for the Scottish market that are sold in scheme containers, you must register to be part of the scheme. If you sell drinks in scheme containers on the Scottish market, you will have to make sure they are from a registered producer and charge the deposit on each drink. You may also have to operate a return point or offer a takeback service.

The governments across the UK have announced plans to introduce Deposit Return Schemes, with the scheme in Scotland planned for launch in 2022 and England & Wales (unconfirmed) from 2024/5. This will make a significant difference to the way beverage packaging is labelled, distributed, charged and collected for recycling. Businesses will need to pay an additional refundable deposit when buying packaged beverages. In on-premise outlets, businesses will be refunded when they make the empty packaging available for collection by The Scheme Administrator.

Businesses in Scotland should talk to their Suppliers, [Circularity Scotland](#), [Zero Waste Scotland](#) and [SEPA](#) to understand the specific obligations on businesses selling packaged beverages.

Before governments within the UK do implement this on a national scale, there are schemes available currently which will allow you to reuse your glass packaging. [LOOP](#) is a global reuse platform enabled by a multistakeholder coalition of manufacturers, retailers, and consumers that aims to reduce packaging waste.

Guidance by theme.



4. Purchased goods and services

In addition to the agricultural items there are many additional products a brewery should consider; you can't brew beer without the right equipment. However, as a general rule, purchasing or updating equipment that reduces your brewery's footprint through efficiency or consistency of operation will repay their costs faster than inefficient alternatives.

The easiest way to start this process is by sourcing your equipment through a sustainable supplier. One supplier called Murphy & Son based in Basford recently worked with Nottingham Trent University to reduce their carbon footprint. They found that immediate changes will provide a 27% reduction, with further longer-term adjustments adding up to a [65% reduction](#).

Thus, sourcing sustainably is one step in the right direction, but making sure you're purchasing quality equipment is the next step.

Equipment needed for brewing ranges from a fermenter to a steam boiler. Boiling the wort

actually consumes between [25 to 35% of the overall energy](#) required in the brewing process. Unfortunately, equipment may also produce waste. For example, the boiler's exterior shell may produce leaks that actually allow the steam to escape instead of helping to perfect your beer. Seal any leaks you can find, and insulate your equipment in order to prevent needing additional energy for temperature adjustments.

The mainstay technology for generating heating or process energy is the traditional boiler. Whether firetube or the various watertube forms, the commercial or package boiler has proven to be highly efficient and cost effective in generating energy for many process and heating applications, which could reduce the brewery's footprint

Keeping this equipment clean is another way to maintain its performance and longevity. Implementing regular cleaning procedures along with choosing low-carbon cleaning brands and minimising water consumption can significantly reduce your footprint.

Practical Actions:

- » Reuse cleaning solution when possible (e.g. the final rinse of one cleaning cycle can be used to start the following cycle or to wash the floors).
- » Consider how to avoid, replace and/or reuse disposables and consumables in your brewhouse.
- » Consider switching to lower carbon alternatives - ask your supplier what Net Zero options they have, and if they don't know, then ask them to find out.
- » Buy concentrate and dilute to use – it makes no sense to pay for the shipping of water!
- » Implement clean-in-place (CIP) systems to limit human error and control chemical concentrations and water use.
- » Rotate cleaning chemistries to decrease the chance of resistant bacteria growth.

Guidance by theme.



4. Purchased goods and services

Water, hops, barley and yeast are the four founding ingredients to every beer and to brew premium beer, you need quality ingredients. However, due to the strain climate change is putting on our agricultural sector, reduced crop output and the need for more inputs like water, fertiliser and pesticides are making both prices and agricultural carbon footprints increase.

Farms using less fertiliser and using regenerative or conservative agriculture techniques that enrich soil health and increase its ability to capture carbon can help reduce a brewery's footprint through better agricultural practice.

Raw material production constitutes roughly [10-15%](#) of a brewery's footprint, with the significant majority attributed to Barley or its equivalent. If the option is available, use locally sourced and sustainably grown malt and barley, eliminating the need to transport supplies from other areas and reducing costs for crop preservation during

transport. There are malt producers who are improving their sustainability, showing that there are methods to reduce emissions from key raw ingredients. Malt supplier Muntons are trialling methods to produce a "low carbon malt" by utilising green compost in order to reduce emissions, as well as a synthetic nitrogen fertiliser.³¹ As a significant customer of malted grains, breweries need to come together in order to apply pressure to their raw material supply chain to reduce their emissions.

Malted barley specifically is consistently an important contributor to most environmental impact categories considered. Opportunities may exist to reduce the carbon footprint of raw material production by brewing with unmalted barley and industrial enzymes, as mentioned in our brewing process section .

31. <https://www.eadt.co.uk/news/business/stowmarket-muntons-launches-low-carbon-malting-barley-trial-2008042>

Guidance by theme.



5. Transportation

It is important to also consider the climate impact of what happens before and after brewery products services are delivered, rather than just focussing on what happens on site. In the UK, transportation is a significant contributor of carbon emissions, accounting for up to [27%](#) of national emissions. Thinking carefully what transportation is associated with your business can help reduce upstream and downstream emissions.

Deliveries

Deliveries associated with business operations must also be considered in carbon accounting. This includes how products and services are being delivered and also how we might deliver products and services as a hospitality business, for example catering, or direct to customer delivery services

Global transportation accounts for an estimated [20%](#) of beer's carbon footprint. Beer, wine, and other alcoholic beverages are generally shipped in climate-controlled vehicles to prevent spoiling.

[When transporting these products, consider using rerouting, electrification and consolidation measures in your distribution.](#) This can make the journey more sustainable and reduce the overall footprint of the beer.

Whether you outsource your deliveries to other companies or have your own fleet of transport, you can reduce your carbon footprint through using technologies that are currently available to us:

[Heineken](#) is currently using a fleet of electric beer trucks and biofuel powered ships.

[Five Lamps](#), in Dublin, is utilising electric vans to deliver small-volume orders in order to reduce their footprint.

Another way to reduce miles travelled is to group deliveries where possible. Dundalk Bay brewery & distillery has implemented this into their sustainability initiative, which you can read more about [here](#).

Case Studies:

[PedalMe](#) is a low-carbon transport company which utilises bicycles to deliver products.

Cycling helps reduce the emissions associated with transport, and is used to transport items ranging from small packages to [beer kegs \(pictured left\)](#).

Currently, Kegstar retrieves over 600 kegs per week from 70+ venues across London, with plans to expand the service outside of London shortly.



Guidance by theme.



5. Transportation

Employee Commuting

Another area to consider in transport is how employees are getting to and from work. Driving cars to work is usually the largest contributor to employee commuting emissions. In places like London it is much easier to get around via public transport, but in more regional areas it may be more difficult to find practical solutions.

Hiring local staff offers these individuals with the option of travelling to work by foot, bike or public transport where available. This can be tricky in more rural or suburban areas, but it is worth taking into account when structuring your business. In their sustainability initiative, Dundalk Bay brewery & distillery has acquired 90% of their staff who live within 20 minutes of the brewery.

To enhance uptake of more sustainable employee commuting, your business can offer [cycle-to-work schemes](#), bike storages and electric charging points. This offers an opportunity for car users to switch to a more environmentally friendly option. This also offers an opportunity for those with electric transport to have a space to charge their vehicle.

Although hands-on workers in the brewhouse will be required to come into work, members of staff that can work from home should be provided with this opportunity in order to cut down on total employee commuting.³²

Practical Actions:

Employees

- Encourage active transport from your staff with ride to work schemes, bike storage, lockers on site. This can be as simple as providing safe places out of the weather for employees to store their bikes, all the way up to providing shower facilities.
- Installing electric charge points for bikes, scooters, and cars can attract eco-friendly customers and encourage staff to utilise more low-carbon technologies. This is particularly beneficial in regional areas that don't have good access to public transport. Grants of £350 per charge point are currently available through providers like PodPoint³³
- Consider setting up the Ride to Work scheme for your employees. This scheme can save your employees between 29-35% savings on new bikes, including electric bikes - see the scheme here: www.cyclescheme.co.uk. Cycling to work has the added benefit of helping your staff become healthier and can even improve their mood.^{34 35}

Case Study:

[Expedia Group](#) relocated their headquarters in 2014 10 miles west from Bellevue to Seattle, Washington. This was a considerable shift for staff who established roots in Bellevue, so Expedia implemented a commute program.

In this program, the company offered to subsidise transport passes, they offered shuttles and promoted ride sharing. In addition, staff were rewarded for their choice to choose more eco-friendly transportation options rather than driving alone. From 2015 to 2020 (pre-COVID), staff driving alone to work dropped from 59% to 13%.

32. <https://travel.zeelo.co/9-ways-to-reduce-your-workplace-carbon-footprint/>

33. <https://pod-point.com/solutions/business/workplace-charging>

34. <https://www.businessfirstonline.co.uk/advice/should-businesses-encourage-workers-to-cycle/>

35. <https://www.northsomersettimes.co.uk/news/clevedon-brewery-owner-delivers-beer-bike-7811446>

Guidance by theme.



5. Transportation

Business Travel

Pre-COVID, business travel was at a high. Companies around the world used all types of transport for business-related transport, and the most carbon intensive of all was business-class air travel. As remote work and e-meetings now become the 'new normal' due to the operational shifts from the pandemic, business travel may continue to be reduced.

If business travel is needed, consider if low-emission options are available:

If travelling by car, see if public transport or an electric vehicle is available.

If travelling by plane, see if rail is a possible alternative, otherwise try to understand what your carbon impact might be through utilising a [flight carbon calculator](#).

Travel Perk offers a [free eBook](#) to review how to run a sustainable business travel program. In the book you can learn about how flying low-emission airlines, utilising carbon offsetting in airlines that offer this service and travelling in economy can reduce your carbon footprint.

Case Study:

[Salesforce](#) relied on employee travel for work purposes before the pandemic hit. In 2019 alone, the company's business travel emissions added up to 146,000 metric tons of CO₂. That's equivalent to emissions from 17,500 homes over the course of an entire year. It would take more than 178,000 acres of forest 12 months to sequester that carbon dioxide. These emissions were the product of a reduction from 2017 by 18%, so there was still plenty of progress to accomplish.

When COVID restrictions spread in 2020, preventing business travel and promoting remote working, the total business travel emissions from Salesforce dropped to 86% (20,000 metric tons).

Conclusion.

While becoming Net Zero may seem like a daunting task at first, it is in fact a four-step process of Calculate, Mitigate, Compensate, Communicate.

This document has provided a range of practical actions that can help with the **Mitigate** part of your journey, simple and affordable steps that you can take to help reduce your emissions.

By digging down into each of the themes described above, you will be able to identify exactly what parts of your business are carbon intensive and take action.

The case studies in this document demonstrate that many other breweries of various sizes have already started taking action to become Net Zero. It is our hope that these examples will inspire other hospitality venues to start or continue on their journey to reduce their emissions.

This document has covered many topics and provided signposts and links to a range of excellent resources available online to help support you further in your Net Zero journey and we will update this resource as more information and case studies become available.

If you are interested in taking the next step for your breweries climate strategy journey, then one of the Net Zero Now team will be happy to give some advice. Contact us for more information, including a free walk through of the Net Zero Brewery Platform – which seeks to make credible carbon footprinting a simple process.

Contact us now:
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