

# Evaluating the Landscape of Greenhouse Gas Emissions and Climate Mitigation Goals of the Global Food and Beverage Sector

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## Research Article

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# Abstract

The dramatic increase of emitted greenhouse gases (GHGs) by humans over the past century and a half has created an urgency for monitoring, reporting, and verifying GHG emissions as a first step towards mitigating the effects of climate change. Fifteen percent of global GHG emissions come from agriculture, and companies in the food and beverage industry are starting to set climate goals. We evaluated the GHG emissions reporting practices and climate goals of the top 100 global food and beverage companies and determined whether or not their goals are aligned with the science of reducing climate warming to less than 2 °C. We found that two thirds of the top 100 (as ranked by Food Engineering) global food and beverage companies are setting some sort of climate goals, but fewer than half included scope 3 emissions in their goals. Only four companies have goals that are aligned with the goal of the 3% Solution: a 4.3% annual emission reduction until 2050. While an increasing number of companies are disclosing and setting targets that include scope 3 emissions, many still do not disclose or report any of their emissions. Our results highlight an urgent need to develop protocols for monitoring, reporting, and verifying GHG emissions and to provide transparent information on climate goals and targets.

## Introduction

Since the start of the first Industrial Revolution around 1760, human activities have emitted greenhouse gases (GHGs) in excess of those emitted by natural sources. A global climate shift in the 1980s drew the attention of scientists and the public to the concerns of such GHGs increasing in the atmosphere<sup>1</sup>. In 1990, a report by the Stockholm Environmental Institute declared an increase of 2 °C above pre-industrial times to be the global temperature limit, and going beyond that limit may result in “grave damage to ecosystems”<sup>2</sup>. Twenty-five years later, 196 countries signed the Paris Climate Agreement, agreeing to limit global warming to well below 2 °C, preferably below 1.5 °C. This is a difficult task, however, as it will require a massive shift in the way we currently do things. Large companies in particular will need to set aggressive climate goals aligned with the science of the Paris Climate Agreement to reduce emissions. One aspect of meeting these targets and bringing about this shift will involve designing and implementing protocols to monitor, report, and verify GHG emissions within such companies to ensure adequate progress is being made.

Beginning in the 1980s, large companies with significant environmental impact began to voluntarily set goals around things like hazardous waste, air pollution, energy consumption, and wastewater, areas that were simply extensions of things already being regulated<sup>3</sup>. Recently, scientists<sup>4</sup>, consumers<sup>5</sup>, and employees<sup>6</sup> are increasingly calling for more direct and aggressive climate action from large corporations. As a result, many companies are setting goals that are more ambitious, and more companies are getting on board<sup>7,8</sup>. As of 2019, 23% of the Fortune Global 500 companies have set climate goals to reduce their carbon footprints<sup>9</sup>. In 2016, 119 companies had set targets with the Science Based Targets initiative (SBTi)<sup>10</sup>, and currently, over 1000 companies have committed or set climate goals with SBTi. However, climate goals that do not significantly contribute to reducing global

atmospheric GHG emissions are not useful goals. Previous studies show that while climate policy has improved over the years, and more countries and individual companies have emission reduction goals, there has been no significant decrease in global emissions <sup>11,12</sup>.

Food production accounts for roughly a quarter of the anthropogenic GHGs emitted annually across the globe <sup>13</sup>, and large food companies are some of the largest emitters <sup>14</sup>. The world's population is expected to reach nearly 10 billion people by 2050 and demand for livestock products may increase by 70% relative to 2005 levels <sup>15</sup>, resulting in greater GHG emissions <sup>16</sup>. In this research, we evaluate the GHG emissions reporting practices of the top 100 (ranked by Food Engineering) global food and beverage companies with the specific goals of (1) evaluating the extent of publicly disclosed GHG emissions and climate goals, and (2) identifying gaps in publicly disclosed GHG emissions and climate goals.

## Methods

### Food and Beverage Company Selection

To study the landscape of GHG emissions and goals, we selected the top 100 global food and beverage companies as ranked by Food Engineering <sup>17</sup>. The food sales of these 100 companies make up roughly 15% of the global food and agriculture industry <sup>18</sup>. Company size was based on revenue generated from food sales only, not overall revenue. For example, Cargill (ranked 9<sup>th</sup> on the list) has a greater overall yearly revenue than Nestle (ranked 1<sup>st</sup> on the list), but Cargill's revenue from food sales was less than Nestle's because Cargill sells other agricultural products besides food. The selected companies operate all over the world and consist of both food and beverage (alcoholic and nonalcoholic) processors and manufacturers. The companies, their industry, and headquarters are summarized in Supplementary Table 1.

### Data Collection

We primarily use resources from the Science Based Target Initiative (SBTi) and CDP (formerly Carbon Disclosure Project), two organizations that guide companies toward greater climate action. The SBTi is a collaboration between CDP, the United Nations Global Compact, the World Resources Institute, and WWF (World Wildlife Fund). They aim to fight climate change by providing companies with technical assistance and resources to set climate goals aligned with science. Science-based targets are goals aligned with keeping global temperature rise to well below 2 °C above pre-industrial levels. Companies set climate targets, and approval is based on rigorous SBTi criteria. We recorded the climate goals of the top 100 global food and beverage companies that set targets and received approval by the SBTi. When SBTi and CDP data were not available, we used company corporate sustainability reports (CSRs).

CDP (<https://www.cdp.net/en>) is a global non-profit organization that works to make environmental reporting the norm by helping companies, cities, and states measure, report, and manage risk in areas of

climate, water security, and deforestation. CDP provides scores for companies and cities based on their level of disclosure and their environmental leadership. We only reviewed the Climate reports that were submitted for 2020, which means data are from 2019. We recorded the scores each company received and from each report pulled out specific pieces of information about each company including active climate goals from 2019 (both absolute and intensity goals), baseline emissions data for those goals, and emissions for all three scopes from 2019.

## Understanding Emissions and Targets

Emissions can be categorized as scope 1, scope 2, and scope 3 (Figure 1A). Scope 1 emissions are those that a company is directly responsible for, such as those released from their owned and operated plants and factories. Scope 2 emissions are indirectly produced by the company, such as the emissions generated by the purchased electricity, heating, and cooling required by the company's own plants and factories. Scope 3 emissions are all other emissions, most often associated with the company's value chain, such as the upstream emissions from growing crops for the product and downstream emissions produced when customers use the product. For food and beverage companies with upstream value chains in agriculture, scope 3 emissions make up the majority of their total emissions<sup>19</sup> (Figure 1B). However, companies have historically had less visibility and influence over the operations producing their scope 3 emissions, so measuring and managing them can be challenging. Here, we evaluate the top 100 global food and beverage companies' GHG reporting practices for these three scopes.

The breakdown of total emissions into scope 1, 2 and 3 emissions of the top 100 global food and beverage companies (a) and the average proportion of scope 1, 2 and 3 greenhouse gas emissions (b).

For this research, we compared company goals to two standards that are aligned with what science says is necessary to keep global temperatures from warming more than 2 °C: the 3% Solution and the SBTi. The 3% Solution is a report, produced by WWF and CDP in 2013, that calculated how U.S. businesses could reach 25% of the IPCC's 2 °C goal by reducing GHG emissions 3% each year between 2010 and 2020<sup>20</sup>. After reaching that target in 2020, a 4.3% annual reduction in emissions would be required each year until 2050 to meet 100% of that goal. To align with this standard, companies must set targets that reduce emissions at least 4.3% each year over the life of the target. The SBTi has two emission scenarios by which companies can set targets: well below 2 °C where emissions must decrease at least 2.5% each year, and 1.5 °C where emissions must decrease at least 4.2% per year (setting a target aligned with the 2 °C emission scenario, which called for at least 1.23% annual decrease, is no longer allowed for scope 1 and 2 emissions, but *is* allowed for scope 3 emission targets)<sup>21</sup>. While the 3% Solution requires a reduction of all emissions produced by the company, the SBTi standards focus on scope 1 and 2 emissions. Companies following the well below 2 °C scenario are also setting targets far less stringent than those of the 1.5 °C scenario or the 3% Solution standards. To evaluate company targets, we calculated the linear emission reductions over the lifespan of the target for total reported emissions and

for reported scope 1 and 2 emissions only and compared them to the 3% Solution and SBTi emission scenarios.-

## Target Evaluation

We collected data on climate goals and scope 1, 2, and 3 emissions from the SBTi targets, CDP climate reports, and annual corporate responsibility reports for each company. We use the latest available data (2019 data from 2020 reports) from each company to identify presence, type, and extent of its climate goals. Companies could have two types of targets: absolute and intensity. Absolute targets aim to reduce overall emissions over a period of time (e.g., reduce absolute scope 1 and 2 emissions 20% by 2030 from a 2015 baseline). Intensity targets reduce the emissions required to produce some unit of measurement (e.g., reduce scope 3 GHG emissions 20% per ton of product by 2030 from a 2015 baseline). Some companies may be hesitant to set absolute goals, seeing them as potentially limiting future business growth, gravitating instead towards only intensity goals. However, both absolute and intensity targets are useful in different ways<sup>21</sup>. Absolute goals are often ambitious and aim to reduce the total GHGs entering the atmosphere. Intensity goals can reflect efficiency improvements and allow for comparison among peers. Having and meeting both types of goals ensure that overall emissions go down and production efficiency goes up. Some companies had climate targets that ended in 2020, we only include 2020 targets when any other (intensity or absolute) future target is not available. For example, when evaluating a company with an absolute target with a 2030 end date and an intensity target with a 2020 end date, we only evaluate the company on its 2030 goal, not 2020 goal.

We compared a company's baseline emission data to its current emissions to understand whether the company is on track towards reaching the proposed goals or, at the minimum, has reduced its current emissions compared to the baseline. (In CDP reports, companies are asked to disclose both market- and location-based scope 2 emissions. If the company specifies which scope 2 emissions they are tracking for their emissions targets, we used the specified scope 2 emissions for calculations. For companies that did not specify market or location, we used location-based scope 2 emissions. When calculating average scope 1, 2, and 3 emissions across all companies, we did not include companies that did not have full emission disclosure across all 3 scopes.) Over time, companies more accurately calculate and measure their emissions, which changes the scope of the emissions included under the baseline emissions. This makes comparing current total emissions to the baseline difficult if the company has measured additional aspects of their total emissions. Actual current emissions data was often much greater than the current emissions reported if not all emission categories were included in the goal or if new areas of emission have since emerged and been measured that were not part of the original goal's range. For this research, we compared only the emission categories included in both the baseline and current emissions, since that is how the companies are measuring their progress on the goal. We note that this standard is imperfect and may not portray an entirely true picture of the state of things. Companies need to be clear about what targets they are claiming to meet and what portion of their total emissions they are addressing and reducing.

As mentioned previously, we compared company goals to the metrics of the 3% Solution, but this is only possible for companies with absolute targets. We could not evaluate intensity targets because production numbers to go along with the intensity are not provided with emission data, another limitation of the data. Only 17 companies had absolute targets and baseline data for all scopes, while 27 others had absolute targets and baseline data for scope 1 and 2 only.

## Results And Discussion

# Extent of Publicly Disclosed GHG Emissions and Climate Goals

### *Emissions Disclosure*

Of the 100 companies evaluated, 71 disclosed current scope 1 and 2 emissions data while 29 did not publicly disclose any of their emissions (Figure 2). Sixty-one companies disclosed at least partial scope 3 emissions, where they had measured some aspects of their value chain but had not mapped it entirely. Only 51 out of 100 companies measured and reported their scope 3 emissions across their entire value chain. While only half of the large food and beverage companies have disclosed their total emissions, this number also indicates a growing trend towards transparency in GHG emissions disclosure. A 2018 study of the top 50 food and beverage companies found that only 32% (17) of companies were disclosing their emissions fully across all three scopes<sup>22</sup>. This number more than doubled in our 2020 report data to 72% (36 of the top 50 companies). The fact that, in just two years, we see a 112% increase in the number of top 50 food and beverage companies reporting their entire scope 1, 2, and 3 emissions demonstrates a growing awareness and change in the industry.

Heat map showing the distribution of where all 100 companies have set goals and disclosed their emissions as of January 2021. Each box contains an abbreviation for one company. Company abbreviations can be found in Supplementary Information Table S1.

Companies disclosed their GHG emissions primarily through CDP reports. Sixty-seven companies submitted Climate reports to CDP in 2020, and only 61 companies had publicly accessible Climate reports (Figure 2). The six other unavailable reports were submitted to CDP but not accessible because the companies had chosen not to disclose their report publicly (CDP staff, personal communication, April 14, 2021). Six companies with submitted reports were not scored by CDP for unknown reasons. CDP scores companies as a way to measure their “progress towards environmental stewardship”<sup>23</sup>.

Companies earn points for their level of detail on disclosed information related to company climate policy, targets, and emissions and their display of understanding of climate change issues and progress made and planned towards climate change action. A summary of the breakdown of CDP scores can be found in Table 1.

Companies that participate in CDP reporting do so for various reasons including corporate stewardship or pressure from customers, retailers, and/or investors. Of the companies without submitted CDP reports, 16 were either not asked by investors or customers to participate in CDP reporting or did not volunteer to do so themselves (CDP staff, personal communication, April 4, 2021). Seventeen others were asked to submit reports by stakeholders, but they either declined or did not respond to the request. Eleven companies without CDP reports instead listed climate goals on their websites or corporate sustainability reports, and 4 of those companies' goals were approved by the SBTi. Only two companies disclosed all emission scopes without a CDP report (Figure 2). A CDP report is therefore not a required part of disclosing emissions or setting climate goals, but few large companies appear to do so otherwise.

## ***Climate Goals***

We found that 68 companies had some sort of climate goal in one or more scopes that extended beyond a 2020 end date (Figure 3). Forty of these had scope 1 and 2 absolute targets, 18 had scope 1 intensity targets, 17 had scope 2 intensity targets, and 10 had both absolute and intensity targets for scopes 1 and 2. Forty-one companies had targets that included all three emission scopes. (As noted previously, 51 companies fully disclosed emissions for all three scopes. However, not all companies with scope 3 goals disclosed all of their scope 3 emissions, and some companies that did fully disclose their emissions did not have scope 3 goals.) Twenty-two of the 37 science-based goals (which all include scope 3 emissions) were set by companies in 2019 or later. The rise in scope 3 targets, as with the rise in scope 3 emission disclosure, is a harbinger of an acceleration in the rate of companies taking aggressive climate action.

Number of food and beverage companies out of 100 that set absolute or intensity climate targets or both for scopes 1, 2, and 3. Numbers in the bars are how many companies fall into each category. Data show the number of goals active in 2019, reported in 2020 reports.

### **Areas for Improvement in Publicly Disclosed GHG Emissions and Climate Goals**

After reviewing the publicly available climate data of these companies, we identified three areas with room for improvement in the way companies are currently disclosing their emissions and setting and monitoring climate goals: (1) the shortcomings in disclosure, (2) the difficulty in tracking progress towards goals, and (3) the lack of science-aligned goals.

## ***1. Shortcomings in disclosure***

As noted previously, we found that 49 companies aren't disclosing their scope 3 emissions. Lack of disclosure from almost half of the largest food and beverage companies in the world shows the grim state of current monitoring and reporting practices in this industry, particularly since scope 3 emissions often make up the majority of a company's GHG emissions. Our analysis of the reported GHG emissions shows that scope 3 emissions contribute over 87% of the total emissions on average and can be as high as 99% (e.g., Nisshin Seifun Group, Constellation Brands, and Saputo). Scope 1 emissions made up an

average of 7% and scope 2 emissions were about 5% of a company's total emissions. We believe an increase in scope 3 measurement and disclosure is necessary to understand the climate impact of this industry and to be able to effectively reduce overall emissions.

## ***2. Difficulty in tracking progress toward goals***

Three things were necessary in order to calculate whether or not a company is making progress towards its target: base year emissions, current (2019 in this study) emissions, and absolute targets for all scopes. Seventeen companies out of 100 had available data to match these criteria (Figure 4). Fifteen of these 17 companies have lower current emissions than their base emissions, according to their reported emissions (companies noted in bold on the x-axis of Figure 4). The two other companies (companies not bolded on the x-axis of Figure 4) have increased their emissions from their baseline, making no progress on their targets. No mention of increasing their emissions was made in the reports of those two companies.

Distribution of base year emissions, current (2020 report) emissions, and target year emissions for seventeen companies with absolute targets and emissions data for scopes 1, 2, and 3. Red line and y-axis correspond to 2020 food sales revenue for each company in billions of USD. Acronyms left to right with base and target dates: Coca-Cola Bottlers Japan (CCJ: 2015-2030), Coca-Cola European Partners (CCE:2019-2030), McCormick Corporation (MCC; 2015-2025), Nissin Foods Group (NFG: 2018-2060), Coca-Cola Femsa (CCF: 2015-2030), Kirin Holdings (KRH: 2015-2030), Diageo (DIA: 2007-2020), Kellogg Company (KEL: 2015-2050), Molson Coors Brewing Co. (MCB: 2016-2025), Barry Callebaut (BRY: 2018-2025), General Mills (GNM: 2010-2050), Smithfield (SMF: 2010-2025), Mondelez International (MON), Mars (MAR: 2015-2025), PepsiCo (PEP: 2015-2030), The Coca-Cola Company (CCC: 2015-2030), Nestle (NES: 2014-2020). Company names in bold have reduced their emissions compared to baseline. Emissions data are acquired from 2020 CDP Climate reports submitted by each company, and revenue data are taken from Food Engineering's 2020 list of top 100 food and beverage companies.

Such promising progress towards meeting climate goals may shroud the true state of things, though. As mentioned previously, actual company emissions are often greater than those reported towards their targets, since actual company emissions may include emission categories that are not included in the original target. In this set of 17 companies, 8 companies had increased their emissions compared with their baselines when looking at their actual current emissions rather than reported ones, though in fact only 2 companies reported an increase.

Since only 17 companies had absolute targets and baseline and current emission data for all three scopes, we expanded our criteria to include those without scope 3 targets or emission data. There are 27 companies with scope 1 and 2 data and absolute scope 1 and 2 targets (Figure 5). Of these, 19 companies have reduced their emissions from their baselines (companies noted in bold on the x-axis of Figure 5) while 8 companies have increased their emissions (non-bolded companies on the x-axis of Figure 5). As with the companies in Figure 4, reported emissions are often smaller than their actual emissions, meaning that while a company may be appearing to move towards their targets, actual

emissions from the company are increasing. The discrepancies between actual and reported emissions make it difficult to accurately track reductions in overall company emissions. Tracking progress is made additionally arduous by the inability to always fully *capture* a company's goal and progress.

Distribution of base year emissions, current (2020 report) emissions, and target year emissions for twenty-seven companies with absolute targets and emissions data for scopes 1 and 2. Red line and y-axis correspond to 2020 revenue for each company in billions of USD. Smaller graph within is zoomed in on the smallest 10 companies. Acronyms left to right with base and target years: Ito En (ITO: 2018-2030), Bacardi (BAC: 2015-2025), LVMH (2013:2020), Sapporo Holdings (SAH: 2013-2030), Nisshin Seifun Group (NSG: 2013-2030), Pernod Ricard (PDR: 2018-2025), The Hershey Company (HER: 2015-2025), Schreiber Foods (SCH: 2017-2030), Barilla (BAR: 2017-2030), Keurig Dr. Pepper (KDP: 2018-2030), Asahi (ASA: 2015-2030), Suntory (SUN: 2015-2030), Meiji Holdings (MEI: 2015-2030), Marfrig Group (MAF: 2019-2035), Carlsberg Group (CLB: 2015-2030), Campbell Soup Company (CAM: 2017-2025), Ferrero (FER: 2018-2030), Hormel Foods Corporation (HOR: 2011-2020), Unilever (UNI: 2015-2030), Danone (DAN: 2015-2030), Ajinomoto (AJI: 2018-2030), Olam (OLM: 2017-2030), Fonterra (FON: 2018-2030), Anheuser-Busch (AHB: 2017-2025), Tyson (TYS: 2016-2030), Cargill (CAR: 2017-2025), Archer Daniel Midland (ADM: 2019-2035). Company names in bold have reduced their emissions from their baseline. Emissions data are acquired from 2020 CDP Climate reports submitted by each company, and revenue data are taken from Food Engineering's 2020 list of top 100 food and beverage companies.

As mentioned previously, we can only evaluate companies' *absolute* targets, as intensity targets are currently difficult to track because they require knowing the amount of product used in the metric, which isn't often publicly available. Regardless of the metric of the target, the amount of units produced is required to measure progress toward the goal. In the CDP reports, baseline, current, and target intensity numbers are provided, so it is possible to see whether progress is occurring, and estimated absolute reduction from the intensity targets is reported. However, we discovered a substantial number of errors and unverifiable numbers in the reports leading to questions about the reported numbers. Currently, CDP reports do not ask companies to submit data about production, so we cannot verify whether intensity goals are being met, but this may be a helpful aspect to include moving forward so that progress to reduce total emissions is accurately monitored.

Many of these companies with absolute scope 1 and 2 targets also have intensity targets covering these scopes or have additional scope 3 intensity targets. Three of the companies with increased emissions (SUN, MAF, OLM; Figure 5) also claimed increased business growth in the CDP reports. As businesses grow, emissions often grow as well, making absolute targets more difficult to meet. All three of these companies, though, had met or were making progress towards meeting their intensity targets. Strong intensity targets can contribute to overall absolute emission reductions<sup>21</sup>, so being unable to account for a company's progress on its intensity goals is a significant shortcoming to tracking company progress towards overall emission reduction.

### ***3. Lack of science-aligned goals***

In addition to examining how companies are progressing on their goals, we also evaluated their goals in comparison with a 3% Solution target estimation. Both The 3% Solution and the SBTi have standards for this annual emission reduction and multiple scenarios for reduction. We compared the company goals to 5 different scenarios: are they in line with a) a 4.3% annual reduction of total company emissions, b) a 3% annual reduction of total company emissions, c) a 4.2% annual reduction of scope 1 and 2 emissions, d) a 2.5% annual reduction of scope 1 and 2 emissions, and e) a 1.23% annual reduction of scope 1 and 2 emissions? Scenarios a) and b) are based on the 3% Solutions, where prior to 2020, annual reduction needed to be at least 3%, but after 2020, reduction must be at least 4.3%. Scenarios c), d), and e) follow the SBTi guidelines, which only include rules for scopes 1 and 2.

Only the 16 companies included in Figure 4 were evaluated on the 3% Solution scenarios since the rest did not have full baseline scopes to compare with. Of those 16, 4 companies (CCE, BRY, GNM, MAR) have targets that are equally or more than aligned with the 3% Solution. We included all companies from Figures 4 and 5 when comparing with SBTi guidelines. Under the 4.2% annual scope 1 and 2 reduction scenario, 13 companies out of 44 are aligned. Twenty-six companies have targets aligned with a 2.5% annual scope 1 and 2 reduction scenario, and 37 are aligned with a 1.23% annual scope 1 and 2 reduction. Thirty-three of these companies have official science-based targets approved by the SBTi, meaning they must be aligned with at least one of these scenarios, though the 1.23% reduction scenario is no longer allowed. We found that two companies (MON, CAR) did not have targets that align with the SBTi guidelines, though it could have been that we were not able to make accurate calculations. MON target included all three emission scopes and did not provide separate scope 1 and 2 baseline emissions, so we were not able to accurately measure. CAR had an intensity goal as well which we are not able to measure.

For companies with large scope 3 emissions, it is hard to imagine that targets are truly science-based if they do not include scope 3. The IPCC estimates that global emissions must fall by at least 45% by 2030 from a 2010 baseline in order to limit warming to 1.5 °C<sup>24</sup>. Scope 1 and 2 emissions from food and beverage companies often make up less than 45% of their total emissions, so even targets that aim for zero emissions from scopes 1 and 2 fall short of this global goal if they do not include scope 3. Due to the difficulty of controlling some aspects of scope 3 emissions, including suppliers and other actors in the value chain in measuring and reducing their emissions will be critical in reaching global climate goals<sup>8</sup>. Transparent communication around scope 3 emissions and targets is important for facilitating constructive dialogue around challenges and moving towards closing the gaps in action<sup>8</sup>.

## **Conclusions**

Our work highlights the landscape of global food and beverage companies setting climate goals, monitoring and reporting GHG emissions, and publicly disclosing the targets and emissions. On the whole, the number of companies setting goals and disclosing emissions is increasing, but we found that

31 of the largest companies in this sector still do not have any climate goals. Of the ones that do have goals, half are not measuring, reporting on, or including scope 3 emissions. Since scope 3 emissions make up about 87% of these companies' total emissions on average, not monitoring or setting targets to reduce these emissions does little to reach the goal of keeping global warming to well below 2 °C. Reaching this goal, though, is only possible if the climate targets are aligned with this goal. As a first step towards achieving this goal, the global food and beverage sector needs to set climate goals aligned with science-based targets, monitor and report absolute and intensity targets, and publicly disclose scope 1, 2 and 3 emissions for transparency and verification.

## Declarations

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### Author Contribution

MR designed the study and analyzed the data with assistance of JA, JR, and KN. MR wrote the initial manuscript draft with contributions from KN, JA, and JR. All authors discussed, edited, revised, and approved the paper.

### Competing Interests Statement

Authors declare no conflict of interests.

### Data Availability

All data used in this study were obtained from publicly available sources, which are noted for each company in Supplementary Table S1.

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## Tables

**Table 1. Breakdown of CDP scores of those 61 companies with available scores.**

Score	% of Companies	Number of Companies
A or A-	41	25
B or B-	41	25
C	15	9
D	3	2

Note: 61 companies had available CDPs, and 61 had available scores, but these are not necessarily the same 61 companies. Some companies with available reports were not scored, and some companies with scores did not have available reports.

## Figures

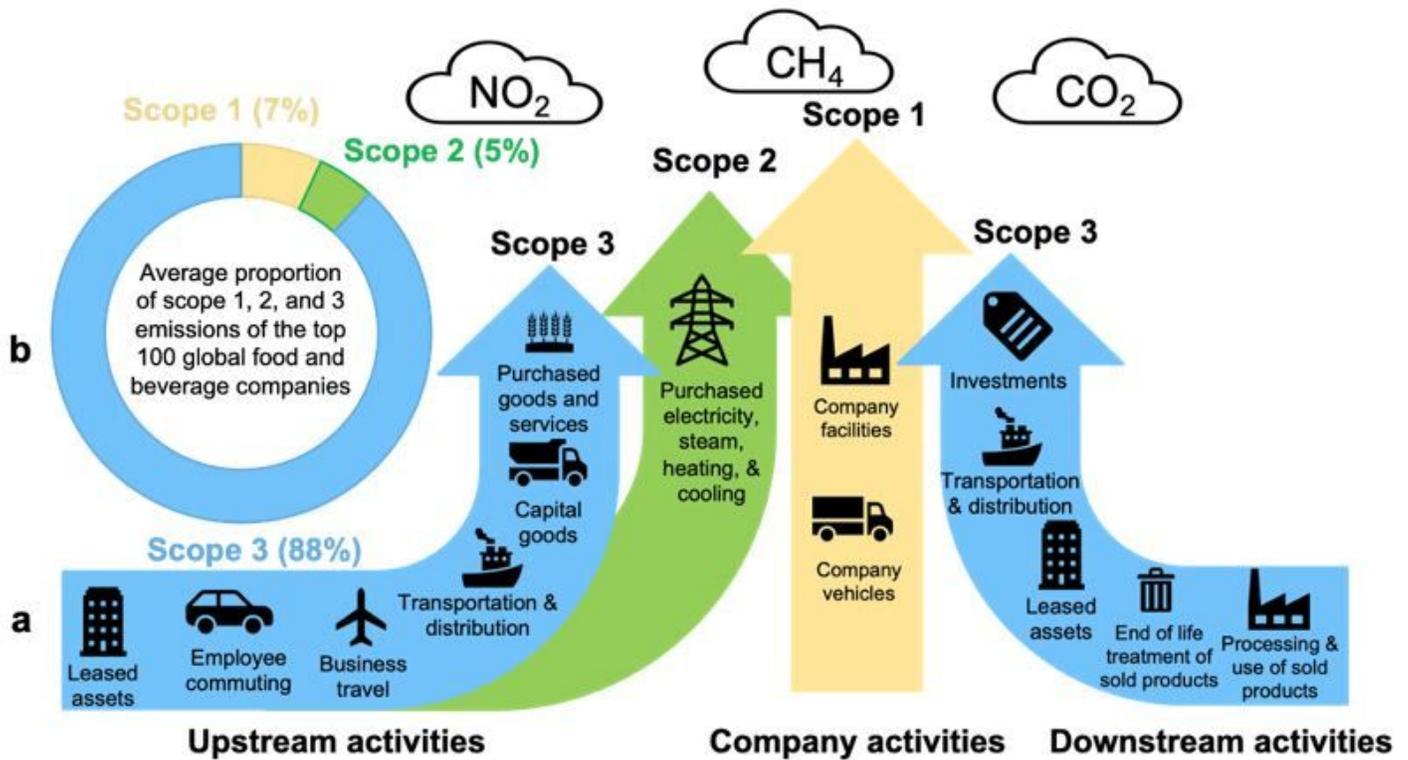


Figure 1

Distribution of scope 1, 2, and 3 emissions The breakdown of total emissions into scope 1, 2 and 3 emissions of the top 100 global food and beverage companies (a) and the average proportion of scope 1, 2 and 3 greenhouse gas emissions (b).

ASA	CCJ	MAR	MCB	NES	PEP	SUN	ANA	HOR	SDL
BRY	DIA	KEL	MCC	NFG	AHB	AJI	FLF	JBS	OSI
CCC	GNM	KRH	MON	SCH	PER	SAP	HER	JRS	PER
CCE	KDP	DAN	CAR	UNI	ITO	CON	CAB	LAC	CMD
CCF	AJI	CLB	BAR	MAF	TTP	LND	FER	MFL	DMK
ABF	SMF	HBC	JMS	ING	BRF	BAC	DAC	DFC	SUD
TYS	FON	HEI	KHC	MEI	ARL	KER	OET	ITY	THB
BUN	GRB	NSG	LVMH	RFC	DFA	PHS	HWG	LBW	TSB
CAM	SAH	MOR	THF	VIO	EJG	SAV	AGR	LOL	YAM
ADM	NHF	MNC	NSU	MLG	RDB	JDE	CHS	MBG	YIG

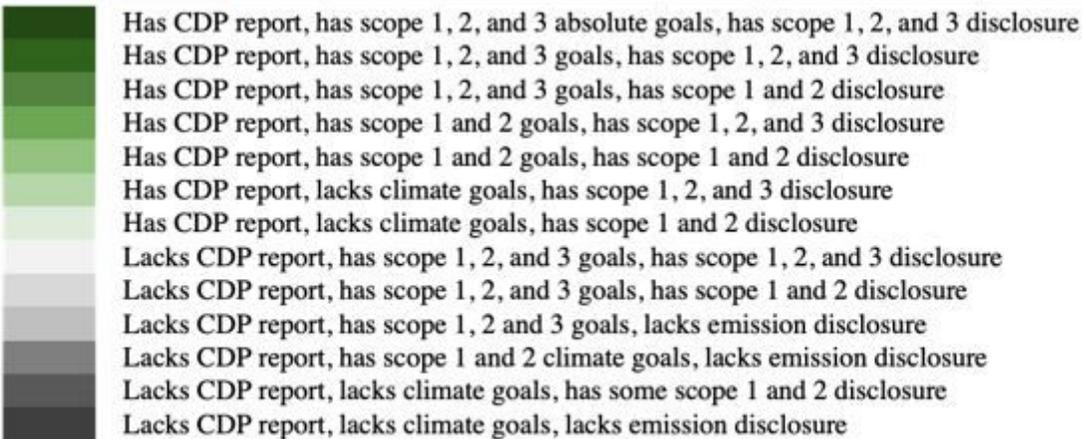
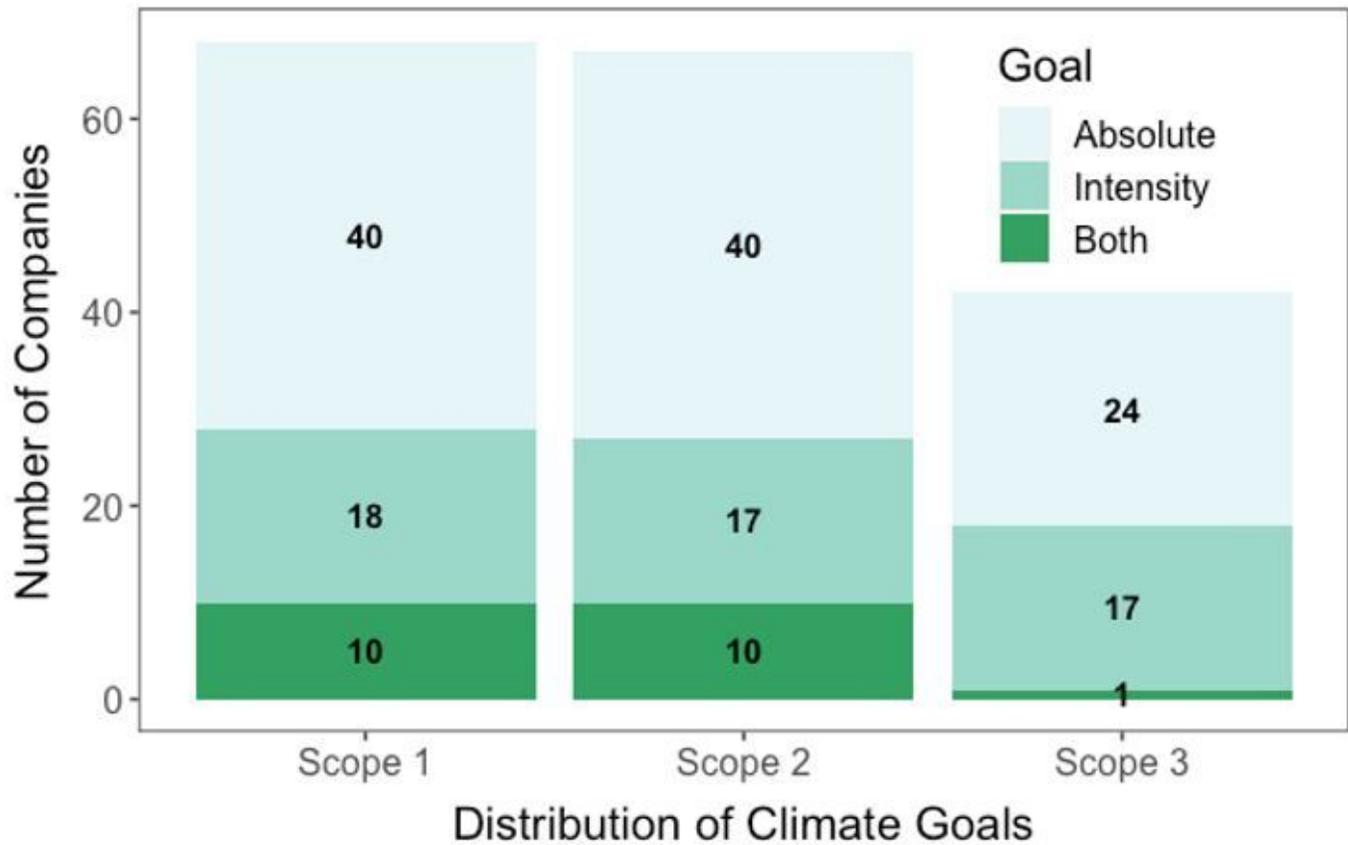


Figure 2

Heat map of company emission and goal disclosure. Heat map showing the distribution of where all 100 companies have set goals and disclosed their emissions as of January 2021. Each box contains an abbreviation for one company. Company abbreviations can be found in Supplementary Information Table S1.



**Figure 3**

Distribution of absolute and intensity climate goals across scopes Number of food and beverage companies out of 100 that set absolute or intensity climate targets or both for scopes 1, 2, and 3. Numbers in the bars are how many companies fall into each category. Data show the number of goals active in 2019, reported in 2020 reports.

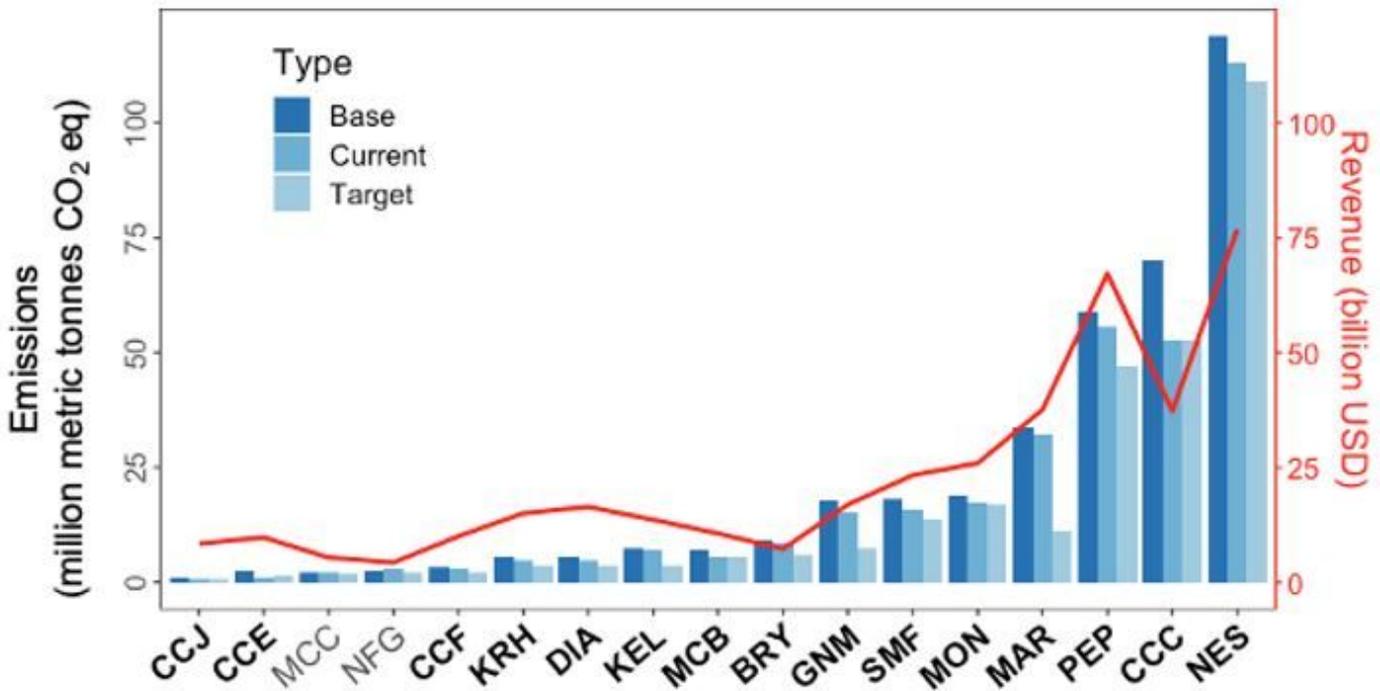
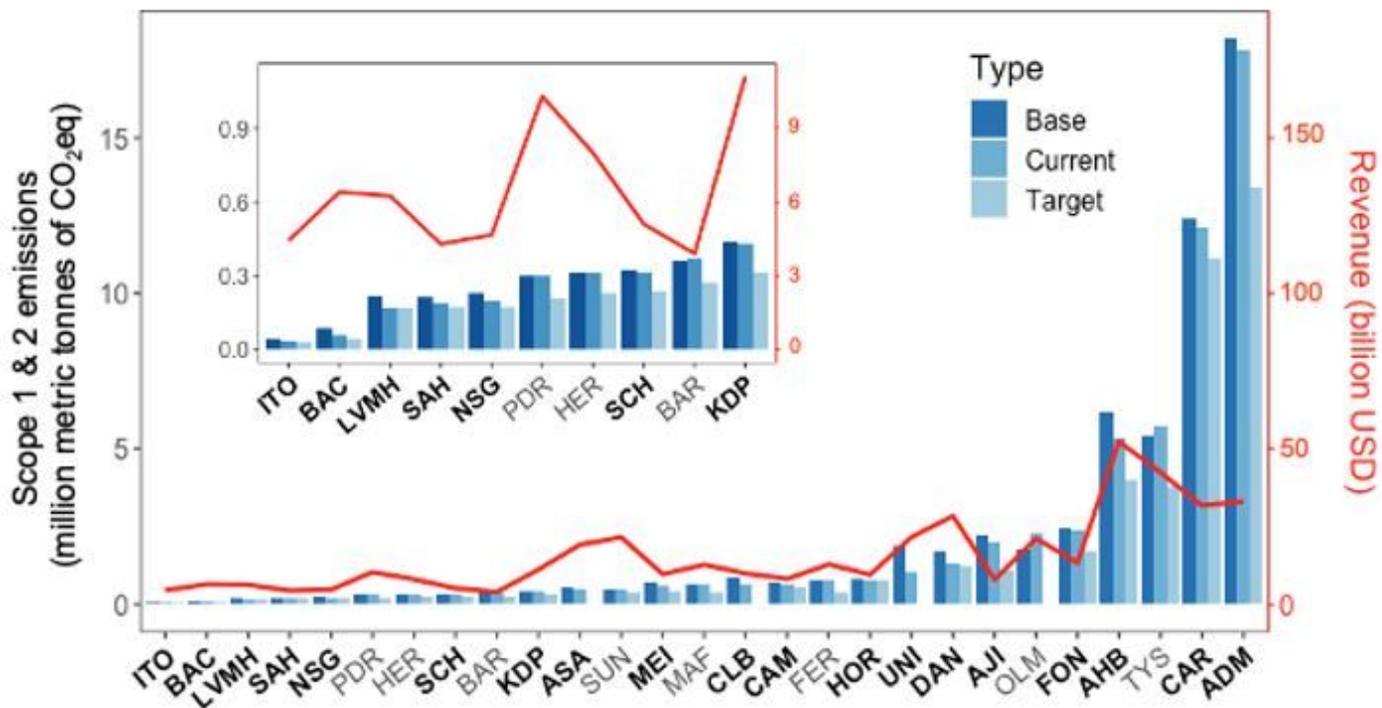


Figure 4

Base, current, and target year scope 1, 2, and 3 emissions for 17 companies. Distribution of base year emissions, current (2020 report) emissions, and target year emissions for seventeen companies with absolute targets and emissions data for scopes 1, 2, and 3. Red line and y-axis correspond to 2020 food sales revenue for each company in billions of USD. Acronyms left to right with base and target dates: Coca-Cola Bottlers Japan (CCJ: 2015-2030), Coca-Cola European Partners (CCE:2019-2030), McCormick Corporation (MCC; 2015-2025), Nissin Foods Group (NFG: 2018-2060), Coca-Cola Femsa (CCF: 2015-2030), Kirin Holdings (KRH: 2015-2030), Diageo (DIA: 2007-2020), Kellogg Company (KEL: 2015-2050), Molson Coors Brewing Co. (MCB: 2016-2025), Barry Callebaut (BRY: 2018-2025), General Mills (GNM: 2010-2050), Smithfield (SMF: 2010-2025), Mondelez International (MON), Mars (MAR: 2015-2025), PepsiCo (PEP: 2015-2030), The Coca-Cola Company (CCC: 2015-2030), Nestle (NES: 2014-2020). Company names in bold have reduced their emissions compared to baseline. Emissions data are acquired from 2020 CDP Climate reports submitted by each company, and revenue data are taken from Food Engineering’s 2020 list of top 100 food and beverage companies.



**Figure 5**

Base, current, and target year scope 1 and 2 emissions for 27 companies. Distribution of base year emissions, current (2020 report) emissions, and target year emissions for twenty-seven companies with absolute targets and emissions data for scopes 1 and 2. Red line and y-axis correspond to 2020 revenue for each company in billions of USD. Smaller graph within is zoomed in on the smallest 10 companies. Acronyms left to right with base and target years: Ito En (ITO: 2018-2030), Bacardi (BAC: 2015-2025), LVMH (2013:2020), Sapporo Holdings (SAH: 2013-2030), Nisshin Seifun Group (NSG: 2013-2030), Pernod Ricard (PDR: 2018-2025), The Hershey Company (HER: 2015-2025), Schreiber Foods (SCH: 2017-2030), Barilla (BAR: 2017-2030), Keurig Dr. Pepper (KDP: 2018-2030), Asahi (ASA: 2015-2030), Suntory (SUN: 2015-2030), Meiji Holdings (MEI: 2015-2030), Marfrig Group (MAF: 2019-2035), Carlsberg Group (CLB: 2015-2030), Campbell Soup Company (CAM: 2017-2025), Ferrero (FER: 2018-2030), Hormel Foods Corporation (HOR: 2011-2020), Unilever (UNI: 2015-2030), Danone (DAN: 2015-2030), Ajinomoto (AJI: 2018-2030), Olam (OLM: 2017-2030), Fonterra (FON: 2018-2030), Anheuser-Busch (AHB: 2017-2025), Tyson (TYS: 2016-2030), Cargill (CAR: 2017-2025), Archer Daniel Midland (ADM: 2019-2035). Company names in bold have reduced their emissions from their baseline. Emissions data are acquired from 2020 CDP Climate reports submitted by each company, and revenue data are taken from Food Engineering’s 2020 list of top 100 food and beverage companies.

## Supplementary Files

This is a list of supplementary files associated with this preprint. [Click to download.](#)

- [ReavisetalSupplementaryInformation.docx](#)