HowGood

HowGood Methodology for Calculating Scope 3 Emissions

Who is HowGood?

HowGood is an independent research company with the world's largest database on food product sustainability. With data and analysis for more than 33,000 ingredients, chemicals, and materials, HowGood helps leading food brands, retailers and investors improve their environmental and social impact. Through in-depth, ingredient-level insights on factors ranging from greenhouse gas emissions to animal welfare to labor risk, HowGood data powers strategic decision-making for the sourcing, manufacturing, merchandising, and marketing of sustainable products. Brands identify opportunities to improve sustainability, drive greater transparency, and empower their consumers to make higher impact purchases. Visit howgood.com for more information.

What is HowGood's approach to research?

HowGood has more than 17 years of research on global food supply chains. The team consolidates and analyzes findings from over 600 accredited data sources and certifications. These include a range of resources such as international frameworks, NGO guidance and standards reports, peer reviewed life cycle assessment studies, journal articles, academic conference proceedings and texts, aggregated commercial databases, targeted industry studies, NGO research, government publications, and news reports from reputable outlets. HowGood employs the most industry-recognized methodologies and incorporates the latest scientific research. Metrics and impact assessments are updated on an ongoing, iterative basis, making HowGood's platform the leading-edge tool for product sustainability. In turn, HowGood is able to provide impact assessments that are accurate, comprehensive, and the most up-to-date. Through HowGood's sustainability intelligence platform, Latis, we are able to scale this approach across products, brands, and the entire food industry.

What is HowGood's Carbon Life Cycle Module and how is it relevant to Calculating Scope 3 Emissions?

HowGood's Carbon Life Cycle Module has been designed according to the GHG Protocol Product Life Cycle Accounting and Reporting Standard (referred to as the Product Standard) guidance for GHG emissions measurement and reduction, as well as ISO 14067. It measures the carbon footprint of an individual product for its entire life cycle, from farm through processing, transport, manufacturing, product use and disposal. HowGood's methodology for calculating Scope 3 emissions utilizes the cradle to manufacturing gate stages of HowGood's Carbon Life Cycle Module to calculate Scope 3 emissions. That is, it's used to measure the carbon footprint of a company's procurement inventory from farm through processing, manufacturing, and all associated upstream transportation.

HowGood's Carbon Footprint metrics at each stage of the carbon life cycle have been designed to guide customers on the GHG impacts of their products, but we recognize that a full and complete picture of these GHGs is not possible to achieve without custom tools and calculations. HowGood's Carbon Life Cycle Module provides a good approximation of attributable GHGs at each stage of a product's life and can guide customers on where to focus their efforts for emissions reductions. For this reason, we detail here the boundaries of our metrics, assumptions made, exclusions from this analysis, as well as some of the sources and reasoning behind these decisions.

This module was built with consumer packaged goods (CPG) companies in mind. We recognize that not all of the stages detailed below apply to every customer or scenario but for completeness we include each of them in this document.

What is HowGood's research methodology for calculating carbon emissions?

HowGood's methodology for calculating GHG emissions is developed in accordance with the GHG Protocol.

1. **Data Collection:** HowGood draws on a diverse collection of data sources, including peer reviewed journal articles to calculate the CO_2e values used within the product carbon footprint. For each data source, HowGood performs a data quality assessment based on the age and comprehensiveness of the findings. For more information on how we score the quality of the emissions factors, please see Product Carbon Footprint Data Quality Ratings.

2. **Ingredient Mapping:** Once the data is collected and analyzed, HowGood conducts a proprietary process of mapping each ingredient to its source crop, animal or material. Using global import/export data and HowGood industry partnerships, HowGood then maps each source crop to its corresponding geographic location to account for the specific on-the-ground practices, impacts, and risks in each locale.

3. **Data Aggregation:** HowGood, to date, has mapped nearly every ingredient, chemical and material (33,000 in total) in the CPG industry, including where and how it is produced. This mapping is used to aggregate data across geographic regions or ingredient categories and develop industry-average impact profiles for CO_2e across every ingredient.

   Based on the ingredient mapping process, HowGood assigns a default location and corresponding industry-average profile for every ingredient in a product. If deeper levels of data granularity are available (from a specific supplier, industry partner, or publication), these specifics are applied.

What data sources does HowGood use to assess GHG emissions?

HowGood draws on a diverse collection of data sources, including peer reviewed journal articles to calculate the CO_2e values for ingredients. For crops and locations where no current data exists, HowGood uses supplementary studies and relevant LCAs from proxy locations where environmental conditions and farming methods are deemed as similar.

Sustainability (Journal)
International Journal of Life Cycle Assessment
FAO Database of Greenhouse Gas Emissions from Agriculture
Journal of Industrial Ecology
European Space Agency Climate Change Initiative
Agribalyse
The Sustainability Consortium
Journal of Cleaner Production
Greenhouse Gas Protocol
USDA LCA Commons Life Cycle Inventory (LCI) database
United States Department of Agriculture
Global Logistics Emissions Council
ESU World Food Database
Savory Land to Market Ecological Outcome Verification
Regenerative Organic Certification
Roundtable On Sustainable Palm Oil
Palm Oil Innovation Group
Carbon Neutral
Soil Carbon Initiative
EcoCert
Roundtable on Sustainable Biomaterials
Rainforest Alliance
Cradle to Cradle
Nature Climate Change
Carbon Neutral Certification
Life Cycle Data Network
ReFED Insights Engine
Global LCA Data Access Network
World Data Center for Geoinformatics And Sustainable Development
USDA Ag Data Commons LCA Collection
Carbon Trust Standard
World Agroforestry - ICRAF
Farm Carbon Toolkit
OpenLCA
ResourceWatch
Consultative Group for International Agricultural Research
Stewardship Index for Specialty Crops
Carbon Disclosure Project
Evidensia
PalmGHG
AdaptWest Climate Resilience Data Explorer
Information Processing in Agriculture
European Life Cycle Database

How does HowGood calculate Scope 3 emissions for procured food materials?

The values provided in HowGood's Scope 3 Report include emissions due only to sourcing the ingredients tracked within HowGood's Procurement module. A company may have other sources of Scope 3 emissions due to other operational activities that they should include in their Scope 3 disclosures. The report includes two categories:

- **Category 1:** Purchased Goods and Services - This considers Cradle-to-gate for the procured material.
- **Category 4:** Upstream Transportation - This considers the last leg of transportation of the procured material.

GHG Protocol Scopes and Categories	HowGood Carbon Life Cycle Stage
Scope 1: Direct emissions from owned/controlled operations **Scope 2:** Indirect emissions from the use of purchased electricity, steam, heating, and cooling	
Upstream Scope 3 Emissions	
Category 1: Purchased goods and services	Cradle to Gate of Procured Material
Category 2: Capital goods	
Category 3: Fuel- and energy-related activities (not included in scope 1 or scope 2)	
Category 4: Upstream transportation and distribution	• **CPG** – Transportation to manufacturing facility • **Ingredient Supplier** – Transportation to ingredient manufacturing facility • **Food Service (restaurant)** – Transportation to food service location • **Food Service (meal delivery)** – Transportation to storage or delivery warehouse • **Retail** – Transportation to retail
Category 5: Waste generated in operations	
Category 6: Business travel	
Category 7: Employee commuting	
Category 8: Upstream leased assets	
Other	
Downstream Scope 3 Emissions	
Category 9: Downstream transportation and distribution	
Category 10: Processing of sold products	
Category 11: Use of sold products	
Category 12: End-of-life treatment of sold products	
Category 13: Downstream leased assets	
Category 14: Franchises	
Category 15: Investments	
Other	

Source: GHG Protocol Technical Guidance for Calculating Scope 3 Emissions

Category 1: Purchased Goods and Services

Category 1 includes emissions from the cradle to gate of the procured material. For simple ingredients, this is on-farm activities, the transportation between the farm and the facility where it is processed into an ingredient, and the emissions due to the processing of the ingredient itself. For complete food products, this includes the on farm activities, the transportation of ingredients between the farm and the facility where they are processed into ingredients, and the emissions due to the processing of the ingredients, transportation to the final product manufacturing facility, and the manufacturing facility itself. In the event that there are multiple processing or manufacturing steps, those additional stages and transportation between them are included as well.

$$Category\ 1: Purchased\ Goods\ and\ Services\ = \sum_{i=1}^{n} \square\ [a_i(x_i)]$$

$$i\ = \{1, \ldots n\}:\ \ materials\ in\ the\ portfolio$$

$$x_i:\ cradle\ to\ gate\ emissions\ of\ material\ i$$

$$a_i:\ amount\ of\ material\ i\ purchased$$

FLAG Emissions

FLAG (Forest, Land, and Agriculture) emissions are a component of the Farm to Farm Gate Emissions stage, and must be broken out separately in accordance with FLAG Guidance as established by the Science Based Targets initiative (SBTi). Note that FLAG emissions are still included as a component of Category 1 emissions.

The following categories must be measured and broken out for FLAG reporting:

- Farm to Farm Gate (Land Management) emissions: any activity occurring on the field where a commodity is grown
- Land Use Change: any land conversion that has occurred in the last 20 years
- Carbon Removals: any carbon that has been removed from the atmosphere due to on-farm activity

Farm-to-Farm Gate

This stage covers GHG emissions due to the growing and harvesting of the material used to create an individual ingredient in a product. The material could be a crop, animal, mineral, or petroleum product. You will find this section is longer and more detailed than the others - this is because most of the emissions for food products comes from the farm. Because of this, our research team has prioritized detailed accounting methods for this stage of the product's life cycle.

Relevant Data Provided by Customers	Relevant data Used in Calculation(s)

• Ingredient • Ingredient Weight • Crop Sourcing Location	• On Farm GHGs from LCAs (EF) • Ingredient Concentration (IC)

$$Farm\ to\ Farm\ Gate\ =\ EF * IC$$

HowGood asks the customer to provide a source location for the crop to provide the data. If the customer does not know the location where the crop was grown, HowGood uses a proxy for where the crop would be grown.

GHG impact is calculated as kilograms of CO_2 equivalent per kilogram of the primary commodity ingredient (kg CO_2e/kg) before any factory or processing emissions (Cradle-to-Farm Gate). On-farm processing, cooling or fermentation, and off-farm cleaning and sorting are included, when relevant to the production of that crop. GHGs are collected at farm gate, which includes all on-farm processes including primary inputs like fertilizer, pesticides, herbicides, and farm machinery fuel needs. Manufacturing of equipment, removals, and land use change are excluded from this value. Harvesting losses are included in the final yield of the product. Additional waste is excluded as it is rarely specified in agricultural LCA studies. Biogenic emissions and removals are assumed to be neutral for crops, with the exception of rice where biogenic methane emissions are included in the final value. Some biogenic emissions are included for animals.

Identifying sources for on-farm GHGs

Measurements are directly sourced from location and crop-specific Life Cycle Assessments (LCAs) from all over the world as well as environmental assessments. Some frequent journals we consult are: International Journal of Life Cycle Assessment, Journal of Sustainable Energy & Environment, Journal of CleanerProduction, Carbon Management (TandFonline), Agricultural Systems (elsevier), Sustainability (MDPI). When searching for the on farm GHGs for a crop and location, our research team prioritizes ISO 14044 LCAs from peer reviewed journals, which use geographically relevant data inventories. We also prefer studies to be within the past 5 years. These conditions cannot always be met but we use the most accurate and reliable data we have at the time and frequently update our database when better data becomes available.

Consistent with the GHG Protocol, carbon sequestration is not included at this time. If a supplier can provide specific measurements meeting the GHG Protocol requirements for removals, then sequestration (removals) are included in a separate metric (see removals below).

HowGood Origin Location Proxy Identification Process

There is not enough research done on the emissions from producing crops and animals outside of the main commodities and conventional methods. Because of this, we sometimes need to choose a proxy value if we can’t find a paper that covers the specific material and location for which we are searching. Our decision process around finding proxy values is below.

Whenever a cradle-to-farm gate GHG value for an origin location is not available both in primary (e.g., LCA study) and secondary (e.g., collection of carbon footprint values) sources, a proxy value is necessary. In this case we use an internal proxying protocol to identify the most appropriate comparable data.

Option 1:
Our first option in selecting a proxy value is to look for an origin in a similar taxonomy (at least family, preferably genus or order); with similar crop type, yield, and agricultural management practices; and, in the same location or climatic/ecological region.

Option 2:
If an origin in a similar taxonomy, with comparable yield and in the same region cannot be found, we look for a similar product (e.g., similar botanical characteristics or same crop category) for the same location (preferable) or same climatic region.

Option 3:
Selecting a proxy value for the same product from a location belonging to a different region is our last option. When taking this route, we ensure that the original source has high quality data.

When choosing a proxy value, we always ensure that:

- The System Boundary is correct: ("cradle to farm gate")
- The functional unit is kg CO_2e/kg. We also specify whether it is fresh or dry weight (whenever this information is known)
- The production system is the conventional/dominant one for the origin location

Land Use Change

Land Use Change is measured in kilograms of carbon dioxide equivalent per kilogram of product (kg CO2e / kg), and takes into account the following factors to assess emissions:

1. **Land conversion or transition** - Whether land conversion or transition has occurred within a landscape or jurisdiction over the preceding 20 years, in the form of deforestation or drained soils. We include pasture in our calculations, in addition to traditional cropland. This data is reported by 245 countries to the United Nations Food and Agriculture Organization (FAO).

    a. **Product allocation factor:** We take the shared responsibility approach to allocating emissions to any crop that was grown in a given jurisdiction that has experienced land use change. This approach attributes land use change emissions based on the percentage of land that a crop has occupied during a given year.

    b. **Time discounting:** We take a linear discounting (or "20 year decline") approach to distributing emissions over the 20-year assessment period. This approach weights recent land use change heavier than it weights older land use change.

2. **Crop location** - We consider the jurisdiction of the crop's location, at a national level.

3. **Crop yield** - We take into account the production yield of the crop in order to calculate land use change emissions per kilogram of product.

4. **Ingredient concentration** - We take into account the ingredient concentration value of the crop.

5. **Regional feed mix** - For animal-based ingredients, we consider the breakdown of pasture, soy and palm oil in the typical animal feed mixes regionally as well as the amount of feed required to produce the ingredient. For farmed aquatic species, we consider the soy in the typical diet as well as how much feed is required by the species. Regional feed mixes are typically reflective of the crops that are predominantly grown in a region, the affordability of crops and generally accepted animal welfare standards. As we increase the granularity of our Land Use Change assessment, we will add additional feed ingredients to reflect the variability of feed mixes throughout the world.

Relevant Data Provided by Customers	**Relevant data Used in Calculation(s)**
• Ingredient • Ingredient Weight • Crop Sourcing Location	• sLUC (EF) • Ingredient Concentration (IC)

$$LUC = EF * IC$$

Carbon Removals

The impact of Carbon Removals is calculated as kilograms of CO2 equivalent per kilogram of the primary commodity ingredient. GHG removals include things like improving forest management practices, and enhancing soil carbon sequestration on working lands.

Carbon Removals are calculated following the submission of primary data from the customer, as specified by the GHG protocol. The primary data required for submission to HowGood is as follows:

Including removals in a GHG inventory requires primary data, ongoing monitoring (and reporting of removals as emissions if monitors are lost), traceability, and quantitative uncertainty estimates.

Stock Change accounting (for land emissions and removals) must be used and cover:
- Biomass
- Dead organic matter (DOM)
- Soil Carbon Pools

HowGood then uses the submitted primary data in the stock difference method as defined in the GHG protocol.

Ingredient Concentration:

One of the more complicated parts of GHG accounting across the entire food system is assessing the amount of raw material to allocate to a single ingredient produced. There are many different allocation methods using mass, value, or a combination of the two. HowGood uses a value and mass-based approach when it comes to allocation. We assess the value of the co- and by-products produced along with the weights of the final output and required raw inputs. This final value gives us our ingredient concentration. We also allow customers to input their primary data of how much raw material is required to create a final ingredient and use this value in other products. Our research team has assessed and created commodity trees across our 33,000+ ingredients to capture this raw material input to more accurately reflect the on farm emissions of an ingredient.

Our final on-farm, LUC, and carbon removal GHGs for an ingredient have the concentration value built into the final value our customers see in Latis.

Example:
It takes almost 7 times as much raw sugar cane to produce an equivalent amount of processed granulated sugar. So, our on-farm value for the raw sugar cane will be almost 7 times as high for the ingredient of granulated cane sugar.

Transportation to Processing

This stage covers the emissions due to transportation between the farm and ingredient processing locations. It also includes all transportation involved in pre-processing or manufacturing of inputs used in the final product, up to the final transportation to the manufacturing facility. This is relevant for complex products that contain nested or component products with intermediate transportation and manufacturing stages of the product life cycle.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
● Ingredient ● Ingredient Weight ● Crop Sourcing Location ● Processing Location ● Manufacturing location (of components)	● Distance between locations (300+ regions creating approximately 45,000 routes between them) ● Mode of transportation (8 modes of transportation, each with 3 emissions factors) ● Refrigeration requirements of the commodity (none, refrigerated, or frozen) ● Ingredient concentration

$$Transportation\ =\ distance * EF * IC$$
$$where\ EF\ is\ driven\ by\ the\ refrigeration\ requirements\ and\ mode\ of\ transport$$

To create this metric, we multiply the weight-distance traveled by the emissions factor of the mode of transportation used. We use the 2019 Global Logistics Emissions Council (GLEC) standard, a GHG Protocol approved industry source for global transport emissions, as our source for emissions factors. Backhauling and empty trips are included in the GLEC emissions factors. Emissions factors are based on tonne-kilometers converted to kg-kilometers to normalize against 1 kg of product maintained in the HowGood database. HowGood customers don't always have visibility into the methods and distances of transportation between the farm and processing location so HowGood uses proxy data in line with specification from the GHG Protocol.

Transportation distances are calculated using arc distance calculations between state, country, or region centroids. For the United States (where most HowGood clients are located) distances traveled within the same state are set at half the distance across the average sized state. When the farm and processing locations are both within the United States, half the distance across the country is used.

Transportation within North America is assumed to be via truck. Transportation between countries outside of the United States is assumed to be via ship.

All transportation stages of the life cycle follow the above methodology, with the exception of this stage between farm and ingredient processing, which is the only transportation stage with ingredient concentration applied. If you are transporting X ton of corn to produce 1 ton of high fructose corn syrup, this stage multiplies the per kg transport emissions by X to reflect the amount of raw material transported.

As our clients and knowledge grows, HowGood updates this proxy data using more detailed modes, including regional data outside of the US. In addition, we plan to accept primary data from customers regarding exact locations of facilities with more exact distances and modes of transportation included.

Upstream Processing

Upstream Processing is an assessment of the energy it takes for the factory processing needs of a given ingredient and the likely fuel(s) needed for that process. Some ingredients are highly processed and require considerable energy to convert them from raw source material into a product that is ready for market. This stage also includes the manufacturing of nested products used as ingredients within a more complex, final product (hereafter referred to as "materials").

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
● Ingredient ● Ingredient Weight ● Processing Location ● Material Manufacturing Location ● Material Manufacturing Type	● Processing and manufacturing type energy requirements by fuel (100+processing types) ● Grid mix at relevant locations (calculated across 300+ regions) ● Fuel type emissions factors (7 fuel types)

$$Upstream\ Processing\ = \sum_{fuels} fuel\ EF * energy$$

Ingredients are assessed for energy requirements of processing after they arrive at the factory and before combination into final products. For example, wheat flour would have all stages of milling's energy requirements assessed. That would include washing, grinding, sorting, and sifting, and bleaching when applicable. **Excluded from this energy value** are overhead operations, employee transportation, and manufacturing of the equipment. HowGood then uses the grid mix at the processing location to calculate the associated emissions due to the ingredient processing.

In many cases, as it is with some extracts, or supplements, multiple parts of the processing have been accounted for where industry standards can be applied (ex: for safflower extract applies alcohol solvent extraction/spray drying process). We account for each part of the processing where that information is provided or where we can safely make standard processing assumptions. Where this information is not available or assumptions cannot be safely made, and an ingredient has multiple processing types associated, the most energy intensive processing type is used.

Many times customers do not have insights into where their ingredients are processed. In this case, the location of the processing facility in relation to the farm location is determined by specific research on the nature of the crop, economic considerations, and processing specialization. Most crops are processed on or near the farm where they are grown. In this case, the same location as the farm will be chosen. There are a few specialty crops which tend to be processed away from the farm in specific regions. HowGood assesses which crops fall into this category by analyzing trade data and checking EcoInvent for references, where available.

We use region grid mix values to determine how much kg CO_2e is emitted per unit of energy when the likely fuel to be used in a process is electricity. We have these grid mix values for US states and most countries and are still developing methodology to calculate them for other compound regions (sub-national and supra-national). For fuel types other than electricity (e.g. direct burning of natural gas, coal, biomass etc), we use the carbon intensity of the applicable fuel. This enables our tool to give biogenic CO_2 emissions data required by many disclosure bodies as a separate metric. Biogenic emissions are not included in this value.

Transportation to Manufacturing

This stage covers the emissions due to upstream transportation of all materials to the final manufacturing facility.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
● Processing Location ● Ingredient Weight ● Manufacturing Location	● Distance between locations (300+ regions creating approximately 45,000 routes between them)

	● Mode of transportation (8 modes of transportation, each with 3 emissions factors)

See **Transportation to Processing** for details.

Product Manufacturing

Manufacturing is an assessment of the energy it takes for the factory manufacturing needs of a given product.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
● Manufacturing Type ● Manufacturing Location	● Energy required by Manufacturing Type (80+ manufacturing types) ● Grid mix at Manufacturing Location (calculated across 300+ regions) ● Fuel type emissions factors (7 fuel types)

$$Manufacturing \ = \sum_{fuels} fuel\ EF * energy$$

To calculate GHGs associated with product manufacturing, HowGood uses the product type/sales category and location of the manufacturing facility. Products are grouped into categories based on similar manufacturing processes. Customers can choose the manufacturing type which best describes their product, or HowGood can make a reasonable assumption based on the sales category.

The energy needs of each process or subprocess associated with the production line is collected/estimated from energy or environmental assessments and life cycle inventories as MJ/kg product per fuel type. They can include refrigeration and lighting but **exclude overhead operations, employee transportation, and manufacturing of the equipment.** We base our estimates on the manufacturing category of the product (frozen entree, cold case milk, chips & snacks, juice beverages, etc). For example, the manufacturing energy required to make yogurt or kefir would include mixing of ingredients (fruit, etc), culture/fermentation process, sterilization of equipment, sterilization of jar/vessel, heat sealing process, and refrigeration.

HowGood then uses the total energy consumption and the carbon intensity of electricity at the manufacturing location and/or emissions factors of the other fuels to calculate the associated emissions due to the product manufacturing.

When customers have conducted product LCAs and can provide manufacturing energy data with enough granularity to map to our inclusions and exclusions, we can ingest that data and create a customer and product(s) specific manufacturing type.

Manufacturing waste is assumed to be 5% by default, however customers can input their ingredient data as the amount of ingredient needed to produce 100 kg of product to account for waste if they wish. See Impact accounting for products where ingredients outweigh the final product for more information on how to do this.

See the last paragraph in **Upstream Processing** for limitations and planned changes.

Biogenic Emissions

Biogenic emissions are carbon released as carbon dioxide or methane from combustion or decomposition of biomass or biobased products. Per ISO 14067, we calculate biogenic carbon emissions separately from fossil based emissions. Biogenic emissions are accounted for in two main areas:

- Combustion of biomass fuel
- Emissions of food waste during manufacturing

Combustion of biomass fuel:
For any processing, manufacturing, or packaging processes which use a biomass fuel, biomass emissions are calculated in the same way as fossil based carbon:

$$\text{Biogenic CO2e} = \text{biomass fuel required per kg of product} \times \text{EF}$$

Biogenic emissions from food waste:
During manufacturing, there is typically food waste. Where customer data is available, we can account for the exact loss in the system. When customer data is not available, we assume 5% loss of ingredients during product manufacturing. 42.6% of the loss is assumed to be anaerobically digested and 2.5% assumed to be landfilled. The emissions from decomposition are calculated as:

$$\text{Biogenic CO2e} = \sum (\text{total mass of waste} \times \text{proportion of total waste being treated by waste treatment method} \times \text{emission factor of waste treatment method})$$

Biogenic emissions calculations are rolled up into a single value for 2 system boundaries: cradle to gate and cradle to shelf.

Cradle to Gate biogenic emissions = (processing biogenic emissions + manufacturing biogenic emissions) * 1.05 + manufacturing waste emissions

Cradle to shelf biogenic emissions = (processing biogenic emissions + manufacturing biogenic emissions) * 1.05 + manufacturing waste emissions + packaging biogenic emissions

Any other biogenic emissions not mentioned in this phase or previous phases are excluded, including biogenic emissions on farm (see farm to farm gate section for more details).

Category 4: Upstream Transportation

Category 4 covers the transportation of ingredients between the facility where they are processed into ingredients and the facility to manufacture the final product.

$$Category\ 4: Upstream\ Transportation\ = \sum_{i=1}^{n} a_i w_i$$

$$i\ = \{1, \ldots n\}:\ \ materials\ in\ the\ portfolio$$

$$w_i:\ transportation\ emissions\ of\ material\ i\ to\ company\ owned\ operations$$

$$a_i:\ amount\ of\ material\ i\ purchased$$

Transportation of Procured Material to Company Owned Operations

To create this metric, we multiply the weight-distance traveled by the emissions factor of the mode of transportation used. We use the Global Logistics Emissions Council (GLEC) framework, a GHG Protocol approved industry framework for global transport emissions accounting and reporting, as our source for emissions factors. Emissions factors are based on tonne-kilometers converted to kg-kilometers to normalize against 1 kg of product maintained in the HowGood database. HowGood customers don't always have visibility into the methods and distances of transportation between the farm and processing location so HowGood uses proxy data.

Transportation distances are calculated using arc distance calculations between state, country, or region centroids. For inter-region transportation, half the distance across the region is used.

Transportation within North America and intra-region is assumed to be via truck. Transportation within Europe is assumed to be via truck with an EU specific emissions factor. Transportation between other regions is assumed to be via ship.