HowGood Methodology

CARBON FOOTPRINT IMPACT LABEL

April, 2023

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 15 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 Footprint impact label?

HowGood's Carbon Footprint impact label is a measure of the greenhouse gas emissions (GHGs) of a product, from Cradle-to-shelf. It communicates the carbon footprint of a product by quantifying the GHG emissions generated in kilograms of carbon dioxide equivalent per kilogram of product (kg CO_2e / kg). HowGood's carbon footprint assessments are built on the world's largest food product sustainability database, with granular emissions factors on more than 33,000 ingredients in the food system.

Calculation of the Carbon Footprint impact label includes all applicable stages of the product life cycle from agricultural production to retail shelf, including ingredient processing, manufacturing, storage, distribution and retail.

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 for ingredients. For each data source, HowGood performs a data certainty assessment based on the age and comprehensiveness of the findings. This process is completed for every ingredient on which there is accurate and verifiable data. For GHG emissions, HowGood relies on the International Panel on Climate Change (IPCC) 2013 global warming potential estimates where available and crop-specific LCAs.

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.

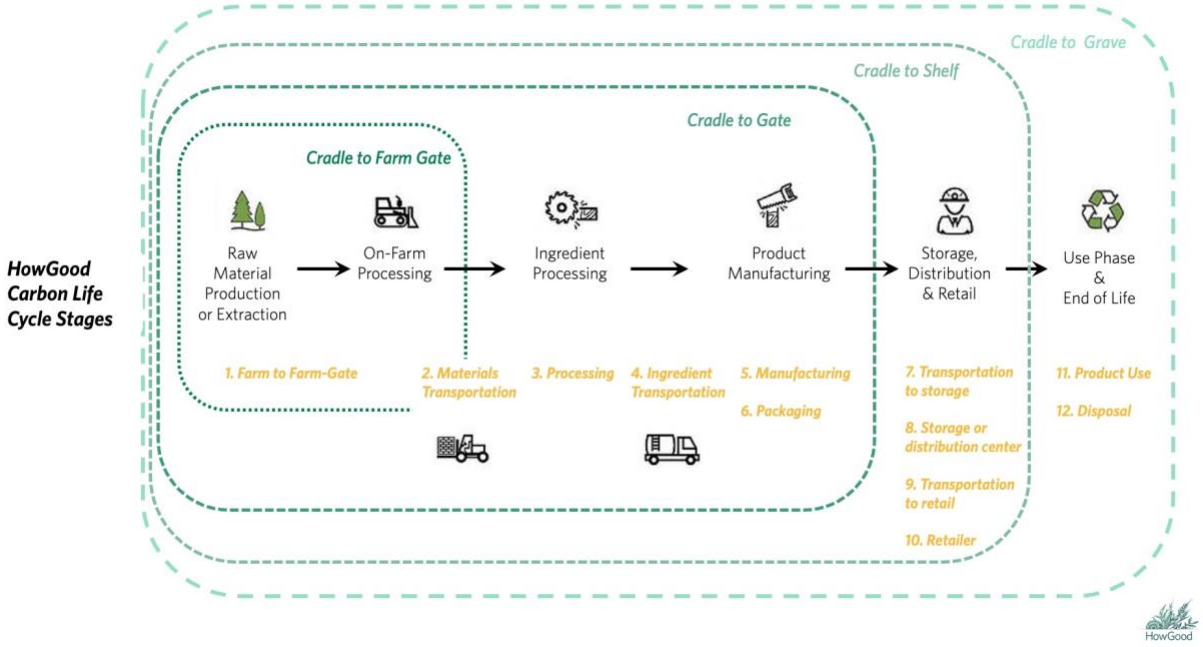
Based on the ingredient mapping process, HowGood assigns a default location and corresponding industry-average profile for every ingredient in a product. If deeper levels of data granularity are available (from a specific supplier, industry partner, or publication), these specifics are applied.

What data sources does HowGood use to assess GHG emissions?

For GHG emissions, HowGood relies on the International Panel on Climate Change (IPCC) 2013 global warming potential estimates where available and crop-specific LCAs. For crops and locations where no current data exists, HowGood uses relevant LCAs from proxy locations where farming methods are deemed as similar (ie. places that have the same fertilizer requirements, same size farm, etc).

How does HowGood calculate carbon emissions at each stage of the carbon life cycle?

HowGood calculates carbon emissions at each stage of the carbon life cycle, defined in the framework detailed below:



1. Crop Production (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 lifecycle.

Relevant Data Provided by Customers	Relevant data Used in Calculation(s)
• Ingredient • Ingredient Weight • Crop Sourcing Location	• On Farm GHGs from LCAs • Ingredient Concentration

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. Direct Land

Use Change (LUC) is included in the overall on-farm GHGs. This LUC value will be available as a separate field upon release of the final GHG Protocol Land Sector and Removals Guidance.

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 soil measurements meeting the GHG Protocol requirements for removals, then sequestration (removals) can be included.

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

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 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.

2. Transportation from Farm to Processing Facility

This stage covers the emissions due to transportation between the farm and ingredient processing locations.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
• Ingredient • Ingredient Weight • Crop Sourcing Location • Processing 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) • Refrigeration requirements of the commodity (none, refrigerated, or frozen) • Ingredient Concentration

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) standard, a GHG Protocol approved industry source for global transport emissions, 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 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.

3. Processing

Processing is an assessment of the energy it takes for the factory processing needs of a given ingredient. Some ingredients are highly processed and require considerable energy to convert them from raw source material into a product that is ready for market.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
● Ingredient ● Ingredient Weight ● Processing Location	● Processing type energy requirements (100+processing types) ● Grid mix at processing facility (calculated across 300+ regions)

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.

HowGood has conducted extensive research into the types of processing that are associated with different types of ingredients. In calculating the Processing energy usage, we assess the processing type based on the ingredient, the grid mix of the location in which it was processed, and the fuels that are associated with that Processing type. If an ingredient has multiple processing types associated with it, then we take that into account and sum all of the associated processing types together.

We use region grid mix values to determine how much kg CO_2e is emitted per unit of energy. 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). This enables our tool to give biogenic CO_2 emissions data required by many disclosure bodies.

4. Transportation from Processing Location to Manufacturing Location

This stage covers the emissions due to transportation between the ingredient processing and final product manufacturing locations.

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 from Farm to Processing Facility (p.5)** for details.

5. 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)

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. We require the manufacturing category from customers contracted for the Carbon Life Cycle Module.

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. 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 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.

See the last paragraph in **Processing (p.6)** for limitations and planned changes.

6. Product Packaging

HowGood requests the specifics of each piece of packaging as well as the recycled content of the materials, similar to the shapes and materials used for Eco-Score. Since our GHG metrics are given per kg of product, we also use average product to packaging ratios to derive the final output. We determine emissions based on the manufacturing region's grid mix values.

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

• Packaging Material(s) • Packaging Shape(s) • Proportion of recycled material used for input	• Packaging material EFs (virgin and/or recycled) (20+ materials) • Packaging shape as ratio to overall packaging (20+ shapes) • Product to packaging ratio (constant)

7. Transportation from Manufacturing to Storage (Optional)

For those products that will travel to a warehouse or distribution center between being manufactured and going to retail shelves, we account for emissions due to transportation between the manufacturing facility and the storage facility.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
• Manufacturing Location • Warehouse 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) • Refrigeration requirements of the product

See **Transportation from Farm to Processing Facility (p.5)** for details.

8. Storage/Distribution Center (Optional)

Keeping products in a storage or distribution location prior to retail impacts a product's total emissions.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
• Warehouse Location • Product Cold Storage Requirements	• Grid Mix at Warehouse Location (calculated across 300+ regions) • Warehouse Cold Storage Energy (constants)

We are including cold storage emissions and **excluding emissions related to other overhead costs** at the distribution center or storage facility. HowGood recognizes that a product may have many storage or distribution centers. However, since our final unit is kg CO_2e/kg final product, we ask customers to choose a single location that best represents their data, and we ask if their product requires refrigeration.

9. Transportation to Retailer

This stage covers the emissions attributed to a product being transported to the retailer. If a product has spent time at a distribution or warehouse facility, the starting point for this journey is considered to be the location of said center. If not, we assume the product has traveled directly from the manufacturer to the retailer.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
● Manufacturing Location OR Warehouse Location ● Retail Location ● Product Cold Storage Requirements	● 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 from Farm to Processing Facility** (p.5) for details.

10. Retailer

A product's next stage is to go to the retailer to be purchased by the user.

Relevant Data Provided by Customers	Relevant Data Used in Calculation(s)
● Retail Location ● Product Cold Storage Requirements	● Grid Mix at Retail Location (calculated across 300+ regions) ● Retailer Cold Storage Energy (constants)

A significant amount of emissions at this stage are due to refrigerants and energy required for cold storage. Other emissions at the retailer are due to overhead operations which we have excluded from our analysis, consistent with the GHG protocol methodology. For this reason, in line with the GHG Protocol, we utilize only the energy required for cold storage at the retailer stage. This energy is combined with the average grid mix of the retailer location to calculate the final emissions at this stage. HowGood recognizes that retailers are rarely in a single location. However, since our final unit is kg CO_2e/kg final product, we ask customers to choose a single region that best covers the area where a product is sold. Out of scope for this analysis is the emissions due to a customer traveling to and from the retailer.

Out of scope for this analysis is the emissions due to a customer traveling to and from the retailer, product use and disposal.