HOW TO CALCULATE EMISSIONS IN YOUR VALUE CHAIN:

The Crawl–Walk–Run Approach

PERSEFONI

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Executive Summary

With the fight against climate change reaching a critical juncture this decade, reducing greenhouse gas (GHG) emissions in line with the Paris Agreement will be essential in mitigating the worst of its effects. At 11.4 times the average emissions of operational (scope 1 and 2) emissions, supply chains (just one part of the value chain) are responsible for the vast majority of emissions in many industries.[1] Consequently, measuring, managing, and reducing emissions across the value chain will be critical for mitigating climate change.

Value chain emissions, also known as scope 3, are considered some of the hardest to measure, report on, and reduce. Just over half of the companies that report to CDP, the largest voluntary disclosure platform for carbon accounting, report at least one category of scope 3 emissions.[2] Many companies reporting to CDP are still trying to find which of the fifteen scope 3 categories are most significant to report on, and leave their scope 3 inventories incomplete. The GHG Protocol's Value Chain Standard defines scope 3 emissions as all of the indirect emissions in a company's value chain, except those from purchased energy which are given their own scope (scope 2).

Scope 3 emissions are broken down into 15 categories, categorized as either upstream or downstream emissions in a company's operations. This guide focuses on how organizations measure emissions in their value chain. We chose value chain emissions because they are the largest contributor to GHG emissions for most organizations and financial institutions. Therefore, addressing value chain emissions arguably presents the greatest opportunity for companies and the environment. Value chain emissions can also be some of the most difficult ones for which to collect data and reduce, and present some of the most significant opportunities for collaboration through stakeholder engagement for sector-wide decarbonization.

Supply chains (just one part of the value chain) **are responsible for**

11.4x

the average number of operational emissions (Scopes 1 & 2).

This guide is designed to help companies start the journey of measuring, managing, and reducing their value chain emissions. It aims to give high-level instructions on how to steadily increase the sophistication of their measurements to gain further insights into emissions reductions and exploit the co-benefits of doing so.

> **... Addressing value chain emissions arguably presents the greatest opportunity for companies and the environment.**

Executive Summary (cont.)

The guide is split into three sections, based on level of experience with measuring value chain emissions:

Crawl (Just Starting Out)

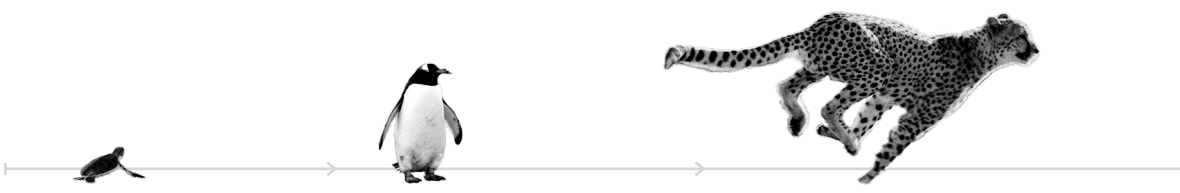
- Define your business ambitions
- Create value chain organizational and operational boundaries
- Assess which scope 3 categories are relevant to your organization's value chain
- Start with high-level calculation methodologies for which you may already have data, such as spend-based
- Begin to prioritize emissions hot spots or areas of greatest risk, which present opportunities for improved data management
- Invest in a climate management and accounting platform

Walk (Established and Effective Processes in Place)

- Use more precise methods to calculate significant emission sources, supported by carbon accounting software
- Identify the scope 3 emissions categories that are the largest contributors to the organization's footprint
- Evaluate your strategy for reducing carbon emissions, including scope 3 emissions
- Commit to a carbon reduction target that includes scope 3

Run (Leading the Way)

- Measure all significant emission sources with the most granular data feasible
- Engage with companies across your supply chain to make reductions. This likely will focus first on larger emitters and then work deeper into the supply chain. Take advantage of carbon accounting software that can facilitate supply chain carbon reporting, including tools offered to smaller suppliers at no cost.



Value chain emissions are becoming increasingly essential to measure, report, and reduce as the proposed rules of the Corporate Sustainability Reporting Directive in the EU, the SEC's proposed climate disclosure mandate in the US, and other jurisdictions now require some sort of scope 3 emissions disclosure. Based on the Crawl-Walk-Run approach, companies can gradually increase the granularity at which they measure emissions across their value chain while improving efficiency, mitigating risk, and reducing emissions.

Why Measure and Manage the Emissions in Your Value Chain?

The SEC's Proposed Rules to Enhance and Standardize Climate-Related Disclosures for Investors proposes to require some companies to measure their scope 3 emissions when material.[3] Further, increased pressure from investors, regulators, and other stakeholders have meant the number of companies now measuring their scope 3 emissions and requesting data from vendors across their suppliers has risen sharply. In 2021, through CDP alone, over 200 companies with 5.5 trillion in buying power requested climate data from 24,000 suppliers.[4] By measuring emissions across their value chain, organizations can mitigate the risks associated with transitioning to a low-carbon economy.

Understanding value chain emissions can also expose organizations to opportunities. By measuring emissions across the value chain, organizations can find opportunities to reduce costs, optimize operations, and improve efficiency. In 2020, suppliers reporting their emissions to CDP saved $33.7 billion through climate-related measures.[5] There are also opportunities to increase competitive advantage through improved reputation and offering more sustainable products and services, which can attract climate-conscious customers and employees.

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$5.5T

in buying power requested climate data from 24,000 suppliers.

The risks associated with transitioning to a low-carbon economy are driving companies to measure emissions across their value chain. It is acceptable under the Greenhouse Gas Protocol to use industry averages and spend-based data to derive scope 3 emissions calculations. However, as they work toward meeting their scope 3 emissions reduction goals, organizations will need to measure value chain emissions more granularly. These measurements will help them to ensure they meet their commitments, comply with regulations, and maintain a competitive advantage.

In 2020, suppliers reporting their emissions to CDP saved

$33.7B

through climate related measures.

How to Calculate Emissions in Your Value Chain?

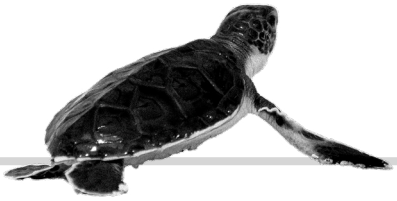
Developing a carbon footprint for scope 3 is often perceived as a laborious and time-consuming process. Because of the difficulty inherent in measuring scope 3 emissions, we advise companies that are new to carbon accounting to take the crawl-walk-run approach to measure and disclose scope 3 emissions. One of the main issues for scope 3 is balancing data quality and reliability with the time and effort required to collect and maintain it. This issue is addressed by improving data quality over time and starting with the data that's most accessible to organizations (typically, financial data); and gradually obtaining more in-depth data from suppliers where emissions are significant, for greater insights.

While calculating the carbon footprint of your value chain is essential for reporting and reducing emissions, optimizing a company's operational processes for a low-carbon value chain should run concurrently with each of these phases. This can include companies improving their production processes resulting in reduced demand for goods and services, and developing schemes to reduce emissions, like cycle-to-work schemes that reduce emissions from employee commuting.

01

Crawl

(Just Starting Out)



Define Your Business Ambitions

Does your company plan to be an industry leader and set ambitious climate targets for your value chain emissions? Do they just need to comply with regulations? Will companies set net zero by 2050 targets, including scope 3, more ambitious interim emissions targets, or science-based targets?

These are all the questions companies must answer to understand the extent of data they need to collect and how robust that data needs to be. The more ambitious their goals are, the more time and resources they will need to invest in creating a strong value chain climate strategy. Setting targets is relatively easy; measuring value chain emissions, creating decarbonization strategies, and tracking progress toward targets takes time, resources, and effort.

Create Operational and Organizational Value Chain Boundaries

Every company creating an inventory of their value chain emissions for the first time will need to assess which categories are relevant to them. Understanding the categories most significant to the organization allows them to prioritize their data collection efforts.

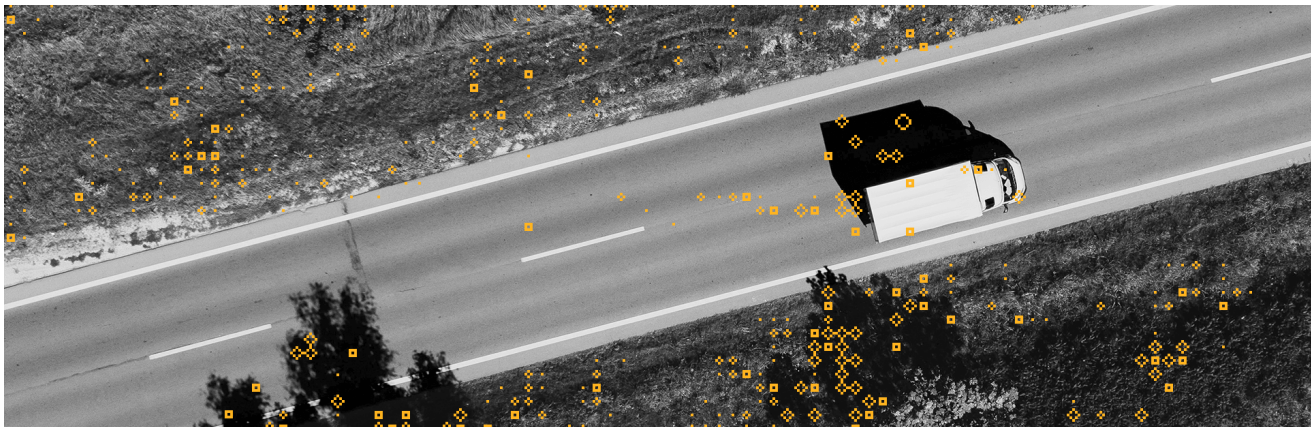
For each category under scope 3, there is a minimum boundary a reporting company must meet to align with the GHG Protocol. Organizations should aim to collect and disclose data on all categories significant to their value chain. Companies may exclude emission sources from their inventory when accounting is not feasible, or categories are not applicable, providing they explain and justify the reasons for leaving these categories out. When excluding a category type, companies should follow the principles of relevance, completeness, accuracy, consistency, and transparency, and only exclude due to a lack of data or if the scope 3 activity is expected to be insignificant compared to other categories (in which case they can use a high-level estimate or flag the emissions as excluded due to insignificance). However, if a company plans to set ambitious climate targets, such as those aligned with the Science Based Targets initiative, it must limit exclusions to those they expect to be insignificant.

Assess Which Scope 3 Categories Are Important To Your Organization

Across the 15 categories of scope 3 emissions, up and down the value chain (as seen in table 1 on the following page), every company will have different alignments to different categories. For example, category 15: Investments, may not matter to a retail company, but for financial institutions that report their category 15 emissions to CDP, scope 3, category 15 emissions make up over 700 times their scope 1 and 2 emissions.[6]

Table 1. Scope 3 Categories: 1 to 15[7]

Upstream Categories	Downstream Categories
1. Purchased Goods & Services: Emissions from production of purchased or acquired products and services not captured under other categories.	**9. Downstream Transportation & Distribution:** Emissions from third-party transportation and distribution of sold products that is paid for by the reporting organization's customers.
2. Capital Goods: Emissions from production of purchased or acquired capital goods.	**10. Processing of Sold Products:** Emissions from processing of sold intermediate products following the sale. Intermediate products are goods used with another product before end use.
3. Fuel & Energy-Related Activities: Emissions from production and distribution of fuel and energy used by the organization (i.e., upstream for scope 1 and 2).	**11. Use of Sold Products:** Emissions from direct use of sold goods and services (e.g., charging electronics). Indirect use of sold goods and services (e.g., washing sold clothing) can optionally be included.
4. Upstream Transportation & Distribution: Emissions from third-party transportation and distribution of sold products paid for by the reporting organization.	**12. End-of-Life Treatment of Sold Products:** Emissions from waste treatment and disposal of sold products at the end of their life cycle. Transportation of waste to the waste treatment facility can optionally be included.
5. Waste Generated in Operations: Emissions from third-party treatment and disposal of waste from a company's controlled or owned operations. Transportation of waste to the waste treatment facility can optionally be included.	**13. Downstream Leased Assets:** Emissions from operation of owned assets leased to other entities that aren't included in scopes 1 and 2.
6. Business Travel: Emissions from employee transportation for business-related activities in third-party owned or operated vehicles (excluding day-to-day commuting). Hotel stays can optionally be included.	**14. Franchises:** Emissions from franchise operations. This is applicable for franchisors and includes scope 1 and 2 emissions from franchisees. Scope 3 emissions from franchisees can optionally be included.
7. Employee Commuting: Emissions from employee commutes between their workplace and home. Remote work can optionally be included.	**15. Investments:** Emissions from investments, also known as financed emissions (e.g., equity investments, debt investments, project finance). This category is mainly for financial institutions, but is relevant for any organization with significant financial investments.
8. Upstream Leased Assets: Emissions from the operation of assets leased by the reporting organization that isn't under their direct control. This often includes leased equipment and small leased facilities.	



Start With High-Level Calculation Methodologies For Which You May Already Have Data, Such As Spend-Based Data

Once organizations understand the extent of the categories significant to their operations, they can start mapping out supplier hot spots in their value chain to determine who the largest contributors are to their footprint, and where to deploy a reduction strategy. To start, this is possible to do using only spend-based data because of the emission factor sets provided by organizations like EPA and Vital Metrics that utilize Environmentally Extended Input Output (EEIO) models.[8] EEIO models link economic activities with emissions estimates. A user that is able to determine how much money was spent within a particular sub-industry or on a specific commodity can easily use one of these emission factor databases to convert spend into a GHG emissions estimate, without having to know specific quantities of their purchases or the exact carbon footprint of the product or service. Once organizations understand the extent of the categories significant to their operations, they can start mapping out their value chain and understanding which of their suppliers are the largest contributors to their carbon footprint.

Spend-based data can be used to estimate emissions at a sub-industry or commodity level. The cash value of products or services can either be aggregated and mapped to a North American Industry Classification System (NAICS) code, or it can be directly mapped to a commodity code. The Persefoni system can recognize this mapping, and automate a match between the industry or commodity code and the emission factor within the emission factor set selected by the user. Spend-based emissions factors capture the industry averages of products and services emissions from cradle-to-gate. Therefore the emission factors are more generic, and do not take into consideration the nuances of different processes that could have been applied throughout the initial phase of the product's life cycle.[9]

> **... Organizations should aim to collect and disclose data on all categories significant to their value chain.**

Prioritize Emissions Hot Spots or Areas of Greatest Risk for More Granular Measurements

Spend-based data gives organizations a good estimate of the emissions coming from each category and what categories are most emissions-intensive and at greatest risk. Based on this information, companies can begin to select which categories should be prioritized for more robust data collection, and decarbonization strategies, including potentially changing procurement practices, and engaging suppliers.

Ranking hot spots of emissions and areas of greatest climate-related risk across the value chain allows organizations to prioritize categories for data collection and management. Data collection and management can be improved drastically through the use of carbon accounting software. Software enables organizations to understand which parts of the business pose the biggest risk to not meeting goals, and enables them to measure, manage, and reduce those emissions in one platform.

Invest in A Climate Management and Accounting Platform

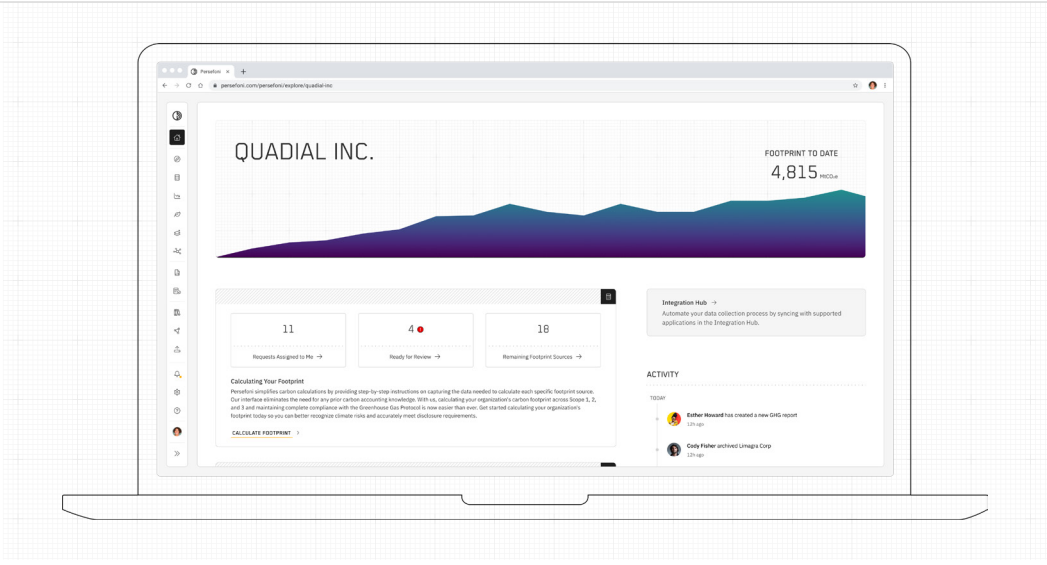
Investing in a Climate Management and Accounting Platform (CMAP) enables companies to bulk upload spend-based data through APIs, automating the process and reducing the onerous aspects of data collection. Spend-based data is then automatically combined with emissions factors, which are preloaded and coded into the platform, for immediate results.

CMAPs guide users through each stage of the crawl-walk-run process using emissions factors and data ingestion based on where they are in their journey. Software also offers additional insights which help companies track progress towards goals and benchmark emissions against competitors and industry averages. As companies advance in their journey of measuring, managing, and reducing their value chain emissions, CMAPs provide a way for companies to give suppliers access to the platform for them to calculate the portion of their carbon footprint that is contributing to the reporting company's scope 3 emissions.

Carbon accounting software will lessen the demanding aspects of collecting and calculating value chain emissions data and significantly reduce the time to make unique insights.

Persefoni Is the #1 Climate Disclosure & Carbon Management Solution

Persefoni's SaaS Platform enables companies and financial institutions to easily meet stakeholder and regulatory climate disclosure requirements and requests.



02

Walk

(Established and Effective Processes in Place)

Use more granular ways of calculating significant emission sources (Supported by carbon accounting software)

As organizations develop in their sophistication and methods of data collection and calculation, they can move from the collection of spend-based data to activity-based data. Activity-based data can improve on spend-based methods providing data collected is good quality, but requires the collection of more robust data internally and from suppliers. Activity-based data is more comprehensive as it includes non-financial data held by companies. Examples of activity-based data includes distance-based activities, such as the number of miles flown or driven, and fuel-based activity data, such as liters of fuel burnt in a delivery truck. These are multiplied by more specific emissions factors to estimate emissions more accurately, with fuel-based being the most accurate.

Collecting activity-based data can be more challenging than collecting spend-based data. However, if the reporting company runs into challenges collecting activity data within certain parts of their value chain, they can always elect to fill those gaps with a spend-based approach in the interim. This allows companies to prioritize activity-based data collection in their most carbon intensive areas of the value chain, without having to sacrifice the completeness of their footprint.

As the emissions data collection and calculations get more granular and the amount of supplier-specific data increases, companies will be forced to commit a serious amount of time and resources. Carbon accounting software will be crucial to make the task less of a burden and create automated, auditable, and repeatable processes for the ingestion and calculation of value chain data. Carbon accounting software will be especially useful for companies who choose to share their platform access with their suppliers so they can directly input their emissions data. The process of the supplier measuring their scope 1 and 2 will enable the reporting company to take their attribution of that for their scope 3 emissions reporting.

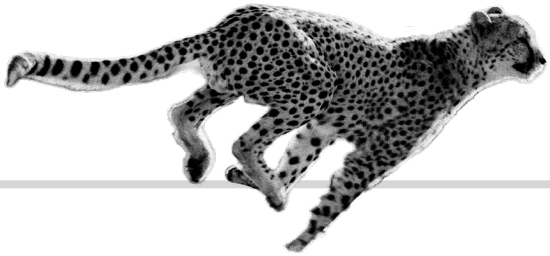
Commit To a Carbon Reduction Target That Includes Scope 3, With a Focus On Emissions Hot Spots For Reductions

Data from more in-depth granular sources will make companies feel confident in establishing a carbon reduction target for the value chain emissions they believe they can meet. Whether companies set a custom reduction target for their value chain emissions or a science-based target, which requires both a near-term goal if scope 3 makes up 40% or more of total emissions for the company and a long-term scope 3 emissions target, more in-depth data will allow for companies to accurately track their progress toward their targets.

With activity-based data giving a much more in-depth understanding of emissions hotspots at a supplier-specific scale, companies will then have the opportunity to track progress toward value chain emissions reduction goals. And by using their purchasing leverage, companies can influence how their suppliers treat their carbon footprint or look for suppliers with a low carbon footprint.

03 Run

(Leading the Way)



Measure All Significant Emission Sources With The Most Granular Data Possible

Once companies have built an iterated process of measuring the most significant categories across their supply chain, they can move on to collect the categories of lesser significance through the same repeated process.

Companies can then become industry leaders by measuring the whole extent of their value chain emissions across every significant category. Having this level of granular data provides organizations with the information they need to pinpoint emissions hot spots and make data-driven decisions on how to reduce scope 3 emissions.

Engage With Companies Across Your Supply Chain to Make Reductions

The first place to start with supply chain engagement strategies is to recognize which vendors would be best to engage with and determine how to engage with them. Businesses can be supportive of their vendors by sharing knowledge and resources to help them decarbonize, enforce decarbonization on vendors, encourage collaboration across vendors towards decarbonization.

Lack of access to data is often cited as the reason companies do not have accurate emissions data from across their value chain. Engaging with suppliers is an advanced way of retrieving the data needed for accurate value chain carbon footprinting. It also provides opportunities for collaboration and optimization and supports sector-wide emissions reductions.

Tier 1 suppliers are often thought to be the best ones to start with. Tier 1 suppliers are companies that directly do business with the company reporting their value chain emissions, and tier 2 would be those who do business directly with tier 1, and so on. Tier 1 suppliers are those that companies generally get the most engagement from, due to the direct nature of the relationship. Successful communication, collaboration, and support of tier 1 vendors helps to form a reciprocal relationship where data is transferred, and emissions can be reduced. A good example of this collaboration with supply chains for emissions reductions is Hewlett Packard Enterprise (HPE). In 2017, HPE committed that by 2025, 80% of HPE's manufacturing spend will go to suppliers with science-based targets, which they hope will reduce their manufacturing supply chain emissions by 15%.[10]

Virtually every company is in the supply chain of another. Sharing scope 1 and 2 emissions with each other is potentially the most accurate way to get supply chain carbon emissions data for the most accurate insights. This process can be automated through the use of a CMAP. Companies can share access to the CMAP they use with their vendors to exchange information and collaborate directly on the platform. Additionally, emerging free versions of CMAP remove any financial barriers to entry and allow companies to collaborate with small and medium enterprises and share emissions data. Once an organization has its entire supply chain on a single platform measuring scope 1 and 2, it can measure the full extent of its supply chain emissions without worrying about data collection.

Once companies have engaged with all of the vendors across their supply chain and have an accurate measurement of their value chain emissions, they must begin to reduce emissions in line with their custom or science-based reduction targets. This can be achieved through changing behaviors, redesigning products and services, updating procurement and operational practices, business innovations, and engaging with suppliers.

Conclusion

Across all of these incremental steps, gradual improvements in the measurement of value chain emissions data enable organizations to make better decisions related to their climate targets and build strategies to mitigate climate risks and harness opportunities. The crawl-walk-run approach could apply to any company starting this process as they attempt to measure, manage, and reduce their carbon footprint.

While going through this process, companies can reduce their value chain emissions by optimizing resource use and changing procurement practices and behavior. However, to take these measures most effectively, a clear understanding of emissions hot spots across the value chain through an accurate carbon inventory is essential. Starting the process is complicated. But once the process is started taking slow and methodical steps towards the run (leading the way) stage will allow organizations to go beyond compliance and become an industry leader driving sector-wide decarbonization across their value chain.

With the maturation of carbon accounting software, this process has become much more manageable as data uploads and calculations are automated. And with vendors across the value chain on the same platform sharing their scope 1 and 2 data, scope 3 can be calculated more seamlessly. The compounding benefit of a free carbon accounting platform for small and medium enterprises is a game changer for measuring the full extent of value chain emissions. With companies now able to offer their suppliers a free version, it completely negates the most onerous aspects of some value chain emissions data collection and calculation.

Having that level of insight into a supplier's emissions will enable companies to use their purchasing power to leverage improvement in climate performance from their suppliers and reduce their emissions across the value chain.

To learn more about how a free carbon accounting product can help you engage with your value chain, reach out to learn more.

References

CDP (2021) - CDP Transparency to Transformation: A Chain Reaction CDP Global Supply Chain Report 2020

CDP (2021) - Engaging The Chain: Driving Speed and Scale CDP Global Supply Chain Report 2021

GHG Protocol (1997) - Corporate Value Chain (Scope 3) Accounting and Reporting Standard

EPA (2022) - Supply Chain GHG Emission Factors for US Commodities and Industries v1.1

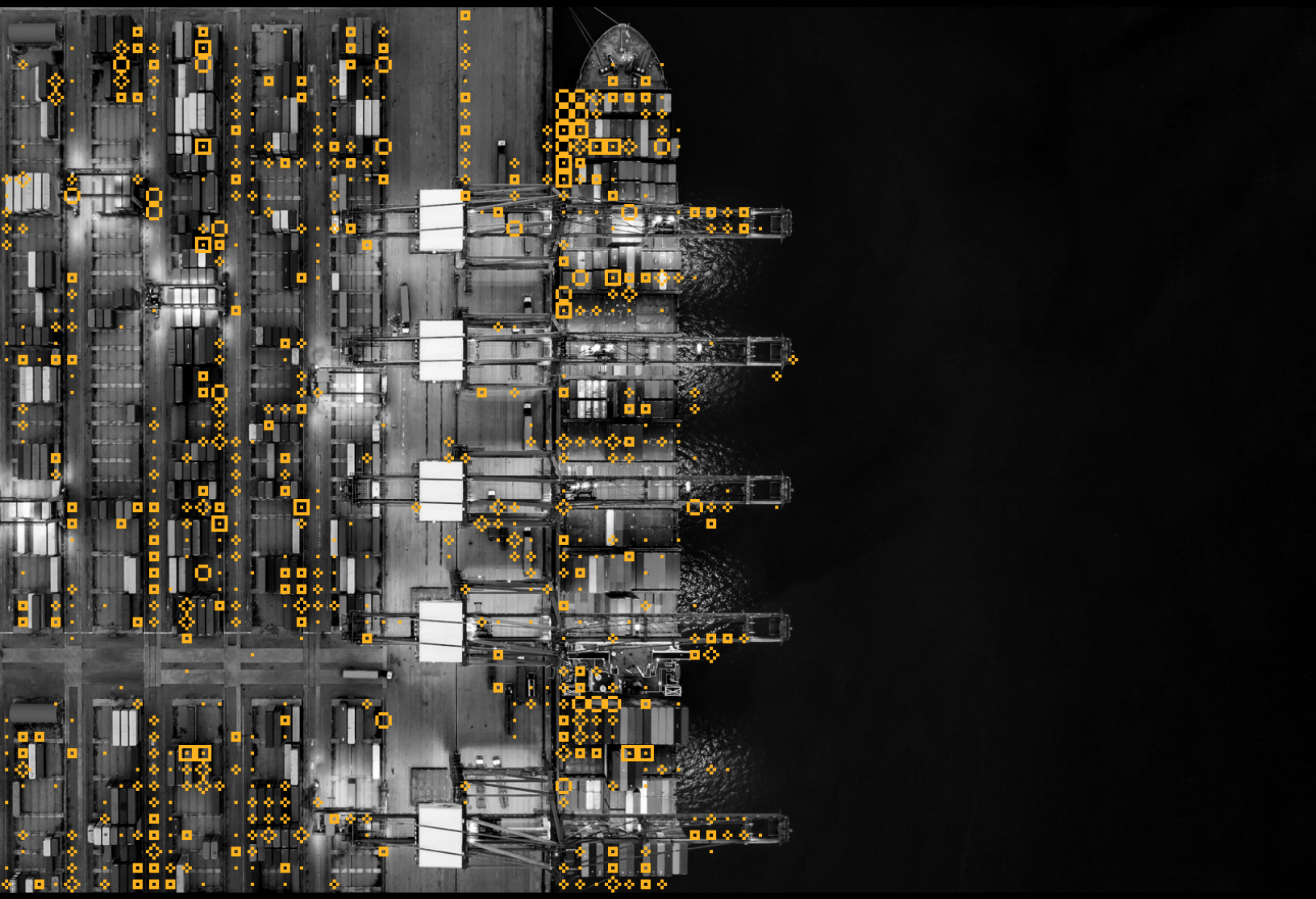
EPA (2022) - US Environmentally-Extended Input-Output (USEEIO) Models

SEC (2022) - SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors

SBTi (2018) Value Change in the Value Chain: Best Practice In Scope 3 Greenhouse Gas Management

WRI (2022) - Trends Show Companies Are Ready for Scope 3 Reporting with US Climate Disclosure Rule

[1] CDP (2021) - Engaging The Chain: Driving Speed And Scale CDP Global Supply Chain Report 2021
[2] WRI (2022) - Trends Show Companies Are Ready for Scope 3 Reporting with US Climate Disclosure Rule
[3] SEC (2022) - SEC Proposes Rules to Enhance and Standardize Climate-Related Disclosures for Investors
[4] CDP (2021) - Engaging The Chain: Driving Speed and Scale CDP Global Supply Chain Report 2021
[5] CDP (2021) - CDP Transparency to Transformation: A Chain Reaction CDP Global Supply Chain Report 2020
[6] CDP (2021) - Finance sector's funded emissions over 700 times greater than its own
[7] GHG Protocol (1997) - Corporate Value Chain (Scope 3) Accounting and Reporting Standard
[8] EPA (2022) - US Environmentally-Extended Input-Output (USEEIO) Models
[9] EPA (2022) - Supply Chain GHG Emission Factors for US Commodities and Industries v1.1
[10] SBTi (2018) Value Change in the Value Chain: Best Practice In Scope 3 Greenhouse Gas Management



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Persefoni is the leading Climate Management & Accounting Platform (CMAP). The company's Software-as-a-Service solutions enable enterprises and financial institutions to meet stakeholder and regulatory climate disclosure requirements with the highest degrees of trust, transparency, and ease. As the ERP of Carbon, the Persefoni platform provides users a single source of carbon truth across their organization, enabling them to manage their carbon transactions and inventory with the same rigor and confidence as their financial transactions.