BUYER'S BOOK **VOL III**

KEELVAR

MOVE FORWARD

How to Enact Sustainable Sourcing Today to Reduce Scope 3 Emissions

A practical guide for Procurement and Supply Chain on the use of sourcing optimization and automation to meet sustainability targets and take the lead on positively affecting global change.

Contents

FOREWORD: A Call to Urgency for Procurement

By John Muncey
Sustainable Logistics and Supply Chain Management Consultant (bio below)

The Intergovernmental Panel on Climate Change report released during the summer 2021 confirmed that Greenhouse Gas Emissions (GHG) are almost certainly to blame for increasing global temperatures and degradation in air quality levels. Critically though, it also provided an update to the "less than 2C" global temperature increase guidance previously included as part of the 2015 Paris COP 21 meeting, with the required target now "well below" 1.5C in order to avoid irreversible climate damage.

The reasons for climate change are well documented and multi-faceted, spanning all industry sectors. For Transport and Logistics specifically, it is estimated that emissions from this sector represent 16% of the total annual GHG emissions. According to the International Transport Forum's Transport Outlook 2021 report, emissions from the global Transportation and Logistics sector are forecast to grow a further 42% by 2050 (from 3.85 trillion tonnes of CO_2 in 2015 to 5.46 trillion tonnes) if the current rate of emission production continues unabated.

Despite being a major contributor, at the time of writing, most countries are yet to implement any legislation which commits Logistics Service Providers (LSPs) to report their GHG emissions or implement measures to ensure an annual reduction. As a result, despite technology being available, many service providers have failed to invest in this area and are still unable to report GHG emissions at the customer/shipment level. Of those who can report, they tend to use less-than-precise default values as they are not capturing primary data directly from their assets.

At the same time, only a relatively small number of companies have made public commitments to reduce their GHG emissions by setting Science Based Targets. Except for a handful of LSPs, these commitments tend to cover Scope 1 and Scope 2 emissions only (which emit from one's own operations), with Scope 3 that includes indirect transportation being excluded. Research has shown that Scope 3 emissions can often represent up to 70% of a company's total GHG emissions and are typically far larger than Scope 1 and 2 combined. By excluding Scope 3, companies are potentially missing the largest opportunity to reduce their total GHG emissions and to help cap Global Warming to less than 1.5C.

We have no time to lose in the battle to reduce GHG emissions. Irrespective of whether your company has set a formal Scope 3 emissions reduction target or not, the Supply Chain and Procurement community has control over its own emissions, as it is you who chooses the sourcing location, the transport mode and your service provider.

Solutions to this challenge are now supported by Keelvar's sourcing optimization and automation platform allows you to factor GHG emissions as part of your buying criteria in addition to price and service performance. This approach incentivizes Suppliers to develop reporting capability if they do not have it in place today in order to compete in your tenders, whereas those that are already reporting GHG emissions will be encouraged to refine the accuracy of their submissions in order to maximize their chances of winning.

This information allows Supply Chain and Procurement professionals to make informed decisions on supplier selection whilst simultaneously establishing a GHG baseline, if one does not exist today, or helps lower overall GHG emissions if a baseline exists.

Critically though, it focuses attention on the immediate need to start decarbonization efforts in earnest if we are to meet our climate reduction objectives.

John Muncey is a 30-year veteran of global logistics and supply chain management who is now working as a consultant on how to drive sustainability in those areas for greater global good. He recently completed the University of Cambridge's Institute for Sustainability Leadership program in sustainable supply chain management. Most recently, he was the Group Vice President for Transport and Logistics at ABB where he worked for over nine years and was involved in their application of Keelvar for sourcing optimization solutions. He spent a decade at DHL including as its VP Power & Energy Sector and Global Customer Manager, and more than nine years as the European Logistics Manager for Quest Diagnostics.

Part One: Overview of Scope 3 and Challenges

Introduction

Corporate Social Responsibility (CSR), an area which includes environmental and sustainability initiatives, saw the largest increase in CPO-level priorities in the past two years, up 22% according to Deloitte's 2021 Chief Procurement Officer Survey. The report also found that 63% of high-performing procurement organizations formally track themselves against sustainability measures. Keelvar's own fall 2021 survey of sourcing professionals finds that 72% of respondents report sustainability in the next five years will increase the most in top supplier attributes considered when making award decisions. Scope 3 emissions, which are those resulting from the activities of your suppliers, land squarely in the hands of the sourcing team to find creative solutions in order to meet sustainability goals.

However, many logistics service providers (LSPs) today aren't setting CO2 emission reduction targets or measurements. That likely means change will be driven from the buyers of those logistics services, where incentives may be at the heart of solutions to climate change. Those incentives will be communicated and delivered through sourcing that uses smarter market mechanisms designed to reward sustainability and penalize pollution. Sourcing teams at large enterprises are well placed to be critical catalysts that align incentives in order to foster sustainable supply chains; in the absence of taking on this leadership role, LSPs will be slow to change on their own. That said, the challenges are numerous. Sustainability objectives must also align with other important business goals so there is balanced decision making.

Businesses need to optimize where they invest in sustainable sourcing, so they can carefully balance trade-offs between cost, service, supplier ratification, and environmental goals.

Next-generation sourcing technology is a critical enabler for the gathering of required data and the alignment of incentives towards sustainable practices. Granular CO2 estimation and appropriate incentive management will drive significant changes, but judicious application is the best means to support adoption. Sourcing optimization is the key to unlocking a complex decision support model which will empower businesses to reach and exceed procurement goals, including greenhouse gas emission reduction. Likewise, there is only one means of ensuring that such approaches are used to precisely follow the processes and data collection standards required to truly implement best practices: intelligent automation of optimized sourcing.

In this buyer's book:

- We present the measures that are incoming for procurement including Scope 3 emissions which will drive changes in supplier selection and the de-facto international standard protocols being used to manage them.

- We present some of the geo-political and economic landscapes that are driving changes in how we have, are, and will manage greenhouse gas emissions.

- We share concepts of Game Theory to illustrate the challenges around incentives and driving desired outcomes.

- We present a practical "how-to" sourcing toolkit for reasoning at scale, by using sourcing optimization and automation to achieve best practice that will be central to sustainability in the coming years.

Though at first the challenge may appear overwhelming, this guide will provide the incentives, knowledge, and mechanisms to ensure a successful journey to sustainable sourcing.

Understanding Scope 3 and its Implications for the Sourcing Process

Greenhouse gas emissions are categorized into three groups or 'Scopes' by the most widely-used, and de facto standard, international accounting tool, the Greenhouse Gas (GHG) Protocol[1].

Scope 1 covers direct emissions from equipment or processes owned or controlled by the organization.

Scope 2 addresses indirect emissions from the generation of purchased electricity, steam, heating, and cooling consumed by the reporting company. A company that acquires its electricity from renewable generation is much more environmentally-friendly than a company that procures from a coal-burning generator.

Scope 3 includes all other indirect emissions that occur in a company's value chain. This is where the main challenge lies for companies in ascertaining their total emissions. Here, intelligent sourcing that applies both optimization and automation has a big role to play.

UK-based environmental sustainability advisory firm Carbon Trust cited in August 2021 research that shows for most companies, Scope 3 emissions represent 65% to 95% of a company's broader carbon impact — either upstream in the supply chain or downstream during the product delivery or usage lifecycle. Yet today, many enterprises do not have formal reduction targets communicated, much less reporting transparency against those targets. Instead, corporate goals may take the form of more general statements with subjective accountability measures, leading to criticisms of "greenwashing." The leaders who are setting clear targets should serve as strong examples and north stars.

Analyzing and taking proactive action on choices made in the formation of the supply chain is therefore a critical step for any business that wishes to become more sustainable and ready for a low-carbon economy.

The GHG protocol raises the challenge to companies to find a way to efficiently capture accurate and granular data from suppliers and then

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[1] Greenhouse Gas Protocol, Corporate Value Chain (Scope 3) Accounting and Reporting Standard, World Resources Institute and World Business Council for Sustainable Development, 2011, https://ghgprotocol.org/standards/scope-3-standard (accessed 9 September 2021)

reason about ways to mitigate the problem of GHG emissions. The Global Logistics Emissions Council (GLEC) developed the GLEC Framework, which is now a globally recognized methodology for harmonized calculation and reporting of the GHG footprint across the multi-modal supply chain and can be implemented by shippers, carriers, and logistics service providers. The practical guidance and solutions presented in the pages of this buyer's book support that framework.

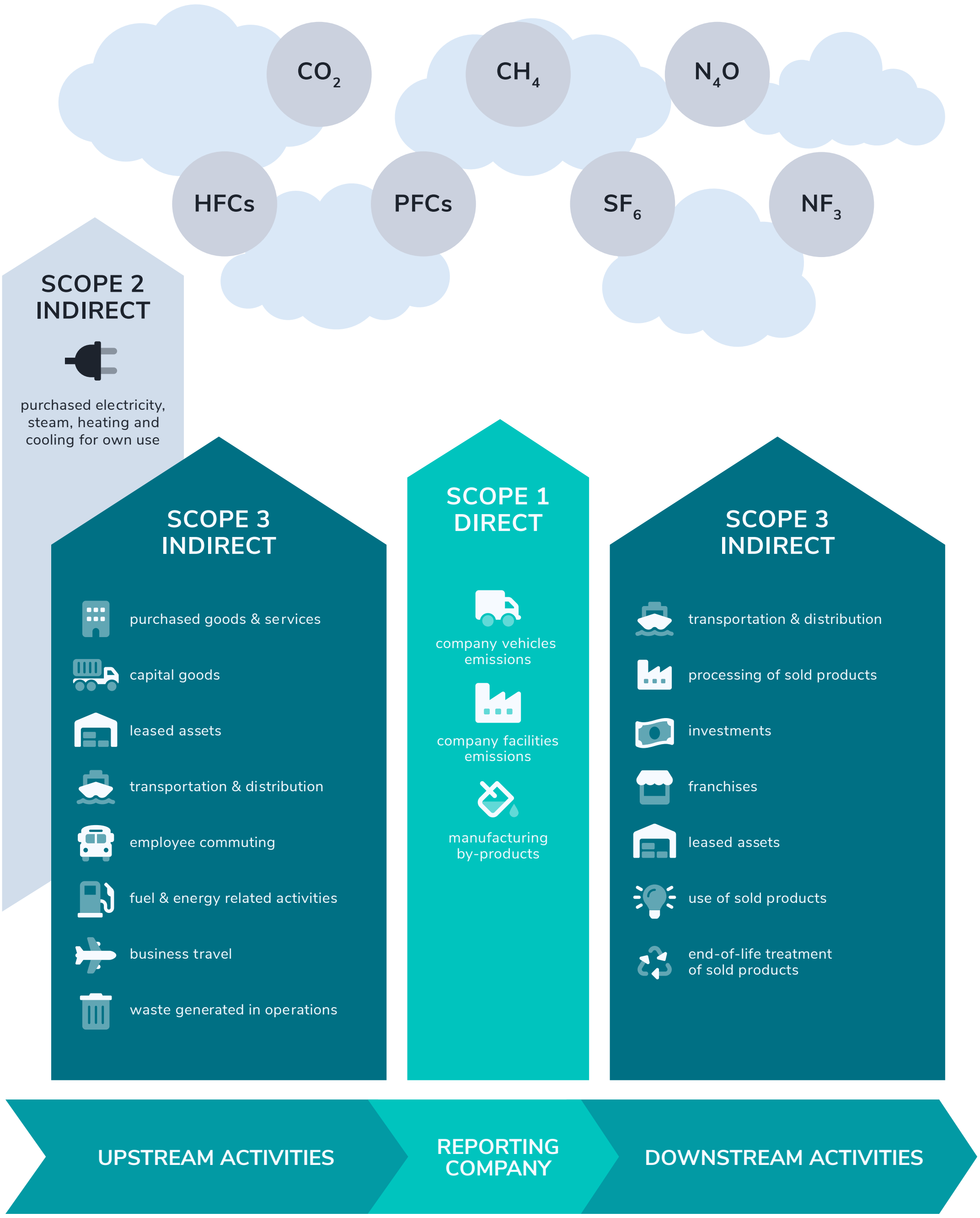


Figure 1: Illustration of the major typical contributory factors to Scope 1, Scope 2 and Scope 3 emissions. Courtesy of www.ghgprotocol.org/

A critical step in the journey to meet these goals is to enhance the sourcing process — which can't exist without a change in mindset. Basic spreadsheets can support simple analysis of expected emissions, but sustainable sourcing is costly. Businesses must optimize where they invest in sustainable sourcing so they can carefully balance trade-offs between cost, speed, incumbency switching, and environmental goals.
The capturing of data is one issue, but the reasoning required to apply this data in negotiations so that efficiencies are discovered quickly is another challenge. Fortunately, sourcing optimization is an ideal technology to address both challenges and can make this a much more manageable business process change.

Each category of goods and services that an organization procures involves choices and trade-offs. For example, in construction there are different types of concrete that are manufactured using different processes. Some processes emit large amounts of CO2 whereas others may emit much less. Likewise, the choice of insulation impacts the lifetime estimated GHG emissions from heating, so the total cost of ownership model that incorporates long run costs must be considered.

These examples illustrate that matching the data you gather to the type of good or service being procured is the essence of the challenge. Numerous environmental science groups have developed 'calculators' or 'toolboxes' to help businesses calculate emissions. This is a useful start, but for most large businesses, spreadsheets are a poor foundation with which to build something that will become critical for business operations in the future.

Robust and extensible SaaS applications that help gather data from suppliers and automate the reasoning process -- so that data cleansing, reasoning, and reporting can be automated -- are vital if sustainability is to be embedded into processes that scale.

Game Theory: Why Incentives Matter to Drive Environmental Change

Our present-day systems of international trade — with economic blocks competing against each other — served a purpose of fostering economic prosperity. A by-product of the race to reduced costs was an increase in consumption of finite resources and no penalties for externalities, i.e. costs that were imposed on everyone else.

Today we are continuously seeing a shift in how countries tackle this, but, developing countries are at a disadvantage. New approaches to jointly tackling a universal challenge are needed so that externalities are internalized and we must find ways to make sustainability as integral as cost, thus incentivizing all players to elevate this goal. The current approach unfairly imposes the cost of pollution on everybody else as a shared cost. Favoring and rewarding companies who champion sustainability will continue to speed the current evolution towards more sustainable strategies. Those who fail to promote these goals must be challenged to improve or be left behind.

Consumers have also signaled their appetite to buy more sustainably as the sales of solar panels, electric cars, battery-powered garden equipment, and other more environmentally-friendly alternatives have soared. Figure 2, data from IBM research, shows a sizable increase in the percentage of consumers placing importance on a brand's alignment with sustainability, in a recent two-year period.

How Important is Environmental Sustainability When Choosing a Brand?

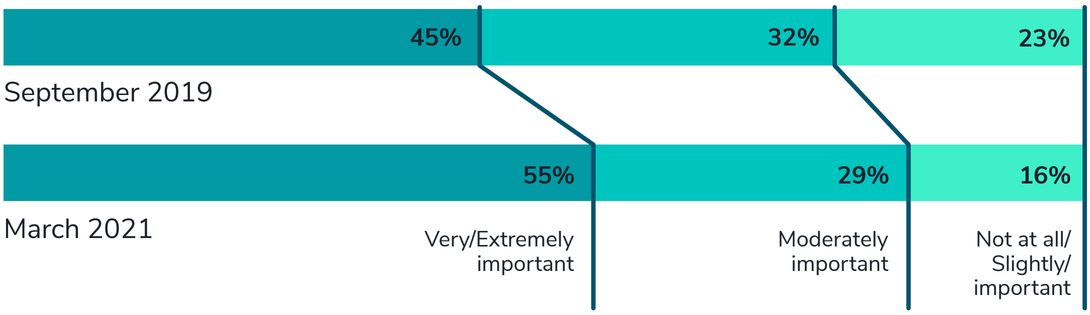


Figure 2. Source: IBM Institute for Business Value, Sustainability at a Turning Point, May 2021

Best-in-class companies are recognizing that championing sustainability can drive consumer adoption and revenue while also recognizing the potential risks of a changing political climate that does not look well upon polluters.

Here's where concepts from game theory apply: Solutions to resource allocation problems and fair division have been created in many different settings. From funding shared public amenities to splitting restaurant bills, there are known mechanisms that offer appropriate incentives for honest behavior that do not impose unnecessary costs on others.

There are also well-known unintended consequences for poorly-chosen mechanisms of resource allocation. For example, the 'tragedy of the commons' is a well-known example of a scenario where a shared resource (grazing area) may be overused by farmers to the joint detriment of all if they are all given unlimited access. Smarter mechanisms that manage incentives can improve overall welfare.

The best solutions invariably find a scheme whereby participants feel they are better off with the scheme than without. Take the example where a parent has a cake and two children, Alice and Bob, who are keen to get as much of the cake as possible. Cutting it into two equal pieces is tricky and can never be done with absolute precision. If the parent cuts the cake, each child may perceive one slice is bigger and lead to a disagreement. However, if one child is invited to cut the cake into equal pieces, say Alice, and Bob is allowed to choose his slice, Alice should be indifferent because she is content that the slices are equal. This second example allows all parties to leave with a more amicable feeling regarding resource allocation despite what was potentially the same breakout. The idea here is we can change the incentive structure and game so that all parties leave feeling it was a win/win.

Solutions stick when all parties feel they're benefiting to some extent.

In Game Theory, a solution concept known as an equilibrium relates to outcomes in which players do not have an incentive to switch from the way they are playing the game.

We assume that global actors in international trade will act in their own self-interest. Therefore, the key is to motivate the will to follow the rules, to better align them with reducing greenhouse gas emissions, and this is where sourcing teams can exert influence on a more "localized" level.

Presently, most sourcing processes make award decisions based on the deliverables and are less focused on the underlying process for manufacturing the packaging materials or producing the cotton shirt. The old maxim, you can't manage what you can't measure, needs to be wrestled with in order to facilitate change. This is where sourcing optimization and sourcing automation have an important role to play. In order to know who is polluting and who is acting sustainably, and to what degree, it's important to understand the supply chain and trace the emissions back to the source of goods and services. This will allow buyers to bias in favor of sustainability while also creating an incentive for suppliers to adapt their processes.

Greenhouse gas emissions are a by-product of our thirst for energy-intensive products and services. Consumption must be adapted in favor of sustainable alternatives. Economic mechanisms whereby sustainable alternatives are rewarded are the essential ingredient for restoring balance in the world's carbon cycle. The crux of the problem for sustainability is that information is being lost along the supply chain; sourcing is a key step to unlocking the requirement to adapt towards sustainable processes.

Mechanism Design for Sustainable Sourcing

The obvious solution to the problem of greenhouse gas emissions is to stop emitting so much greenhouse gas. However, the problem is that this joint goal puts the different countries of the world into hot debate with each other because we are witnessing a tragedy of the commons occurring on a global scale. Our atmosphere is the commons, and individual countries gain more by engaging in activities that pollute this atmosphere because that cost is passed onto everybody.

How do we square the circle of fair division of costs for reducing pollution? Mechanism Design is central to solving this challenge. It can be used to calculate appropriate incentives for switching so that companies and individuals have an impetus to become sustainable. While global politics will play an important role in encouraging (if not ultimately prescribing) some of these mechanisms, businesses will be responsible for operationalizing them. Implementation throughout supply chains and in particular, the act of sourcing, will play an integral role. What follows in this paper is a practical guide for helping to achieve these goals through the use of sourcing optimization solutions.

Mechanism Design can assist all stakeholders as we shift towards a more climate-forward strategy.

Part Two: Practical Sourcing Guide

Sourcing Optimization to Minimize GHG Emissions Alongside Cost: Bid Event Design

It's time to run a sourcing event that factors in sustainability in the decision. The first step is to design a competitive bidding process that invites suppliers to submit bid data and information that enables the sourcing team to analyze trade-offs.

Digital transformation has a significant role to play in decarbonizing supply chains at scale. Relevant emission or environment-impacting data that reside with transportation companies — and which often remain siloed or underutilized — must be integrated into systems that can leverage the information for the benefit of sustainability initiatives.

While most large, sustainability-focused organizations have a clear picture of their Scope 1 and Scope 2 emissions, Scope 3 emission data can be more elusive, often being hidden deep in the supply chain. For organizations that want to truly understand and track their Scope 3 emissions, the key is to not only surface the data, but to actively incorporate it into their supply chain and procurement processes. sourcing optimization provides the best means of achieving this at scale where suppliers' emission data can be ingested, measured, and analyzed as part of the tendering process.

A key difference between ordinary eSourcing and sourcing optimization is that the latter offers a solver to analyze complex trade-offs between multiple objectives. Mathematical solvers can quickly compute the best combinations of conditional offers that suppliers may be willing to offer. Optimization enables expressiveness from suppliers and also enables nuanced trade-off analysis in scenarios where multiple objectives need to be considered. Sourcing optimization is frequently used in transportation events because time and cost trade-offs are an essential aspect of making award decisions. Adding a third dimension of sustainability allows you to evaluate the cost and service changes associated with a lower carbon strategy, quantifying the business impact to drive executive decisions.

While competing suppliers will have different equipment and processes that lead to alternative options in cost, speed, and emissions, a single supplier may provide varying grades of solutions, from basic to premium, so they typically wish to communicate alternatives in their offers. These grades usually involve price trade-offs, so it's important for the procurement team to elicit this information rather than limiting options too soon.

A well-designed sourcing optimization tool permits suppliers to suggest their own alternatives above and beyond those of your team, leveraging their category knowledge to drive innovation. Through optimization we can leverage the power of data to evaluate these alternatives versus our perceived standard and drive step changes in our organizational performance.

Bid Sheet Design - A Worked Example in Road Transportation

Sustainable sourcing calculations can be worked into many different categories — from logistics to packaging to indirect facility services. Logistics is certainly "low hanging fruit" due to its size and frequency of use in supply chains, spanning ground, sea, and air freight movement. In the example that follows, we focus on a full truckload use case, to clearly introduce the mechanism and data collection concepts in a category that can be broadly understood by all of us, since we are all familiar with road-based vehicles. We will also show product screenshot examples from Keelvar's Sourcing Optimizer product for illustrative purposes.

To build a sourcing process that can support sustainability objectives in road transportation, we must first identify key vehicle components that contribute to the variability in the greenhouse gas emissions produced by vehicles. It is well-established and understood that the type of fuel used by a vehicle affects the amount of carbon emissions it produces. Because different fuel types emit different levels of greenhouse gases, it is critical to capture the fuel type being used by a supplier's vehicles. However, vehicle emissions are not solely dependent on fuel type.

The vehicle class type, whether it is a light goods vehicle, medium-duty truck, or heavy-duty truck, significantly impacts its emissions. In 2020, road freight transport produced almost 2.4 billion metric tonnes of carbon dioxide globally[2]. A breakdown based on vehicle type highlights the stark differences in the emissions produced by light goods, medium-duty, and heavy-duty vehicles.

[2] Statista, Road freight fleet emissions worldwide as of 2020, by vehicle type [website], https://www.statista.com/statistics/1200116/road-freight-emissions-by-vehicle-type-worldwide/ (accessed September 14 2021)

- Light goods vehicles (<3.5 tonnes): 144 million vehicles produced approximately 600 million tonnes of CO_2.
- Medium-duty trucks (3.5-15 tonnes): 36 million vehicles produced approximately 600 million tonnes of CO_2.
- Heavy-duty trucks (>15 tonnes): 27 million vehicles produced approximately 1.2 billion tonnes of CO_2.

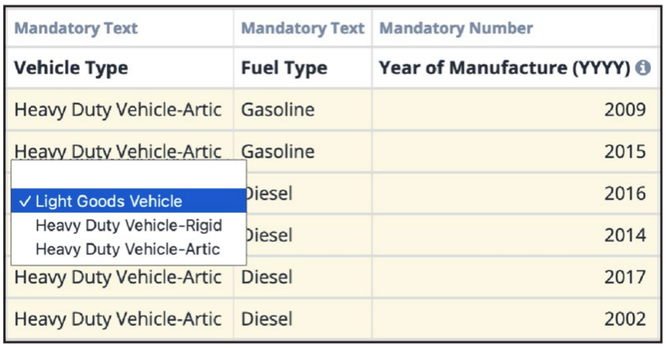
The sheer disparity in emissions produced per vehicle type precludes the use of supplier fleet averages as a metric with which to measure transportation and distribution emissions, although admittedly in some situations, you may need to work with best-available data today and develop a roadmap for improving with more specific data collection over time.

A vehicle's emissions control technology also affects its emissions. Older vehicles produce more emissions because they use less effective emissions control technologies and may have been built to less rigorous emission standards. And, as vehicles age, their emissions control technologies deteriorate, leading to increased emissions. Thus, the age of a vehicle provides useful and relevant data that can be leveraged to calculate emissions with even more precision.

These three vehicle components — fuel type, vehicle type, and vehicle age — contribute to a vehicle's total emissions. Any process that aims to accurately account for the Scope 3 emissions produced in road transportation must capture these data.

Capturing Supplier Vehicle Data

Sourcing optimization provides a means of gathering the data required to calculate emissions from suppliers during the bidding stage. In the same way that suppliers are asked to submit standard data, such as the origin, destination, chargeable weight, and type of service, in a transport event, we can design bid sheet columns that enable suppliers to enter information about the vehicles that will be used to transport the goods — even if these are best estimates at this point. By providing a bidder-input column for each component, we can specify the vehicle data we want from suppliers that will be used to assess their emissions.



Mandatory Text	Mandatory Text	Mandatory Number
Vehicle Type	Fuel Type	Year of Manufacture (YYYY)
Heavy Duty Vehicle-Artic	Gasoline	2009
Heavy Duty Vehicle-Artic	Gasoline	2015
✓ Light Goods Vehicle	Diesel	2016
Heavy Duty Vehicle-Rigid Heavy Duty Vehicle-Artic	Diesel	2014
Heavy Duty Vehicle-Artic	Diesel	2017
Heavy Duty Vehicle-Artic	Diesel	2002

Figure 3. Bidder-input columns to capture vehicle component data, example from Keelvar's Sourcing Optimizer

Information about three vehicle components that contribute to transport emissions — the type of vehicle, the fuel type used by the vehicle, and the year of manufacture — is captured for each lane. This lane-level approach to capturing the vehicle data is highly granular and provides the perfect platform for the next step in the process: applying the emission factors.

Calculating Emissions Factors

An emission factor is a value that relates the quantity of a pollutant with an activity associated with the release of that pollutant into the atmosphere. While the predominant greenhouse gas released by vehicles is carbon dioxide (CO2), nitrous oxide (N2O), and methane (CH4) are also emitted. Assessments or models of GHG emissions that do not account for these gases fail to capture the true impact of transportation on global warming and the environment. There are established emission factors for CO2, N2O, and CH4 for freight transport and these data can be easily incorporated into a sourcing process that aims to capture and apply emission factors at a granular level.

By using formulas, we can leverage the data provided by suppliers to ascertain the applicable emission factors. Although we require that suppliers only enter data for three components that impact emissions — fuel type, vehicle type, and vehicle age — we can determine the emission factor for multiple greenhouse gases from these data.

The CO2, N2O, and CH4 emission factors for distance traveled are applied based on vehicle fuel type, vehicle type, and vehicle age. The emission factors used are from The Greenhouse Gas Protocol[3].

[3] Greenhouse Gas Protocol, 'Emission Factors from Cross Sector Tools' (2017), Transport Vehicle Distance tab, https://ghgprotocol.org/sites/default/files/Emission_Factors_from_Cross_Sector_Tools_March_2017.xlsx (accessed September 16 2021)

Mandatory Text	Mandatory Text	Mandatory Number				
Vehicle Type	Fuel Type	Year of Manufacture (YYYY)	CH4 (g/mile)	N2O (g/mile)	CO2 (kg/mile)	CO2 (g/mile)
Heavy Duty Vehicle-Artic	Gasoline	2009	0.033	0.018	1.493	1,493.220
Heavy Duty Vehicle-Artic	Gasoline	2015	0.033	0.018	1.493	1,493.220
Light Goods Vehicle	Diesel	2016	0.001	0.002	0.627	626.543
Heavy Duty Vehicle-Artic	Diesel	2014	0.005	0.005	1.720	1,720.339
Heavy Duty Vehicle-Artic	Diesel	2017	0.005	0.005	1.720	1,720.339
Heavy Duty Vehicle-Artic	Diesel	2002	0.005	0.005	1.720	1,720.339

Figure 4. Bidder-input columns and calculated emission factors, example from Keelvar's Sourcing Optimizer

Figure 4 shows how by using formula columns, Sourcing Optimizer can automatically apply the relevant emission factors to the vehicle data entered by suppliers. Note: The formulas used for each emission factor column are provided in Appendix A.

Different gases have different effects on global warming. The global warming potential (GWP) of a gas refers to the heat it absorbs in the atmosphere as a multiple of the heat absorbed by an equivalent mass of carbon dioxide. We can use the GWP index[4] to calculate the carbon dioxide equivalent (CO2e) of CH4 and N2O. This converts each emission factor to a single unit of measurement, which we can then sum to get the total emission factor for each lane, making the analysis of supplier sustainability more tangible.

CH4 (g/mile)	N2O (g/mile)	CO2 (kg/mile)	CO2 (g/mile)	CH4 GWP	N2O GWP	Total GWP
0.033	0.018	1.493	1,493.220	0.815	5.275	1,499.310
0.033	0.018	1.493	1,493.220	0.815	5.275	1,499.310
0.001	0.002	0.627	626.543	0.025	0.447	627.015
0.005	0.005	1.720	1,720.339	0.128	1.430	1,721.897
0.005	0.005	1.720	1,720.339	0.128	1.430	1,721.897
0.005	0.005	1.720	1,720.339	0.128	1.430	1,721.897

Figure 5. Emission factors converted to CO2e to calculate the GWP, example from Keelvar's Sourcing Optimizer

Now that we have the total emission factors, we can build scenarios that optimize for sustainability in the supply chain and reward more environmentally-friendly suppliers.

[4] Greenhouse Gas Protocol, 'Global Warming Potential Values' (2016), https://www.ghgprotocol.org/sites/default/files/ghgp/Global-Warming-Potential-Values%20%28Feb%2016%202016%29_1.pdf (accessed September 17 2021)

Orthogonal Approaches to Optimizing Sustainability

When a business decides to optimize for sustainability, they must implement a mechanism which prioritizes sustainable suppliers over others. Businesses can opt for a penalty mechanism that imposes an explicit bias against polluters and thus reduces the likelihood that they will be awarded lanes. They can make the penalties proportionate to the excessive emissions levels — potentially on a progressive scale — so that particularly egregious polluters are more heavily disadvantaged. This is very much the “stick” approach to incentivization.

However, an alternative approach, and one that facilitates incremental sustainability improvements, focuses on budget allocation. Businesses can assign a proportion of their spend to sustainable sourcing, and optimize for sustainable suppliers within that budget. Sourcing teams can control how much spend they can feasibly allocate to sustainability objectives in each event. From there, Sourcing Optimizer, using scenarios and business rules, can provide the optimal award outcomes to support these business goals. Suppliers that use modern fleets equipped with sophisticated emissions control technology, and thus pollute less, will be awarded more of this sustainable sourcing budget as a result. This is the “carrot” approach to incentivization.

We can use a scoring-based mechanism design to examine supplier performance in terms of cost and sustainability. Two bid sheet columns are essential to this design:

- **Price:** The bidder-input column featuring the price entered by each supplier for each lane they are bidding on.
- **Total GWP:** The column that calculates the total emissions factor.

We create a series of feedback formula columns based on an X/Y split, where X is the weighting assigned to Price, and Y is the weighting assigned to Total GWP. The sum of X and Y must equal 100.

Formula: `(Price/xMEDIAN(Price)) * X + (Total GWP/xMEDIAN(TotalGWP)) * Y`

Each variable is divided by its own respective median value. This is because we must first standardize both variables before summing them together as each uses different units of measure and the scales are also not guaranteed to be equal.

The median is used as a measure as it is not affected by the presence of outliers unlike other summary statistics such as the mean, and as a result, bidders are more fairly penalized or favored. We use Sourcing Optimizer's xMedian function to get the median of the values across bidders for both Price and Total GWP.

The standardized variables are then multiplied by their respective weights. If X > 50, we are ensuring a greater bias towards Price. If X < 50, we are ensuring a greater bias towards Total GWP. If X = 50, and Y = 50, we are providing equal bias towards Price and Total GWP.

For example, the following split applies a weighting of 90 to cost and 10 to total emissions:

```
(Price/xMEDIAN(Price)) * 90 + (Total GWP
xMEDIAN(TotalGWP)) * 10
```

Finally, as both variables are standardized and the weights have been applied, both variables must be summed together. This produces a final calculation that is used to rank the bidders on both their Price and Total GWP inputs.

By creating scenarios for each Price/Total GWP split, we can evaluate the cost of each and determine the most sustainable scenario within our allocated budget.

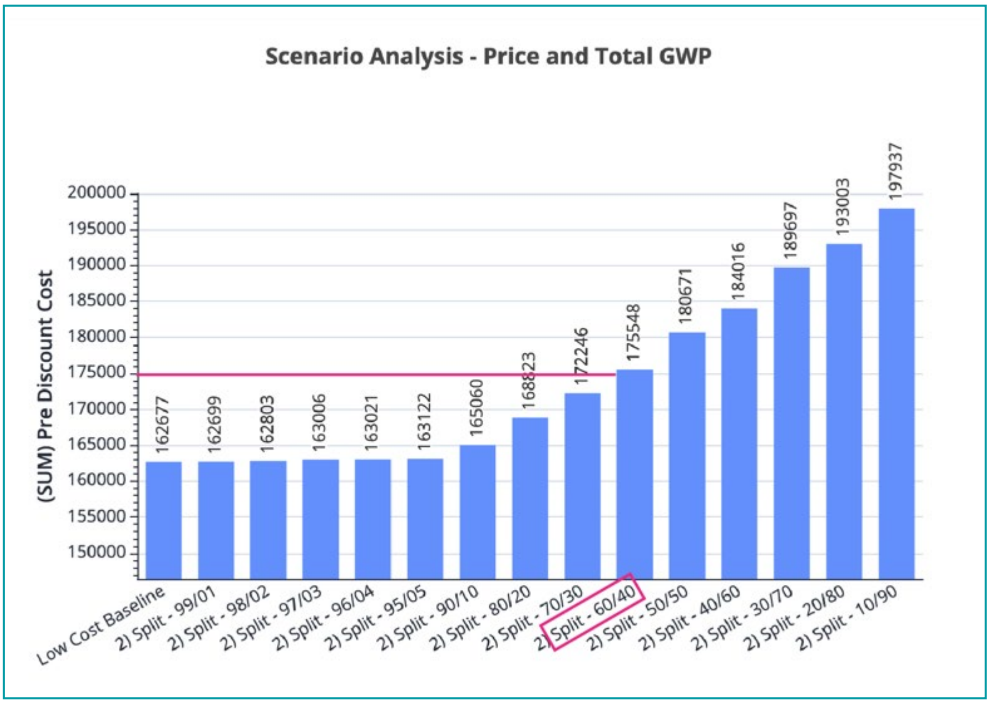


Figure 6. Visualization of all scenarios

Figure 6 is a visualization of all configured split scenarios and the Low Cost Baseline, which optimizes for lowest cost only. The visualization clearly demonstrates the escalating costs that will be incurred by weighting too heavily in favor of sustainability. However, depending on a business's budget and sustainability objectives, there is a lot of scope to incorporate sustainability without sacrificing significant additional spend.

For example, if our budget allows us to spend up to $175,000 as long as sustainability objectives are met, we can see from this scenario visualization that we can almost afford a 60/40 Price/Total GWP split. To identify the exact scenario required to bring us within budget, we can run additional scenarios between 65:35 and 61:39 Price:Total GWP splits. Using this scoring mechanism, a sourcing team's analysis can be as granular as required to identify the optimal trade-off between cost and sustainability.

In Summary: Putting Sustainable Sourcing Into Practice

By leveraging all of the above tools and strategies, a business can not only drive innovation from their suppliers to identify opportunities in their network, but they can bring quantitative data, without burdening a purchasing team. Such data will drive companies to make informed decisions about the impact they want to have on the environment and how it will in turn impact their competitiveness.

Leveraging suppliers as partners, and sources of data, can help unlock unexpected opportunities to meet sustainability goals, but without optimization it can be cumbersome or impossible to evaluate your options. Through intelligent sourcing optimization, we can build processes that simplify and standardize this process in a way that results in digestible decision support analytics.

Businesses must adapt to the increasingly volatile world we live in, as well as to meet new regulations and satisfy consumer preference. It will be the more agile and accountable companies who thrive in the current and future business environments.

Appendix

Cost Model Formulas for Sustainable Sourcing Optimization

The following formulas are based on calculations available in Keelvar's Sourcing Optimizer product.

COLUMN	FORMULA
CO2 (kg/mile)	`IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),0.54382716, IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),0.54382716, IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),0.54382716, IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),0.54382716, IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),0.54382716, IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),0.54382716, IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Diesel"),0.62654321,`  `IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),1.001136364, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),1.001136364, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),1.001136364, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),1.001136364, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),1.001136364, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),1.001136364, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Diesel"),1.153409091,`  `IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),1.493220339, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),1.493220339, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),1.493220339, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),1.493220339, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),1.493220339, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),1.493220339, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Diesel"),1.720338983,0)))))))))))))))))))))`
CO2 (g/mile)	`CO2 (kg/mile) *1000`

CH4 (g/mile)	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),0.0346,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),0.0151,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),0.0178,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),0.0155,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),0.0152,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),0.0157,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Diesel"),0.001,
	
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),0.0493,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),0.0528,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),0.0546,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),0.0533,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),0.0341,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),0.0326,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Diesel"),0.0051,
	
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),0.0493,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),0.0528,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),0.0546,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),0.0533,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),0.0341,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),0.0326,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Diesel"),0.0051,0
	))))))))))))))))))))

CO2 (g/mile)	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),0.0621,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),0.0164,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),0.0228,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),0.0114,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),0.0132,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),0.0101,
	IF(AND(Vehicle Type="Light Goods Vehicle",Fuel Type="Diesel"),0.0015,
	24
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),0.1092,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),0.1235,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),0.1307,
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),0.124,

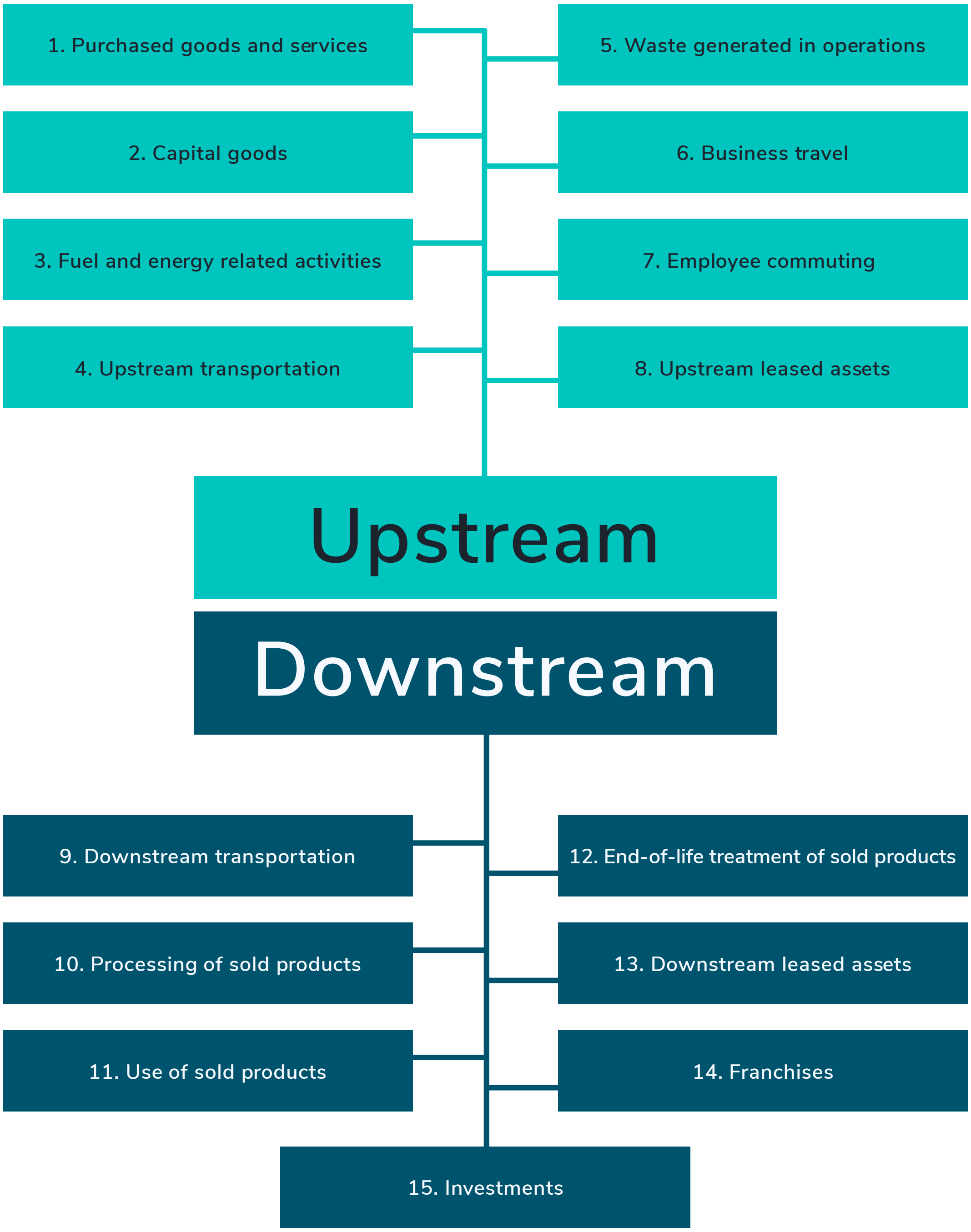
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),0.0285, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),0.0177, IF(AND(Vehicle Type="Heavy Duty Vehicle-Rigid",Fuel Type="Diesel"),0.0048,
	
	IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2000),0.1092, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2001),0.1235, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2002),0.1307, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2003),0.124, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)=2004),0.0285, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Gasoline",Year of Manufacture (YYYY)>=2005),0.0177, IF(AND(Vehicle Type="Heavy Duty Vehicle-Artic",Fuel Type="Diesel"),0.0048,0))))))))))))))))))))

CH4 GWP	CH4 (g/mile)*25
N2O GWP	N2O (g/mile)*298
Total GWP	CH4 GWP+ N2O GWP+ CO2 (g/mile)
X/Y Split	Price/xMEDIAN(Price)) * X + (Total GWP/ xMEDIAN(Total GWP)) * Y

Sources and Additional Reading:

- Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Standard
- Science-based Targets for Ambitious Corporate Climate Action
- Deloitte's 2021 Global Chief Procurement Officer Survey
- Deloitte's 2021 Global Chief Procurement Officer Survey - Infographic
- IBM Institute for Business Value: Sustainability at a Turning Point, May 2021
- The Global Logistics Emissions Council (GLEC) Framework
- Statista: Road Freight Fleet Emissions Worldwide as of 2020, By Vehicle Type
- Food Industry Executive: Sustainable Sourcing and Supply Chain Agility, June 2021
- Inbound Logistics: You Bet, We Still Care About Sustainability, June 2021
- Future of Sourcing Digital: Greener Procurement Grows With Optimization, May 2021
- Keelvar's 2021 Voices of Sourcing Report: Sourcing In Flux Amidst Current and Future Challenges

The Scope 3 Standard Identifies 15 Categories of Value Chain Emissions



About Keelvar

Founded in 2012, Keelvar is moving procurement forward with our best-in-breed SaaS software for intelligent sourcing optimization and automation, designed for easy adoption, scale, and productivity. Our customers are global, blue-chip corporations and mid-sized companies using our solutions across transportation, direct materials, indirect goods and services, and packaging categories.

Contact us for pricing and a demo: **www.keelvar.com**

About Our Charity Partner

Keelvar donated in 2021 to help improve our world, through One Tree Planted, a 501(c)(3) nonprofit on a mission to make it simple for anyone to help the environment by planting trees. Their projects span the globe and are done in partnership with local communities and knowledgeable experts to create an impact for nature, people, and wildlife. Reforestation helps to rebuild forests after fires and floods, provide jobs for social impact, and restore biodiversity. Many projects have overlapping objectives, creating a combination of benefits that contribute to the UN's Sustainable Development Goals.

To learn more, visit **onetreeplanted.org**


Keelvar

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THE PRESENT CERTIFICATE IS AWARDED TO PRIVILEGED AND DISTINGUISHED PARTNERS OF ONE TREE PLANTED WHOSE CONTRIBUTIONS HAVE BEEN AND CONTINUE TO BE, ESSENTIAL TO THE REFORESTATION, CONSERVATION AND PROTECTION OF FORESTS AROUND THE WORLD.

Matt Hill

MATT HILL

CHIEF ENVIRONMENTAL EVANGELIST

ONE TREE PLANTED

September 14, 2021

DATE

YOU CHANGED THE WORLD