



Quick-Start Guide to GHG Modeling for Sustainable, Profitable Supply Chains



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The term “sustainability” is thrown around so much in marketing jargon that it can feel like a buzzword, but the reality is that thriving as a business in the 21st century requires a sustainable approach. The good news is that it doesn’t require a massive investment of time or money to introduce more sustainability into your supply chain design. With the right tools and some basic knowledge, you’ll be on your way to reducing greenhouse gas emissions (and thus, your carbon footprint).

This guide will help you answer some of the common questions organizations have about greenhouse gas emissions in the supply chain:

- What are the benefits of reducing GHG emissions?
- How do we start calculating and reporting carbon emissions?
- How can we identify where emissions are coming from across the supply chain?
- How do we balance profit against reducing emissions?

Key Terms

Before we dive in, let's identify a few key terms you'll see in this guide.

Carbon Footprint:

A calculation of the total amount of greenhouse gas emissions generated by an individual's or an organization's actions.

Greenhouse Gas

(GHG): A gas that absorbs and emits radiant energy at thermal infrared wavelengths, including water vapor, carbon dioxide, methane, nitrous oxide, and ozone.

Emissions:

As used within discussions about environmental impacts, emissions are the greenhouse gases released into the air as a result of activities like burning fossil fuels and industrial agriculture. Emissions are produced throughout supply chains.

Net Zero: The ultimate goal of climate change reform is to achieve a perfect balance, a "net zero" balance, between the amount of greenhouse gases produced and removed from the Earth's atmosphere.

Sustainability: McGill University offers a fantastic definition: "Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs."

Why Should My Company Take Action Now?

Apart from tackling greenhouse gas emission rates because it's the right thing to do for the environment in the short and long term, there are several other compelling reasons to take a proactive approach to understanding greenhouse gas emissions across your supply chain:

- **There's a cost to climate events - for governments and corporations.** According to the National Oceanic and Atmospheric Administration (NOAA), the cost of climate and weather disasters in the United States last year totaled more than \$165 billion—the third most costly year on record. For corporations operating in these regions this means supply disruptions, demand shifts, productivity slow downs, and increased costs to re-build or re-deploy assets. Mitigating these events in the future should be top of mind for all companies if they think about this issue in terms of dollars and sense.
- **Customers want you to reduce your carbon footprint.** According to a [2021 survey](#), four out of five people surveyed across seven major industrial countries say it is important or very important that corporations commit to becoming net zero. The same survey revealed that younger generations, in particular, say that emissions commitments influence their willingness to buy goods from a given company.
- **You don't want to work with suppliers that wind up on the wrong side of the regulatory agencies.** There are several hefty fines that can be levied by agencies like the EPA. [Clean Air Act violations](#), for example, can be assessed at a rate of \$37,500 per day, per violation. Large fines are inevitably passed through to clients, driving up the cost of doing business with producers that are slow to adopt emissions reduction techniques. Given the increasing global pressure on the U.S. to reduce its overall carbon emissions, more regulation in the future is inevitable.
- **Reducing greenhouse gas emissions can help you uncover hidden cost savings throughout your supply chain.** New partnerships with eco-forward suppliers and service providers are one way this can happen. Optilogic's Cosmic Frog greenhouse gas model can help organizations compare scenarios that could include hidden cost savings found by changing transportation routes, opting to relocate distribution centers or reconsidering where to source raw materials.



The Challenges of Reducing Greenhouse Gas Emissions in the Supply Chain

A World Economic Forum survey identifies three primary challenges impacting supply chain emission reductions:

1. Lack of Standardization

Unfortunately, there isn't an overarching standard for reporting emissions (though many organizations are required to report them in various ways). This presents significant challenges when it comes to comparing and contrasting carbon emission rates. It can also be difficult to find reported data in the first place. While some organizations are proactive and transparent and share their emissions-related data freely, others are more reluctant to publish these figures or simply lack the technology to do so in an efficient way.

2. Lack of Scaled Solutions

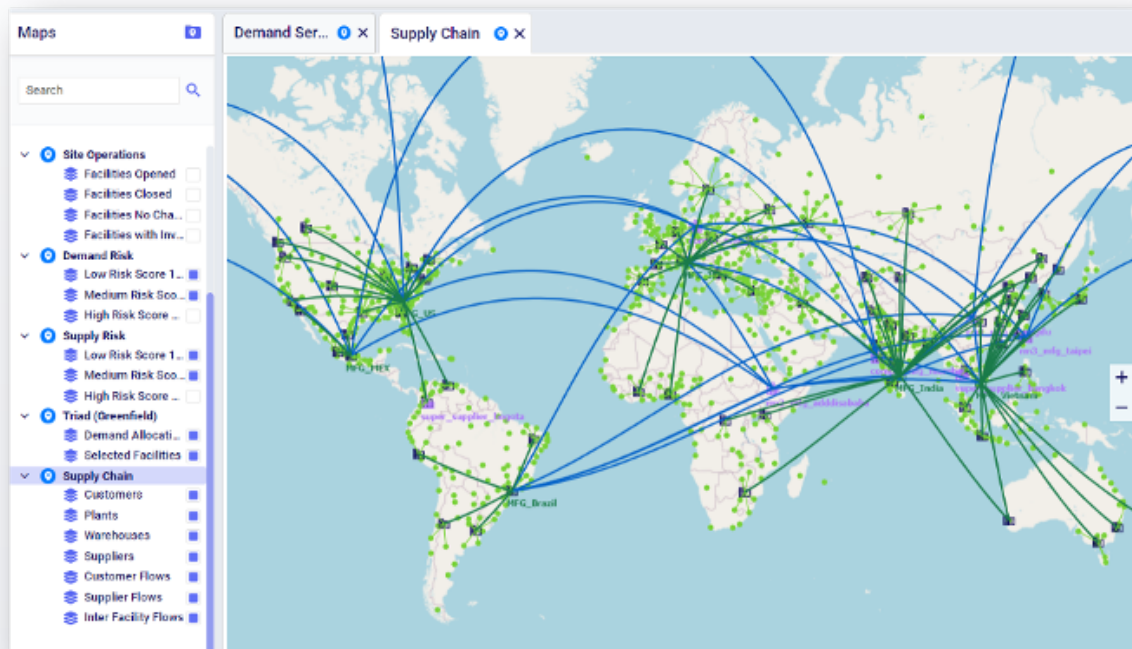
Legacy technology can't keep up with the speed and breadth of scaling that large organizations strive to achieve. Supply chain management tools that don't include a truly scalable framework are limited in their ability to consider impacts related to environmental sustainability.

3. Competing Organizational Objectives

Sometimes, it can be a hard sell to explain the need to invest in sustainable supply chain design to organizational stakeholders working in capacities unrelated to supply chain issues. "If it's not broken, don't fix it" is a common mantra.



Every Supply Chain Design Decision Has an Environmental Impact



Historically, organizations have made supply chain decisions primarily based on cost and service. Today the scope of supply chain network design has widened to include financials, service, risk, and ESG metrics. A growing number of supply chain leaders are beginning to quantify sustainability metrics as part of strategic supply chain design decisions.

Traditional supply chain network design inputs/outputs:

- How we ship
- Where we produce
- Our desired service goals
- Profit and cost goals
- How we distribute

Sustainability inputs/outputs:

- Scope 1-3 CO2 emissions
- Water usage
- Power sources
- Recycling flows and landfill impact
- Fair trade certified sources

Supply Chain Design Facilitates Sustainability and Profitability

Taking a truly proactive approach means that sustainability must be considered at the supply chain design level. Great news— that's where Optilogic shines, and, thanks to the Cosmic Frog supply chain design platform, making smart, eco-forward strategic supply chain decisions is easy.

What is Cosmic Frog, anyway?

Cosmic Frog is the only supply chain design platform that is 100% SaaS-based and balances cost, service, and risk for more resilient supply chains amid volatility.



Supply chain design technology enables you to evaluate strategic, systemic changes. It does this by creating digital models of the future supply chain to test the impact and performance of multiple alternatives.

Because Cosmic Frog is the only supply chain design solution that offers optimization, simulation, and risk analysis across an end-to-end supply chain in a single platform, you can start making more informed decisions beyond just cost. That includes considering GHG emissions and other sustainability metrics in strategic design decisions.

You Can Use Cosmic Frog to:

Understand how your business is performing against sustainability metrics: Dive deeply into emissions level scenarios, supported by data from sources like the [Greenhouse Gas Protocol](#) that set emissions benchmarks and help companies quantify carbon emissions.

Not sure where emission rates are highest along your network? Cosmic Frog can help you pinpoint those areas so you can prioritize impactful environmental decision-making.

Model and optimize the end-to-end supply chain according to your CO2 goals: Use sequential optimization in Cosmic Frog to constrain the model subject to the CO2 limit you're aiming for. Evaluate the effect on elements such as production, transportation, and sourcing across the supply chain.

Evaluate strategies for water usage, packaging reduction, and more: It's not just about modeling and reducing CO2. It's also critical to consider factors such as water resource usage and packaging. With Cosmic Frog you can model critical resources and make plans for how to reach goals. Tie in circular supply chain metrics and emissions and contributions to landfill from cradle to grave.

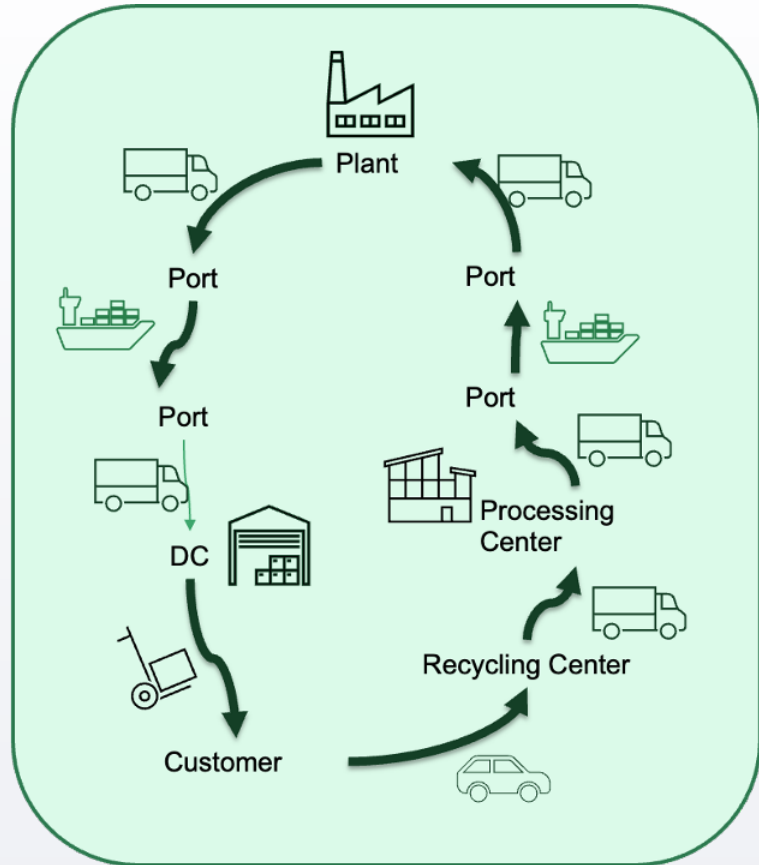
Model sustainability risk factors:

Evaluate sourcing and manufacturing options according to numerous risk factors including natural and climate related risk, economic resiliency risk, and fair trade labor source risk. Because Cosmic Frog provides a risk score on every scenario run, you can take understand how risky your supply is across a number of metrics and develop a proactive approach to reduce risk.

Take a long view of the environmental and financial implications of supply chain decisions:

Using Cosmic Frog you can trade off the cost, service, risk, and sustainability factors of strategic decisions, including:

- Supplier choice
- Distribution locations
- Transportation details
- Natural disaster risk
- Recycling and re-use processes
- Much more



Best of all, you'll be able to see how making even small changes can lead to improved sustainability across your supply chain design—there's no need to wait 'til all your ducks are in a row to get started.

How Does the Cosmic Frog Greenhouse Gas Model Work?

Cosmic Frog is a great way to assess the financial, service, risk, and ESG (CO₂, water and packaging) trade-offs of potential supply chain changes.

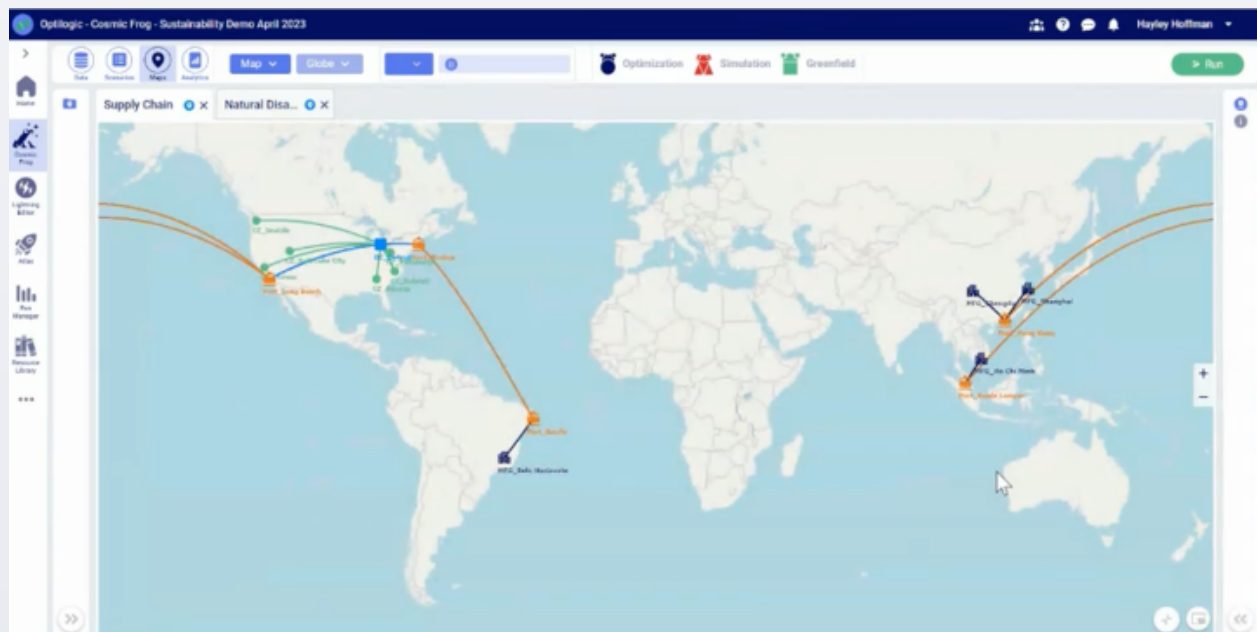
In this simple example, a company wanted to explore:

- Can we reduce CO₂ emissions without significantly increasing costs?
- Should we move our China facilities? How does this impact CO₂, cost, service, and risk?
- Can we improve water usage during production and packaging efficiency to reduce landfill waste?
- What are our recycling flows, costs, and CO₂?

Develop a Baseline Model

The baseline is the starting point for any supply chain design analysis. Optilogic offers tools to help you get started quickly with your baseline. Use the technology filters in Cosmic Frog to filter on the required data elements for building your baseline. Upload data directly from spreadsheets, an ETL tool or other options. The baseline scenario is automatically created, so you only need to click “Run.”

The starting point for this analysis is a baseline scenario showing all manufacturing facilities.



Customize Model Data

Data components of the model are:

- Customers
- Facilities
- Sourcing
- Production policy
- Demand

You can also include and customize policies such as inbound and outbound stocking policies, capacities, and transportation costs.

VariableName	OriginName	DestinationName	Coefficient	Type	UOM	FacilityName
FGTransportEmissions	Port Long Beach	DC_Detroit	25.764246297533943	Flow	EA	
FGTransportEmissions	Port Boston	DC_Detroit	6.68623224764942	Flow	EA	
FGTransportEmissions	Port Hong Kong	Port Long Beach	79.297987232707	Flow	EA	
FGTransportEmissions	Port Recife	Port Boston	43.512174949001	Flow	EA	
FGTransportEmissions	Chengde	Port Kuala Lumpur	20.843705682342637	Flow	EA	
FGTransportEmissions	Hu Chi Minh	Port Kuala Lumpur	6.87202143919211	Flow	EA	
FGTransportEmissions	Shanghai	Port Kuala Lumpur	23.4523538181942	Flow	EA	
FGTransportEmissions	Belo Horizonte	Port Kuala Lumpur	107.64240454333995	Flow	EA	
FGTransportEmissions	Shanghai	Port Recife	103.78946473340776	Flow	EA	
FGTransportEmissions	Chengde	Port Recife	102.35487421543035	Flow	EA	
FGTransportEmissions	Hu Chi Minh	Port Recife	107.22623958849032	Flow	EA	
FGTransportEmissions	Belo Horizonte	Port Recife	113.92877339108247	Flow	EA	
FGTransportEmissions	DC_Detroit	CZ_Atlanta	4.530640130188195	Flow	EA	
FGTransportEmissions	DC_Detroit	CZ_Pittsburgh	2.249791996230995	Flow	EA	
FGTransportEmissions	DC_Detroit	CZ_Raleigh	5.58001946229056	Flow	EA	
DCMfgEmissions	Prod_Florida	CZ_Kan City MO	19.36848022437393	Flow	EA	

On the production side, the model includes classic bill of material data. Two new pack styles with different cardboard weights, as well as water consumption data are also included.

Build and Run Scenarios

Now it's time to evaluate numerous scenarios to test alternatives. For example, some scenarios may be more expensive but require less packaging for improved sustainability.

In one click, connect via API to Southpole to bring in the appropriate CO2 emissions data.

If you wish, use sequential optimization to prioritize objectives. For example: choose to minimize cost first, then carbon emissions, then risk. Use sensitivity analysis to find the right balance.

Use the scenario grid to easily and dynamically build scenarios. For example: Analyze China-only production versus Brazil and Vietnam. Understand how flow, sourcing, and distribution change across scenarios.

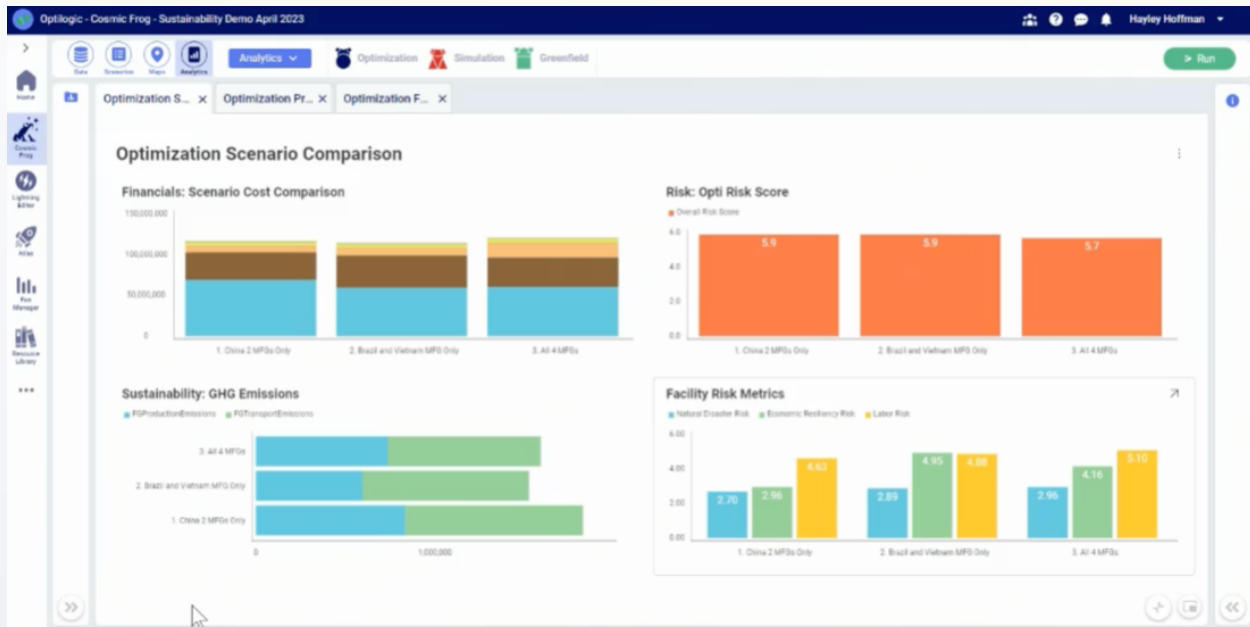
	3. All 4 MFGs	1. China 2 MFGs Only	2. Brazil and Vietnam MFGs
Include all 4 MFGs	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Exclude Brazil MFG	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Exclude Vietnam MFG	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Include China MFG	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Exclude MFG, Shanghai	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Exclude MFG, Chengde	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Include Vietnam and Brazil	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
MFG, Chengde Prod Constraint	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Include Prod Constraints	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Explore possibilities by easily adjusting demand, sources, modes, alternative bills of material, and more to find the best designs to execute.

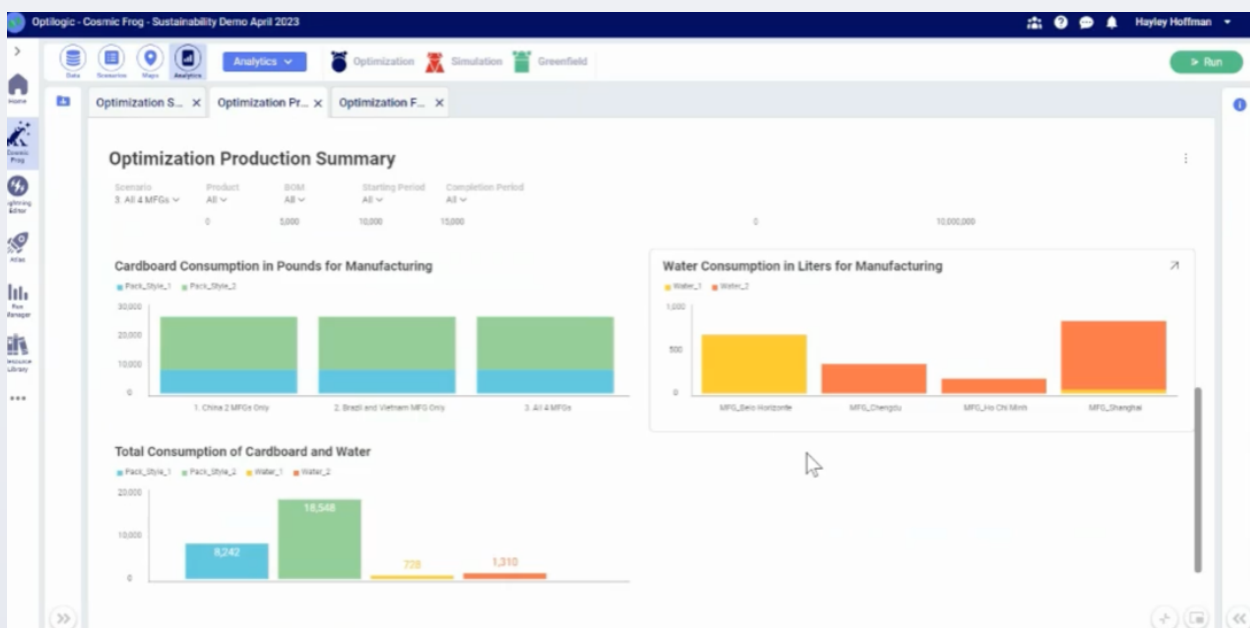
Provision the cloud solving resource size you need to run tens to hundreds of different scenarios concurrently.

Visualize and Analyze Scenarios

Cosmic Frog provides a risk rating on every scenario run, an aggregate of network, geographic/political risk, and sustainability risk metrics.



There are many different ways to visualize data in dashboards: network, production, transportation, flows, and more. Go beyond CO2 emissions analysis to compare total consumption of water and cardboard at the scenario and manufacturing site levels.



Start Modeling Your Future Supply Chain Today



Remember, you don't need to have a firm grasp on every iota of data related to emissions across your supply chain network to start reducing your carbon footprint. The Cosmic Frog GHG Model can help you identify network changes that can start paying dividends in both sustainability and profitability right away.

Ready to dig in? [Create your free Cosmic Frog account](#) and navigate to Model Templates > GHG Model

Want to talk? [Contact us](#) to discuss how Cosmic Frog can help you model sustainability strategies and so much more.

