7bridges

The Green Ratio

The optimal path to a sustainable supply chain

What if making your supply chain greener didn't have to cost the Earth?

"Human activities are estimated to have caused approximately 1.0°C of global warming above pre-industrial levels, with a likely range of 0.8°C to 1.2°C. Global warming is likely to reach 1.5°C between 2030 and 2052 if it continues to increase at the current rate."

2022 Intergovernmental Panel for Climate Change AR6 Summary for Policymakers

We've reached a point where the reality of the climate crisis is clear: human actions have caused harm to the planet and will continue to do so if left unchecked. Working to mitigate and adapt to climate change is no longer an option; it's necessary. According to a 2016 McKinsey report, over 80% of a company's greenhouse gas emissions come from its supply chain. But that means those same organisations have the greatest opportunity for positive change in their logistics and transportation.

Unfortunately, business leaders often face challenges determining the best path forward to navigate the transition risks that come with decarbonisation and meeting commercial objectives. Striking the right balance is a vital part of choosing strategic next steps.

Contents

About 7bridges

The 7bridges SaaS platform brings all your logistics data together and uses AI to make smarter decisions, reduce costs, improve service levels and increase your supply chain resilience and efficiency.

In 2022, 7bridges was the winner of the "Overall Data Solution of the Year" in the SupplyTech Breakthrough Awards.

The cost of change vs. the cost of inaction

Transitioning to a greener and more sustainable supply chain is not always high on the increasing list of priorities for business leaders. It's not flashy enough to shout about on social media, it sounds like a lot of hard, messy work and, truthfully, it sounds *resource intensive*.

If an organisation's supply chain is the biggest carbon emitter, making changes that reduce those emissions feels like an enormous task.

But is it?

Choosing not to invest in decarbonising your supply chain comes with costs too.

According to a paper from the World Bank and the OECD (Organisation for Economic Co-operation and Development), 88% of carbon emissions in 2018 were priced at £25 per tonne of CO_2e[1] — a number they advised was woefully insufficient to account for the impact it has on our climate. These rates have since climbed significantly, reaching an all-time high of nearly £84 tonne CO_2e. As emissions monitoring tech and climate regulations increase, it's reasonable to expect that cost to rise again alongside them.

In addition to the rising costs of carbon, increasing physical climate risks (such as flooding wildfire or drought) and higher fuel prices will continue to impact logistics and transport. These changes will not only cause greater costs for doing business, but they could make the price of transitioning to more sustainable practices even more exorbitant.

[1] Carbon pricing reflects the costs of impact greenhouse gas (GHG) emissions that the public pays for. These impacts include things like damage to crops, health problems from drought or heatwaves, and loss of property from sea level rise, amongst others. The goal is to shift the financial burden of GHG emissions back to their sources.

Passive tactics, like using carbon offsetting schemes, aren't enough to compensate for the emissions that come from supply chains. That would demand exceptionally advanced and detailed emissions monitoring data to be effective at all. But existing carbon offsetting schemes also frequently rely on lifetime carbon store amounts.

So, how can 7bridges help businesses to balance and optimise for both costs and carbon emissions?

At 7bridges we have a proprietary AI called LEO which analyses and optimises logistics costs and operations. But what if you can also tune LEO to optimise logistics for carbon footprint?

Our platform drives real, decisive change through supply chain optimisation—including in terms of carbon footprint. To understand how LEO can best help businesses balance carbon goals with commercial goals, we harnessed its capabilities to model scenarios using real-world data and ran a simulation.

Carbon offsetting

Because of the way carbon offsetting schemes[2] calculate carbon removal, the direct effects of current carbon emissions are not negated by the long-term effects of introducing (planting) new carbon stores (trees). Other considerations when examining offsetting schemes include biodiversity impact and long term protection plans for the trees. The complications here and uncertainty around the long-term impacts of these offsetting schemes suggest direct action to reduce carbon emissions needs to be a priority for organisations.

About LEO

LEO (Logistics Engine for Optimisation) is the AI that underpins the 7bridges solution. First built in 2015, LEO has been learning from logistics data since its creation and has become the world's leading logistics AI. Constantly learning, adapting to changing conditions and refining its decision-making processes over time, LEO enables businesses to gain a competitive edge through their supply chain.

[2] Carbon offsets are not our get-out-of-jail free card.

Executive summary

Increasing pressure from consumers and regulators means that the need to reduce carbon emissions is only going to grow over time. Since supply chains are a major part of a business' emissions, the opportunity to make changes here is significant. This simulation proves the business priorities of cutting costs and cutting carbon don't have to be in conflict with one another.

Our simulated supply chain, based on an average European pharmaceutical organisation, showed interesting results:

Cost optimisation - Optimising the logistics for cost only had no bearing on its carbon emissions and continued at the same output levels seen before optimisation.

Carbon optimisation - Purely focusing on carbon footprint reduction in LEO showed that it's possible to optimise and reduce emissions by 51%.

The Green Ratio - Our simulation found the optimal balance between optimising your supply chain for lowered carbon emissions and optimising for costs. This balance is represented by a number we've dubbed supply chain's '**Green Ratio**.'

Learn more

A quick note on ratios:

When we express the Green Ratio as a decimal (**0.129**), it represents the ratio as **0.129:1**— Another way to write that would be **129 kgCO_2e:1000 GBP** which might seem more familiar to some readers.

The Green Ratio describes the ideal balance between optimising for costs (and keeping shareholders happy) and optimising for sustainability (and keeping the planet and your climate-conscious customers happy) Businesses can now use LEO to discover their **Green Ratio** and determine how that is best achieved within their supply chain. This simulation showed that an average pharmaceutical business can use a **Green Ratio** of **0.129** to balance carbon emissions to cost. This means for every £1,000 businesses spend on last-mile logistics, they should be emitting around 129 kgCO_2e. Our expectation is that this ratio is a good starting point for other businesses as well.

Many common tactics to reduce carbon have either low-impact or are long term projects. Using LEO to align to your Green Ratio, your business can see immediate, high-impact changes to your carbon emissions.

Example:

Carbon offsetting can be actioned quickly, but has a lower overall impact. Meanwhile, investing in a greener fleet could be higher impact, but is a long term endeavour. Optimising your supply chain correctly, however, could give your business high-impact results right now.

We also identified five key areas that are most likely to impact carbon reduction capabilities and arranged them from most impactful to least:

1. Total distance travelled to the final destination
2. Expected delivery service levels (eg. same day, express, economy)
3. Shipments consolidation and vehicle load factor
4. Provider's operational efficiency, including vehicle used and efficiency
5. Carbon footprint of running the warehouse

Supply chain's 'Green Ratio'

To explore the Green Ratio, we created a simulation that would help us explore the balance between reducing carbon emissions and reducing cost. In order to make this work, we created Pharma Co, a fictional organisation modelled on a typical pharmaceutical business that operates in the European market.

Pharma Co started with a carbon footprint of **882** tonnes CO_2e per per year. LEO found that switching their strategy to one which utilises smart logistics with multi-carrier optimised fulfilment immediately created the opportunity for a carbon savings of 23%. In the future, this could be further improved by 36% if logistics service providers themselves improve their overall carbon-emissions efficiency.

Understanding Graph 1

When you look at the graph on page 11, you'll see where the Green Ratio sits in terms of optimisation. If you move that point further to the left, your costs will go down while your carbon emissions rise. On the other hand, shifting the point further to the right means you'll see lower carbon emissions, but rising costs.

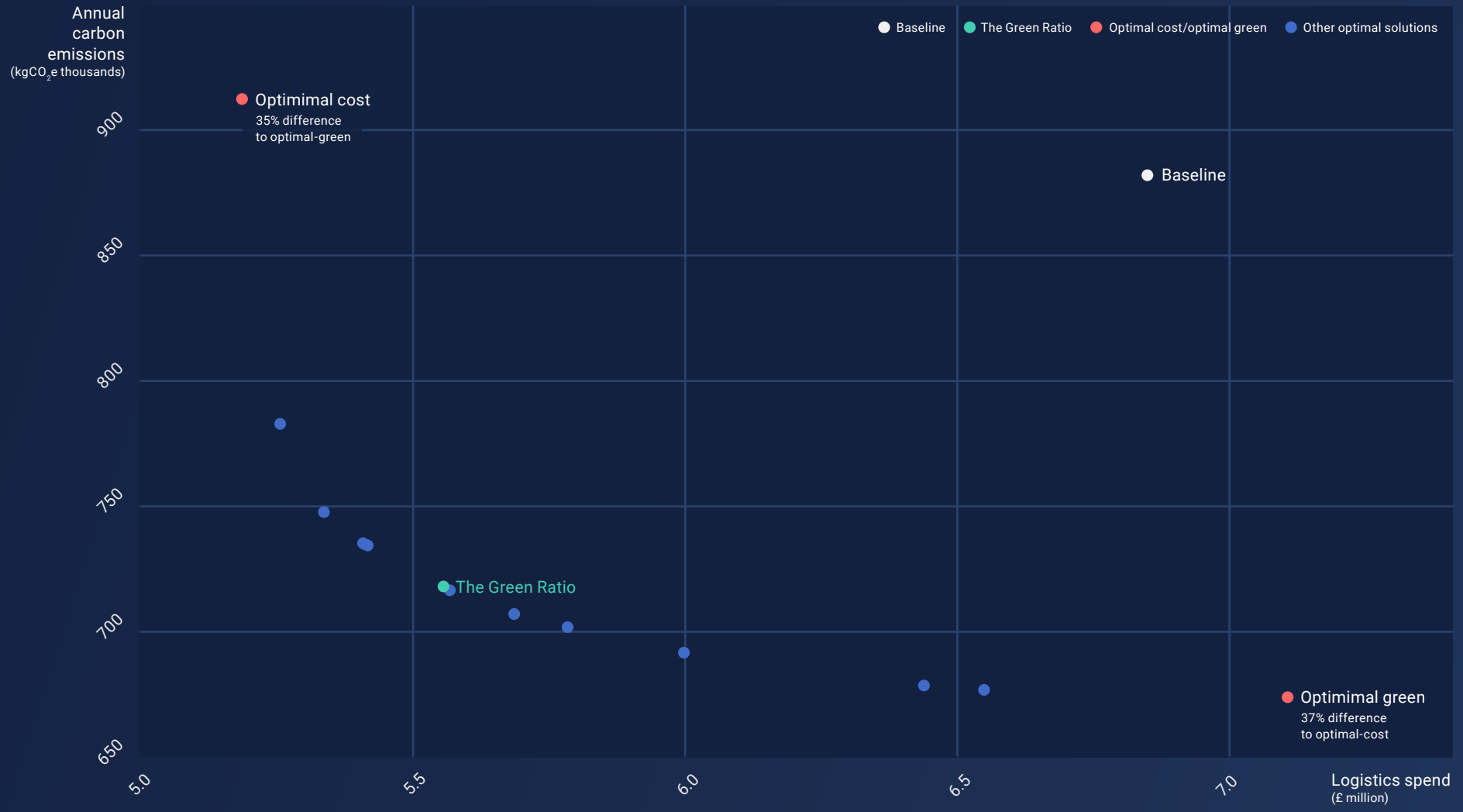
This is a total opportunity of 51% reduction in carbon footprint from their initial baseline figure of 882 tonnes CO_2e per year. That equates to nearly 450 tonnes of CO_2e per year saved! The reduction also amounts to £112k costs saved from carbon emissions in 2030, supposing carbon prices continue to rise as expected. (The current expectations see the carbon price tripling by 2030, hitting £250 per tonne CO_2e).

So, how do we balance them and find the Green Ratio for Pharma Co? The ratio will depend on a businesses' carbon strategy and its appetite to invest in a lower carbon footprint, i.e. sacrificing cost savings now to improve carbon footprint may result in greater cost avoidance in the future. A more carbon-ambitious company would need to use a very different number from a cost-focused company.

Looking at Pharma Co's evenly-weighted goals, we coupled cost and carbon into one multi-optimisation to better understand what the ideal results are. The analysis shows the curve of optimal solutions Pharma Co could have when balancing carbon & costs. We believe the most effective strategy uses around a **0.129 carbon to cost ratio**. That ratio comes from an even balance of sacrificing 7% cost efficiency and 7% carbon efficiency. This figure is the Green Ratio for Pharma Co. It represents a balanced middle ground between the two types of optimisation.

Graph 1

Logistics spend vs. carbon emissions

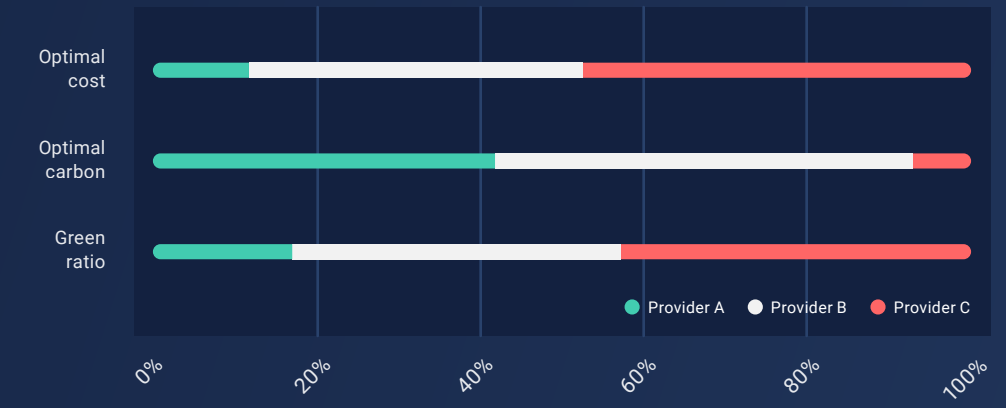


For Pharma Co, the 0.129 ratio translates into an interesting trade-off on carrier and fulfilment location strategies:

- Even split between Provider B and rovider C, and Provider A taking almost 20% of shipments
- And nearly half of shipments originating from Belgium, with the remaining being evenly split between England and Germany

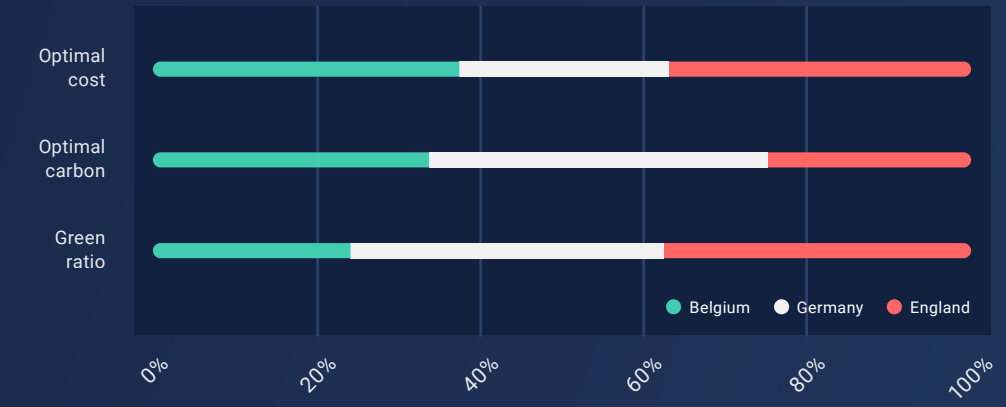
Graph 2

Provider mix



Graph 3

Fulfilment location mix



Setting up the simulation

We modelled the logistics operation of the average European pharmaceutical industry's commercial supply chain, but these findings are relevant to other sectors as well. The model covers everything from fulfilment location, storage and pick & pack, to the last-mile delivery to the end-customer.[3]

Pharma Co's average shipment

- Pharma Co typically ships 13kg packages
- These travel from Belgium, England and Germany to final customers spread across the UK, Germany, France, and more of mainland Europe.
- Pharma Co ships a total of almost 240,000 orders per year.
- These shipments are often fulfilled from Belgium and England. They have a German warehouse but, traditionally, it is only used for a small subset of shipments.
- To simplify operational complexity, their operation focuses on a single carrier strategy. We'll call that single logistics provider '**Provider A**.'

Pharma Co's current rate card and spend

- Pharma Co's operation is yet to be fully optimised.
- Right now, Pharma Co is spending £6.8m per year to run its logistics network.[4] (This covers their base spend, excluding any surcharges, combined with base handling fees and storage related to the shipping activity).

[3] The model only considers ambient shipments, so temperature controlled shipments were excluded. The carbon footprint model assumes only ambient temperature controls, with a simple non-reusable passive temperature-controlled package and refrigeration on each storage facility. [4] Baseline assumed to be less-urgent delivery time for the purposes of the case study.

The rules they have in place at the moment are based on experience and tradition with minimal data intelligence backing the decision. Through a procurement exercise[5], Pharma Co was offered the rate card for Provider A as well as two rate cards from other providers which we will call Provider B and Provider C.

Although Pharma Co doesn't have yet visibility of its current carbon footprint, LEO calculated it at 882 tonnes CO_2e per year. This is the baseline emissions amount that we'll compare optimisations against.

We loaded all of these data points into our platform and turned on LEO to use its AI to optimise towards cost, carbon footprint and the optimum compromise to achieve a satisfying result for both.

Pharma Co's Supply Chain Summary - snapshot before optimisation

Warehouse sites:
Belgium, England, Germany

Annual orders:
240,000

Most used distribution sites:
Belgium, England

Logistics carriers:
1

End customers:
UK, Germany, France

Annual logistics spend:
£6.8M

Typical shipment weight:
13kg packages

Annual CO_2e:
882 tonnes

240,000
orders

£6.8M
base logistics spend

882
tones of CO_2e

[5] A procurement exercise with 7bridges uses advanced insights from our global carrier network to recommend the best supplier for your requirements.

Cost vs. carbon optimisation

Before we get into the results, it's important to think about optimising for cost versus optimising for carbon. Traditionally, supply chains have optimised for cost at the expense of all else. As green considerations become more regulated and take up a greater portion of public awareness, cost-based optimisation may not always be the highest business priority.

Cost optimisation

Using the 7bridges platform to optimise for cost makes sense and is why many businesses choose to work with us in the first place. That kind of optimisation is a relatively easy sell to board members and leadership teams. When setting up LEO to optimise for pure cost savings, the results show a savings potential of £1.5m (23%) from the baseline.

These savings happen by combining the strengths of the three providers (A, B and C) into a multi-carrier strategy with an optimised fulfilment strategy. However, the cost optimisation doesn't produce any changes in the carbon footprint from the baseline. This means that focusing on cost alone prevents your company from using supply chain efficiency as part of any green goals or net-zero targets.

Read more

High spending consumers choose green

While the above article focuses on retail, many of the principles and concerns remain relevant for all industries. Individual consumers are choosing greener options and mandatory reporting and regulations are coming into play. Shifting toward sustainable supply chains needs to be a priority for long-term business.

When setting up LEO to optimise for pure cost savings, the results show a savings potential of **£1.5m** (23%) from the baseline.

Carbon optimisation

On the other hand, it's possible to cut Pharma Co's carbon footprint by 23% when setting up LEO to optimise towards carbon emissions. In this scenario, Pharma Co chooses the lowest possible carbon footprint with the current set-up of providers and fulfilment location. However, optimising towards a green supply chain comes at a 4% increase from the £6.8m baseline costs.

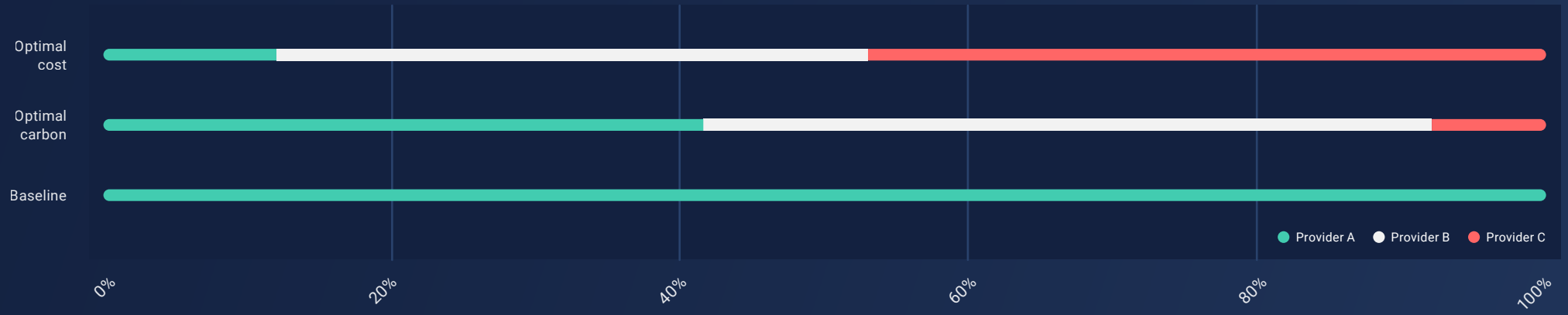
When changing its supply chain priorities from finding the optimal cost to uncovering the optimal carbon solution, Pharma Co shifts its logistics strategy significantly.

This includes switching the share of work from Provider C to Provider A. Meanwhile, Provider B maintains its share. Provider A is greener than Provider C, but not as cost-competitive. Also key to optimisation is Pharma Co transitioning from Belgium fulfilment to Germany and England locations.

This optimisation is only possible through the use of a multi-carrier strategy and smart allocation. 7bridges customers use holistic, transparent logistics data combined with LEO's AI to significantly drive supply chain costs down. LEO helps customers leverage each provider's strengths into a multi-carrier solution and optimising fulfilment strategy from where costs are most competitive.

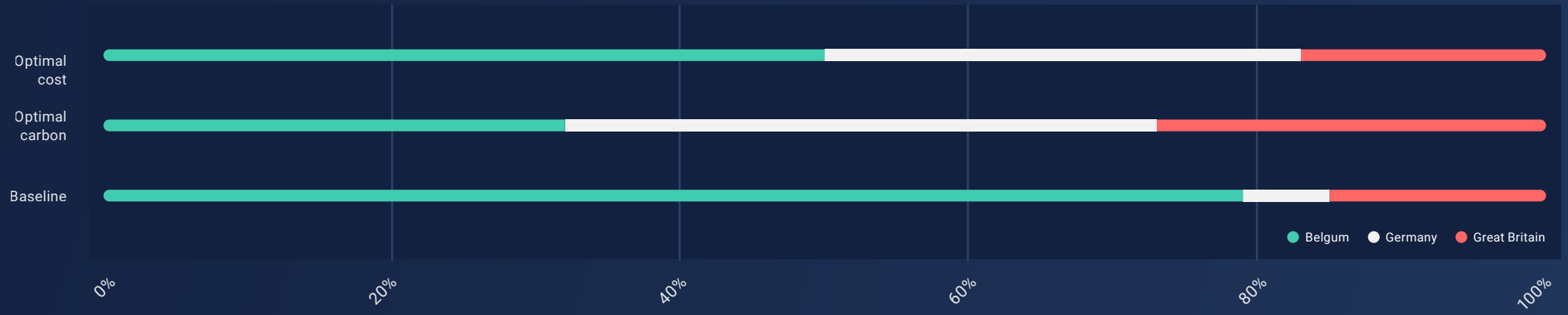
Graph 4

Provider mix



Graph 5

Fulfilment location mix



By looking at an individual order (15kg order to Rome, Italy), we can see how the different components, transport, storage and pick & pack, stack up to a total carbon footprint. We can also see how that varies across providers, origin fulfilment location and service.

As expected, 80-90% of the carbon footprint is originated from transportation to the final destination, with the majority of that referring to air travel. 5-10% is due to storage (both energy consumption and storage related activities), and with pick & pack taking the last <5%.

From the graph, we can confirm the hypothesis that Provider A is greener than the other two - a result being driven by the vehicle used, its efficiency and the average load factor of the vehicle. We can also see, as expected, Economy services are less carbon-intensive, and that the relative differences between providers may not always be the same across services.

> **80-90%** of the carbon footprint is originated from transportation to the final destination.

Focusing on Provider A, we can also see that Germany would be a greener option for transport to Rome with Provider A. This is only possible given the decrease in transport emissions. There is an obvious increase in storage carbon costs in England and Germany due to the different countries' energy emission factors (as energy consumption is a major contribution to storage carbon footprint), which could become dominant for other lanes.

Overall, we see that choosing the right fulfilment location could have an impact on the carbon footprint up to nearly 30%, whereas the right provider would only vary by 7%. The fulfilment location is especially impactful because of how many other factors it affects, including total distance travelled. This shows how complex getting to the right answer can be, and points to the need for a holistic AI-driven analysis that considers all the different variables into one optimisation objective - or in this case two: carbon + costs. Without it, a significant amount of cost and carbon reduction can be "left on the table" when using more primitive strategies.

For instance, the optimal "green solution" on a single-carrier strategy would be to focus only on Provider A, leaving out 6% potential for carbon reduction; and the optimal "green solution" focused on one warehouse operation in Belgium would have a carbon cost increase of 23% compared to the optimal operation. Similar results would be found on the cost side leading to 5-20% missed cost savings.

The pharmaceutical industry is typically rife with urgent deliveries, whether that's due to customer expectations, product expiry dates, timely interventions or otherwise. However, there is frequently room within the business to loosen this constraint to some extent. Taking that into consideration, what would the impact of delivering next-day compared to a less urgent delivery look like?

Here, LEO calculates savings potential of up to 36% on carbon emissions when using a slower service' - which will be followed by cheaper rate cards as well. These carbon savings are driven by the ability providers would have to better consolidate shipments into one journey, hence increasing the load percentage of each vehicle.

As customers don't always require next day delivery, and some products may not always have tight expiry dates (and also because providers aren't always able to meet the service level), using LEO to intelligently decide when to use a slower service (and which to use) not only saves costs but also reduces carbon footprint.

Graph 9 shows how carbon footprint for express vs. economy service changes across providers for the Belgium-to-Rome lane. These savings from Express to Economy delivery could be increased even further by 28-32% if more shipments were delivered using land-based vehicles (e.g. road trucks), as opposed to air.

Through that exercise, we found that the **five main drivers to reduce carbon footprint** are:

- Shipments consolidation and vehicle load factor (high impact)
- Total distance travelled to the final destination (high impact)
- Provider's total operational efficiency, including vehicle used and efficiency (medium impact)
- Carbon footprint of running the warehouse (medium impact)
- And, finally, expected delivery service levels eg. same day, express, economy (low impact)

A note on greener logistics providers

With logistics providers going "green" to meet their net-zero ambitions, how much further can logistics go with reducing carbon emissions?

By improving the road-fleet efficiency by roughly 60% [6] (e.g. fleet electrification), an additional 11% savings could be achieved - Provider "Greener 1". On the other hand, increasing the overall air-efficiency by approximately 30% [7] (e.g. using greener fuels or a more efficient fleet), the impact could go up to 25%, as we've seen the air journey has the highest impact on emissions - Provider "Greener 2".

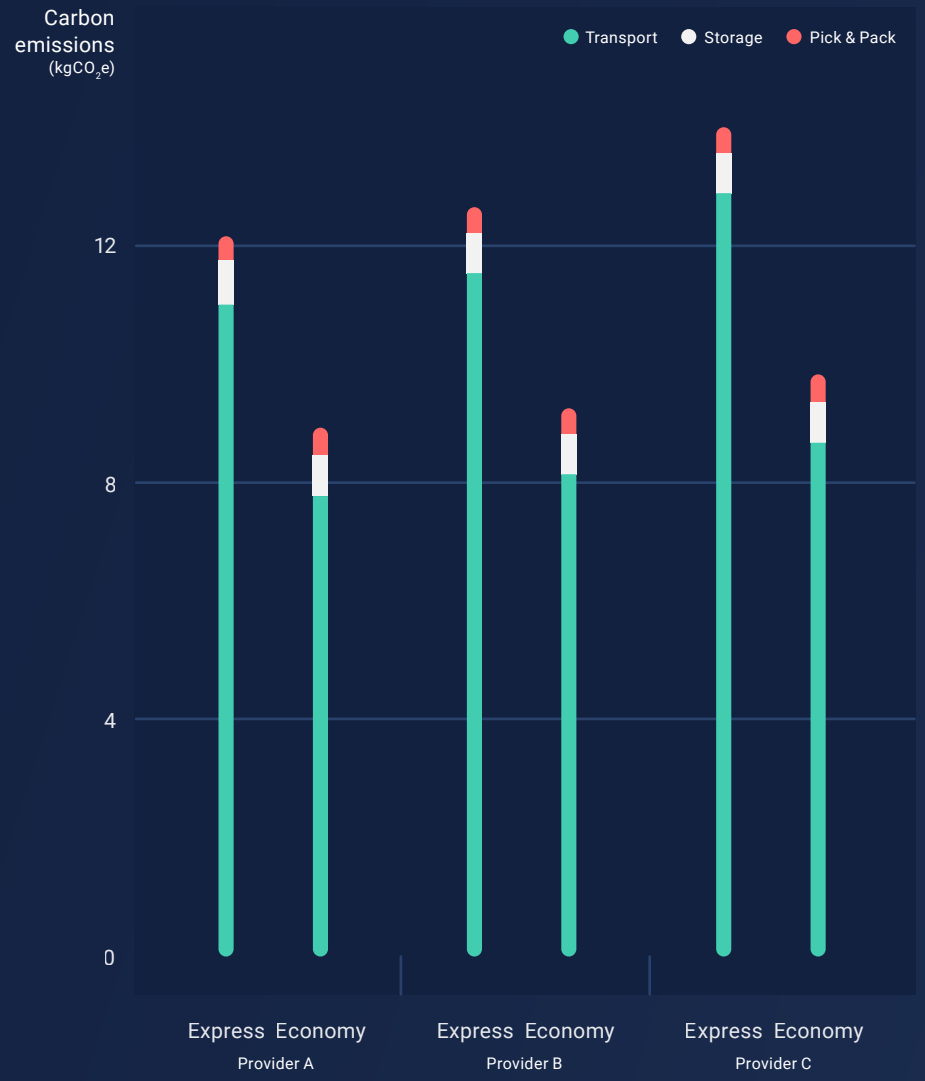
Finally, both road and air improvements would stack up to 40% additional savings when compared to the best individual provider - Provider "Greener 3". Overall, the greenest option (Provider "Greener 3") would save an additional 36% when compared to the optimal green solution initially calculated.

These results are evidenced in the Belgium-to-Rome example discussed above where we added the three new "Green providers from the future". Looking at this individual lane across all providers and all possible services, there is a 60% delta between the best and worst carbon-intensive choices - hence, a significant room to reduce carbon footprints.

[6] Flying and Climate: Airlines Under Pressure to Cut Emissions. [7] Comprehensive Transport Emission Reduction Planning: Guidelines for Evaluating Transportation Emission Reduction Strategies.

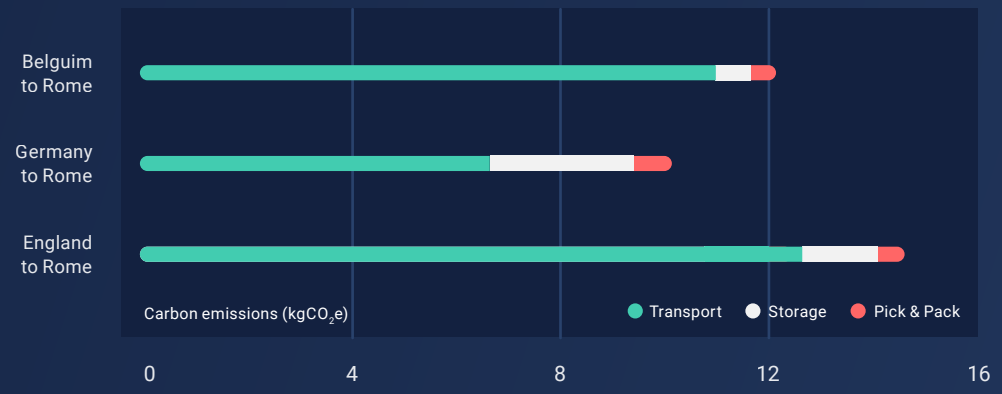
Graph 6

15kg order Belguim to Rome (Provider A)



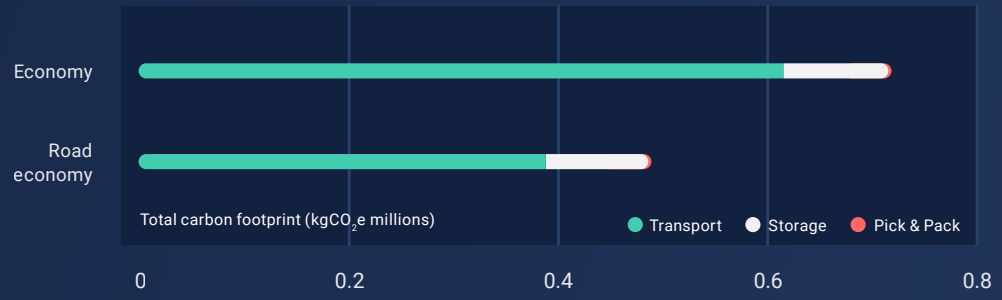
Graph 7

15kg order to Rome, IT (Provider A)



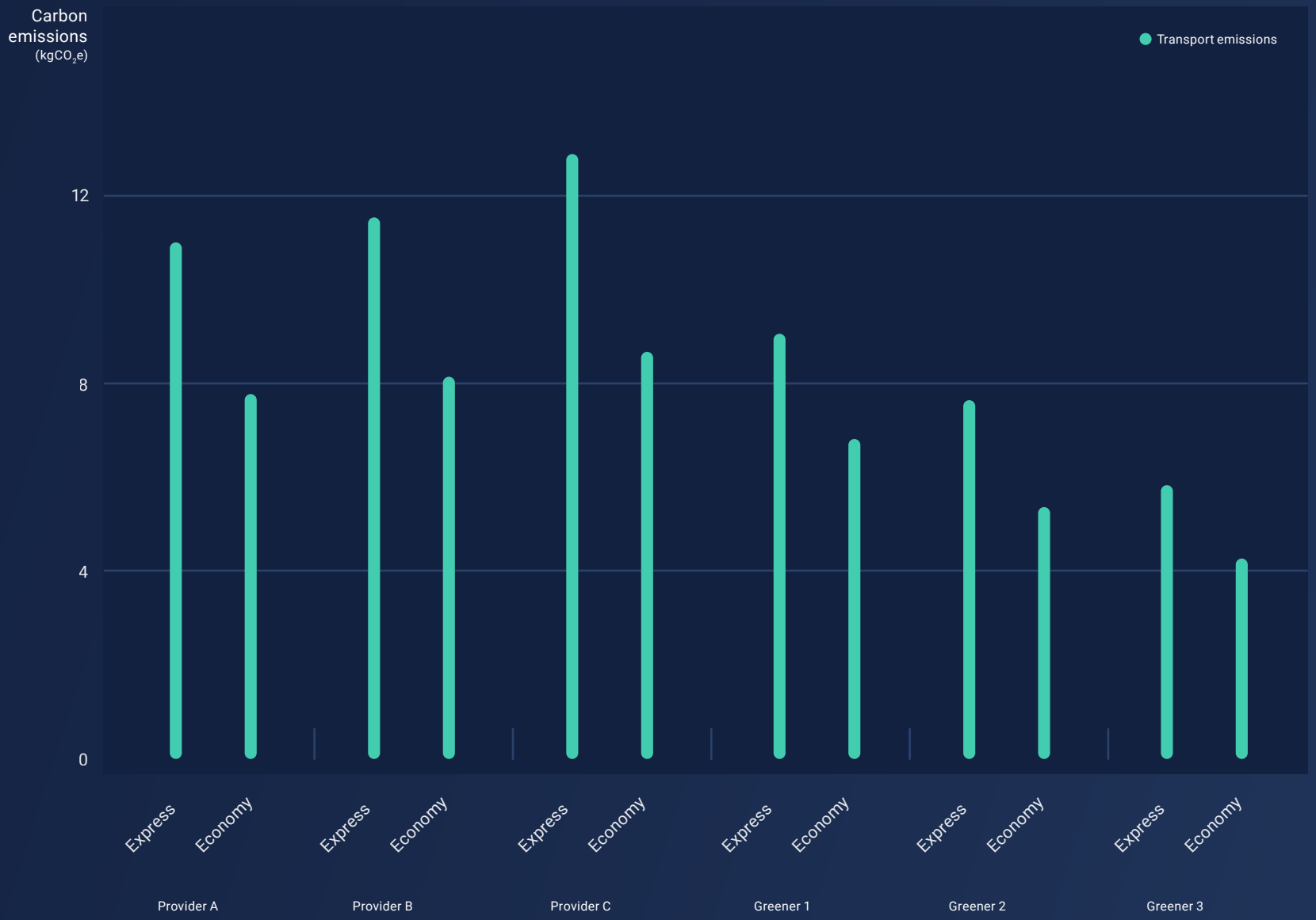
Graph 8

Total carbon-stack (Provider A)



Graph 9

15kg order Belguim to Rome (Provider A)



Conclusions

Although cost is likely to remain the major driver for logistics optimisation, we've now shown that there's an opportunity to significantly increase carbon emissions performance with just a minimal cost savings loss.

The weight of carbon footprints on the cost-carbon equation will be driven by other market conditions, meaning that savings loss could shrink in the coming years. Factors that may impact that margin include the evolution of carbon prices, the introduction of regulatory fees or fines and future fuel prices. All of which could result in increased pressure to reduce overall emissions.

But now we have the **Green Ratio** to help guide us toward a supply chain solution that is as sustainable for the planet as it is your bottom line.

Using LEO's optimisation calculations, you'll see what changes you can make for the biggest impact. From changes to inventory requirements to warehouse placement to customer service levels, you'll be able to finely tune your supply chain to achieve your green and commercial goals.

Key takeaways

- Optimising the logistics for cost only continued at the same output levels seen before optimisation.
- LEO showed that it's possible to optimise and reduce emissions by 51% when carbon is the primary focus
- Five essential factors have the greatest impact on carbon emissions:
  - Shipments consolidation and vehicle load factor
  - Provider's network and total distance travelled to the final destination
  - Provider's operational efficiency, including vehicle used and efficiency
  - Carbon footprint of running the warehouse
  - Expected service level and ability to optimise the drivers
- Within those, choosing the right fulfilment location was the most significant. That alone could have an impact on the carbon footprint up to nearly 30%, whereas using the right provider would only vary by 7%.
- **The Green Ratio.** The **Green Ratio** is the ideal balance between optimising your supply chain for cost and optimising to reduce your carbon footprint. Our simulation shows that a **0.129** carbon-cost ratio is ideal based on an average European pharmaceutical company.

7bridges

Ready to decarbonise your supply chain sustainably?

Get in touch to learn how LEO and the 7bridges team can help you find your Green Ratio.

Get in touch