

Operations Practice

Making supply-chain decarbonization happen

Active supply-chain decarbonization is becoming a license to operate for businesses, but companies aiming to be role models in the fight against climate change must overcome roadblocks along the way.

by Peter Spiller



© Thomas Winz/Getty Images

Five years on from the Paris Agreement, governments, regulators, investors, and customers are increasingly demanding that business play its full part in global efforts to tackle climate change. Companies are responding with a wave of public commitments to ongoing emissions reductions.

These commitments initially focused on the Greenhouse Gas (GHG) Protocol's Scope 1 and Scope 2 emissions, which are produced directly by companies or indirectly through the purchase of energy. Today, however, more organizations are also pledging to reduce their Scope 3 emissions generated in the upstream and downstream value chain. Of the 239 companies that signed up to the Science Based Targets Initiative in 2020, for example, 94 percent included commitments to reductions in emissions at customers and suppliers. That is a big step: for many companies, Scope 3 accounts for 80 percent of their overall climate impact.

Setting ambitious targets is one thing. Delivering against them is another. Achieving net zero for Scope 1 and Scope 2 emissions is a formidable technical and economic challenge for many companies, especially those in energy- and resource-intensive sectors, such as heavy industry. Tackling Scope 3 presents an additional layer of complexity, including opaque carbon-accounting and tracking practices; the need to work collaboratively with customers, supply networks, and industry groups; and the difficulty of keeping stakeholders engaged in a complex, multiyear change effort.

Mapping the decarbonization journey

Companies typically move through three interrelated steps on their decarbonization journeys (see sidebar, "Three steps toward net zero"). One technology company, for example, had a reasonably good understanding of its Scope 1 and 2 emissions, but lacked a granular understanding of Scope 3. Investor scrutiny and a newly defined sustainability strategy had resulted in the desire to set new science-based targets, including Scope 3—thus requiring a comprehensive baselining effort. The

results revealed that the company's actual Scope 3 emissions across all 15 GHG Protocol categories were somewhat lower than its initial high-level estimates, accounting for about 70 percent of total emissions. While procured materials were responsible for the lion's share, there were also significant emissions associated with customers' use of the company's products.

A decarbonization pathway exercise suggested that 30 percent of total Scope 3 emissions could be abated through relatively straightforward measures, such as product and logistics optimization and procurement of low-carbon energy by suppliers. While these measures would require intensive collaboration with both suppliers and customers, half of the changes would be cost-neutral for the technology company. Where abatement costs fell on vendors or customers, they were small enough to be of little concern, especially as the whole market was set to adopt similar measures.

The organization designed a ten-year transformation program using the same basic playbook it had previously applied in cost-improvement efforts, which included significant internal upskilling; integration of the low-carbon theme into a multitude of policies, KPIs, and decision frameworks; and a number of pilot initiatives to create immediate, visible impact and momentum.

Five challenges to overcome

Examples like the one above are the exception rather than the rule, however. Many organizations are struggling with their Scope 3 decarbonization efforts. And, as delivery timelines are longer and targets are generally vaguer, program leaders tend to get away with underperforming efforts. That approach won't cut it for long. Customer, regulatory, and investor scrutiny are poised to increase significantly in the coming years, putting underperformance into the public spotlight.

As organizations seek to ramp up their decarbonization efforts, they must overcome five primary challenges (Exhibit 1).

Three steps toward net zero

Progressing toward net zero winds through three phrases: establishing a baseline, defining a pathway, and then overseeing implementation and tracking.

Baseline and value at stake

The first step determines the actual greenhouse gas (GHG) baseline generated by a company's value chain. Scope 1 emissions can often be measured relatively easily at the plant level, either via sensor-generated data or through emission-calculation models. Likewise, Scope 2 emissions are a function of the electricity, heat, cooling, and steam the company purchases, which generally come with specific emission factors that can allow for fairly easy calculation. Consolidating this data across tens or hundreds of plants and office locations can still be a challenge, however.

Measuring Scope 3 emissions that cover the whole value chain outside of a company's own operations is a more complex task. The GHG Protocol defines 15 emission categories, including purchased goods and services, capital goods, up- and downstream transportation and distribution, and the use (or end of life) of sold products. Gathering the required activity data (typically at transaction level, such as spend or shipment records), as well

as the appropriate emission factors, can be a significant effort.

Once the baseline is defined, companies benefit from a clear articulation of the value at stake associated with these emissions. Areas to explore include the required abatement or offsetting costs, the regulatory and customer-sentiment risks, and the opportunities from lower-carbon portfolio and business-model shifts, or the savings associated with more efficient—and hence lower—carbon use of input materials, such as packaging or energy. The value at stake from improved environmental, social, and governance (ESG) practices in general, of which greenhouse gas–related effects often take the lion's share, can be significant: for financial, automotive, and technology companies, for example, we estimate that 50 to 60 percent of earnings before income and taxes may be at risk from increased social and regulatory pressure to improve ESG performance.

Pathway and target definition, and program setup

Once the baseline and value at stake are clear, it comes down to defining the right decarbonization target and a realistic pathway to reach it. Depending on the industry, the first third of the

decarbonization journey can be net-present-value positive, saving money while reducing emissions at the same time. These measures may include packaging- and waste-reduction efforts, shifts to renewable energy, logistics optimization, and the like. While the operational changes required to reduce Scope 1 and Scope 2 emissions are within the control of the company, Scope 3 can be tackled only by collaborating with customers and suppliers. In line with a realistic pathway, companies will want to set formal decarbonization targets to document their commitment for customers, investors, and the public.

Implementation and tracking




Initiative implementation will typically happen within the different business areas or functions, led by an overarching program-steering and initiative-tracking mechanism. Factories work on the reduction of fugitive emissions, energy consumption, and waste. Procurement addresses renewable-electricity sourcing and the cascading of decarbonization targets to suppliers—often linked to supplier-development and collaboration efforts designed to help partners achieve the targets. R&D will work on reduced-carbon product designs, while sales will steer and influence customers to lower-carbon products.

Lack of carbon-accounting foundations

Carbon-accounting practices at most companies today are at a level where cost accounting was 40 years ago, before the widespread use of integrated-

transaction or enterprise resource planning (ERP) systems and the development of broadly accepted standards to ensure apples-to-apples comparisons. Data—specifically when it comes to Scope 3—are

Five challenges stand between businesses and net-zero value chains.

What needs to be done?	Key challenges
 Baseline and value at stake Set baseline of Scope 3 emissions and quantify value at stake	<ul style="list-style-type: none"> •Lack of carbon-accounting foundations •Overreliance on secondary data for Scope 3 emissions
 Pathway and target definition Develop a carbon-abatement cost curve to prioritize pathway and set targets	<ul style="list-style-type: none"> •Significant uncertainty over cost and technical feasibility of carbon-reduction levers
 Implementation and tracking Mobilize	<ul style="list-style-type: none"> •Requires industry-wide collaboration to address many sources of emissions •Needs sustained engagement by internal and external stakeholders through a multiyear change program

often spread across multiple spreadsheets, while processing is done using inconsistent emission databases, and decision-supporting reports and dashboards for management are missing. Definitions for important terms, such as “offset,” may not be universally accepted.

The gaps may have been acceptable when carbon-footprint data were used only to inform the annual sustainability report. But these times are over. Carbon is a new currency: in early May 2021, it traded at about €50 per metric ton on the EU Emissions Trading System. CFOs and other business leaders will likely require much more accurate, granular, and timely emission transparency to run the business in the future.

Recognizing that need, established ERP vendors and recent start-ups are now offering carbon-accounting platforms. Some allow for targeted emission calculation using utility bills, travel, and logistics patterns; others link footprint insights immediately to offsetting marketplaces. At the same time, traditional corporate-transaction-system providers have started to add carbon accounting to their ERP and customer-relationship-management (CRM) systems.

The best carbon-accounting approach will naturally depend on a company’s specific needs. Professional-services companies, for example, may be well served by systems that collect and analyze office utility bills and travel patterns. Most industrial companies will be well advised to explore ERP-type solutions, especially in hard-to-abate sectors such as steel or cement, where regulatory pressures and offsetting needs are high. Access to multiple data sources and data engineering to ensure quality and reliability of inputs is typically the most critical element in setting up carbon-accounting solutions.

Since further innovation and development is ongoing, it’s likely that the best long-term carbon-accounting solutions for many companies are not yet available. That reality necessitates an iterative approach: companies can find or build a bespoke solution that meets their most pressing needs, piloting available solutions that help properly estimate emissions in relevant areas (such as transport or oil-based materials). Considering the significant momentum and strong commitments made by various technology players, it’s reasonable to assume that the current patchwork of carbon-accounting solutions will consolidate over time.

Reliance on secondary data

The immaturity of carbon accounting is most apparent for Scope 3 emissions. Emission calculations are usually based on rough activity data and standard (meaning average) emission factors. In the world of financial accounting, this level of approximation would be the equivalent of companies using average industry costs and revenues to prepare their annual financial statements.

In the upstream supply chain, accurate, product-level emissions are not available for everything companies procure today. Many suppliers don't properly understand their own Scope 1 and 2 emissions, let alone those of second-tier suppliers and beyond. And even when estimates are available, different companies use different industry averages, factors, and assumptions. That makes apples-to-apples comparison of suppliers impossible.

Moreover, most emissions estimates today focus on organization-level or institutional emissions. To be relevant and transferable between actors in the supply chain, these figures need to be converted into product-level data, taking into account the granular emissions associated not only with the manufacturing process within the company but also the emissions associated with the transport of the specific quantities of raw materials used in manufacturing. There is no standard methodology for doing this, nor are there easy-to-use systems to capture, verify, and communicate these data across multiple parties in a value chain. Finally, the level of trust among value-chain partners to share the respective data and act upon it is, so far, limited, because of fears (often legitimate) that granular carbon data could be used to deconstruct cost structures.

Differentiating emission data by supplier is important, however. Upstream Scope 3 emissions can be significantly improved simply by choosing suppliers of lower-carbon materials—which can often provide equivalent supplies at 30 percent lower emissions per unit.

Addressing the data gap in supplier-emissions tracking will require collaboration and partnering between multiple players in the value chain. Promising work is under way here, including the Value Chain Carbon Transparency Pathfinder for fast-moving consumer goods, launched by the World Business Council for Sustainable Development, or the Open Footprint Forum, an initiative in the oil and gas industry.

For the time being, however, many companies will also choose to request relevant primary emissions data from their highest-emitting suppliers in company-specific surveys, in hopes of enabling some of the carbon-tracking and reduction use cases—recognizing that because of a lack of comparability and tier-n reach, they are developing what can only be an interim solution.

High uncertainty, higher costs?

Once a company has executed all of the no-regret decarbonization levers—such as waste, energy, and materials reduction; renewable-electricity transition; and logistics optimization—it will likely still face a substantial gap to its zero-carbon target—50 to 70 percent is a typical figure. The next-level levers are more complex, and costly, to act upon. Take an automotive OEM, for example. With the industry still largely reliant on internal-combustion-engine-fueled cars, 80 percent of the typical automaker's current Scope 3 emissions arise from the fuel burned by customers. Most OEMs are making the shift to electric vehicles, a step that requires a significant shift in R&D, portfolio, and ultimately value pools. After the shift is made, almost 100 percent of emissions would sit in the upstream value chain, depending on the electricity mix used to charge the cars.

Of these upstream emissions, almost 45 percent are connected to the making of steel and aluminum, and 35 percent to the car's battery. Decarbonization of these elements is possible, but hard. Steel plants need to convert from coal-fired blast furnaces to electric-arc furnace technology, carbon capture and storage (CCS), or direct reduced-iron routes using hydrogen. Similarly, aluminum smelters would

need to be electrified using renewable electricity, and lower-carbon raw materials and feedstocks for batteries need to be found. The good news is that paths to decarbonization do exist: we estimate that advanced battery-manufacturing approaches operate at roughly half of the carbon intensity of traditional ones.

Companies can take a mid- to long-term perspective to these challenges and actively engage to shape the required future supply ecosystems—a move that will call for partnership with other players in the value chain. New technologies, from bio-based packaging materials to hydrogen fuels and CCS, can be explored and put on the decarbonization pathway.

For many industries, the up-front costs of this transition will be large, long before any benefits can be reaped. Structuring investment decisions, operations extensions (such as a relined blast furnace for a steelmaker), and technology or business-model transitions in a way that preserves options for later green pathways to develop is critical—and can help preserve financial value. As they seek ways to address hard-to-abate emissions, companies can also explore every opportunity to tap into energy transition and recovery funds that public-sector players may offer.

Building alliances

Companies typically try to grow their revenues, cut their costs, and reduce their Scope 1 and 2 emissions by optimizing their own operations—not least because faster progress on any of these moves than industry peers may create competitive advantage. Companies realize that value-chain decarbonization is a different game.

We have already described the need to team up with value-chain partners to build emission-data-sharing networks and new supply ecosystems. Forging alliances is such a pivotal element in achieving sustainability and decarbonization that it is worth exploring in more detail.

Most companies we speak with acknowledge that the pure notion of decarbonization appeals to a higher purpose and hence warrants a lower bar with regard to competitive posture. At the same time, many alliances and partner networks are characterized as discussion venues with little real business impact. Business leaders are therefore looking to prioritize their efforts on alliances that matter.

Building, nurturing, growing, and creating impact from alliances can require significant effort, especially in new territory, such as setting industry standards for carbon accounting or defining decarbonization best practices in specific raw materials. To avoid spreading themselves too thin, a company can keep a map of its relevant alliances, ecosystems, and partners, regularly assessing their impact potential against effort, and doubling down on a few (for example, the preeminent industry alliance, the relevant standards body, and a few functional industry forums).

Sustaining engagement

Any transformation requires a significant communication and change-management effort. The playbook for traditional cost transformations is usually well-known and practiced, yet more than 70 percent of transformations still fail. Decarbonization efforts face additional challenges.

First, staff will require a fair amount of education on everything from the basics of climate change to the specifics of emission accounting and management, decarbonization levers, and partner collaboration. Second, the pace is slower, typically spanning years rather than quarters. Success arrives later, and is less tangible. Hence, there is a risk of falling momentum and rising fatigue. Third, the space is quickly evolving. Process innovations, new technologies, and new alliances will all demand constant upskilling of staff.

On the bright side, however, there is immense hunger from employees to engage on topics that give them a sense of purpose—and decarbonization is a top-of-mind topic for many.

Starting with a simple, clearly articulated, and publicly stated purpose is the first step to mobilize an organization toward the same goal. Purpose-driven companies in fields including consumer goods, apparel, and even energy and materials combine sustainability goals with higher profits and, in some cases, market capitalization as well.

Translating this purpose into clear incentives (“putting your money where your mouth is”) sends a clear signal to the organization that the “purpose” is not only for external posturing but is truly meant as a key outcome for the company. Formal mechanisms include setting up internal carbon-pricing schemes to incentivize innovation and investment, formally reporting carbon-adjusted earnings per share, or introducing reporting and incentive systems that reward innovative carbon-reduction work.

This process is already under way. When we interviewed approximately 2,600 companies last year, 23 percent indicated they are already using an internal carbon charge, and another 22 percent plan to do so in the next two years.

Upskilling employees at scale, across different parts of the organization, will likely drive significant benefits. A well-informed sales force can communicate an organization’s low-carbon value proposition effectively to customers, for example. A skilled and knowledgeable procurement team can mobilize suppliers and secure access to renewable energy sources. Capability-building efforts can extend to suppliers and customers, too—especially if companies truly want to build the ecosystems and communities needed to support Scope 3 emissions-reduction efforts.

Given the high dependence on collaborative, coalition-led solution development, fostering exchange among cross-functional stakeholders within the company—and building a community of experts across companies (as part of alliances, for example)—will be critical to expand the organization’s access to the latest ideas and innovations. In the best case, a company’s drive for

decarbonization and sustainability can become a magnet for high-performing talent.

Becoming a role model

Broadly speaking, we see two camps of companies when it comes to GHG target setting and decarbonization. Some, typically led by a strong CEO vision, lay out an audacious target and then “organize the troops” to achieve it. They rely on today’s sufficiently large wiggle room and the self-fulfilling momentum of a bold ambition. Others, meanwhile, invest significant time and caution to “get it right” and avoid overcommitting.

We believe the right balance is found somewhere between these two extremes—recognizing that the expectations of companies and the pace of change are only increasing, as evidenced by recent court decisions and shareholder votes. Companies therefore need to think and act decisively about each aspect of decarbonization, and decide where they want to lead the transition alone, where they should collaborate with other stakeholders, and where they should leave the development of new technologies or business models to others (Exhibit 2).




Companies ultimately have to do their homework with regard to carbon baselining, target setting, and pathway definition, addressing the five challenges laid out above. At the same time, only a clear and visible move will put an organization on the decarbonization map in the eyes of customers, regulators, and employees. Public commitments also help generate the necessary change momentum, especially when they are tied to compelling value at stake for the company.

The business community, which will be instrumental in bringing about the required global carbon-emissions reduction, will need role models in the form of companies and Chief Experience Officers (CXOs) that spearhead the change. Take the example of Ørsted, formerly known as Danish Oil and Natural Gas. Over the past ten years, the business has embarked on an ambitious decarbonization journey, selling most of its carbon

Exhibit 2

Companies can make a strategic choice to follow, share, or lead on specific decarbonization opportunities.

Choices differ by sector and by factors including state of technological development

Choices	What to do	Aluminum example
 Follow Levers outside direct control and are led by other players or industries	Passively wait for industry to embark on decarbonization pathway to implement new technologies	Inert-anode electrolysis: limited by technological development; when commercialized, would reduce both cost and carbon; a follow strategy would likely rely on sourcing from suppliers at the forefront of development
 Share Levers too big for individual players and differentiation not possible	Share knowledge and position for collaboration to enable and coordinate decarbonization of customers, suppliers, and value chain	Closed-loop recycling: limited by availability of high-quality end-of-life metals; a share strategy would center on orchestrating an end-of-life ecosystem
 Lead Levers of strategic advantage	Be in the driver's seat when it comes to low-carbon leadership and take active role and investment to drive decarbonization in value chain	Greater use of recycled aluminum: use is limited more by specification than cost; a lead strategy involves working with key suppliers to enable and expand usage in high-profile products

assets and moving into offshore wind and solar. It has become the world's leader in offshore wind, erecting wind farms not just in Europe but also in North America and Asia. As a consequence of this portfolio shift, Ørsted increased its share price three-fold between its IPO in June 2016 and May 2021.

Or take Interface, a European carpet manufacturer which set out on its mission-zero target back in 1994. The company has reduced the GHG footprint of its own operations by 96 percent, and cut end-product carbon intensity by 69 percent, by launching products using natural, bio-based, or recycled materials. Some of these products even

achieve a negative carbon footprint, while programs set up to recycle materials such as fishing nets provide additional sustainability benefits and support local communities.

Managing carbon emissions in an extended value chain has become a strategic necessity for most organizations. The critical task they face is twofold: to understand the implications of their choices, and to overcome the five challenges regardless of the choices they make. Those that succeed can build new value in a resource-constrained world.

Peter Spiller is a partner in McKinsey's Frankfurt office.

The author wishes to thank Eric Hannon, Ruth Heuss, Christiaan Heyning, and Divya Shenoy for their contributions to this article.

Designed by McKinsey Global Publishing
Copyright © 2021 McKinsey & Company. All rights reserved.