



Getting from hard-to-abate to a low-carbon future

Ecosystem approaches for the toughest climate challenges

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The decarbonization imperative

THE SHIFT TO a low-carbon economy is underway and is likely to unfold far faster and with more profound implications than many might expect. Far from distracting society from ongoing climate action, the pandemic period coincided with a rapid escalation of pressure on multiple fronts:

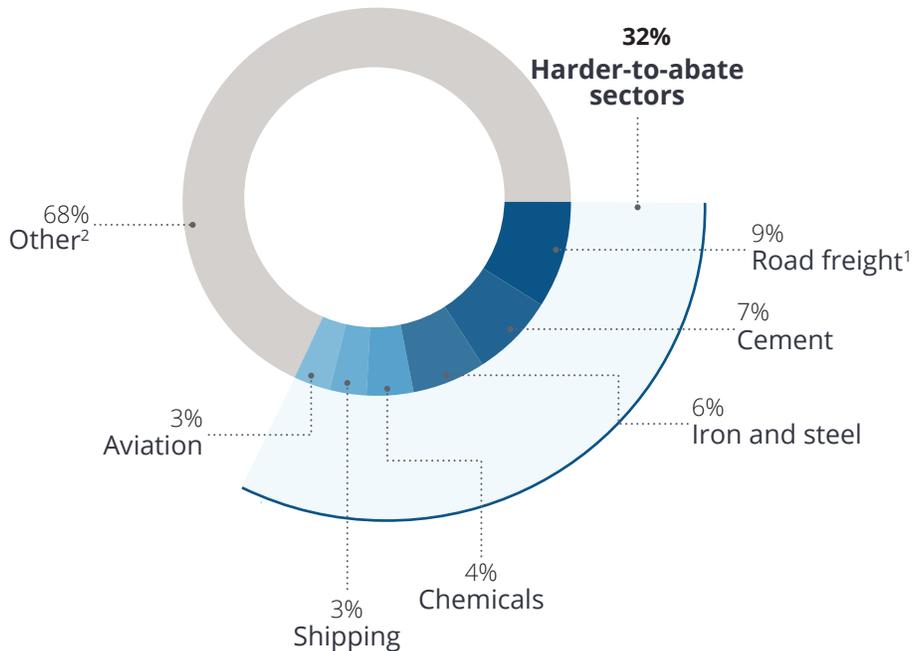
- Financiers and investors are increasingly demanding companies address emissions. Influence is being applied both by individual investors, some of whom are taking on activist roles and pushing for stronger climate action, and investor-led initiatives which are rapidly growing both in size and influence. Climate Action 100+, an investor-led initiative to act on climate change, has enlisted more than 540 investors, engaged across 33 markets, and representing more than half of all global assets under management.¹ More than 70 asset managers recently signed a pledge with the Net Zero Investors Initiative, which formed in December 2020; signatories have committed to supporting the goal of net-zero greenhouse gas emissions by 2050 or sooner and include some of the world's largest asset managers, such as BlackRock and Vanguard.² Hard-to-abate industries are not exempt. For example, the Poseidon Principles lay out a framework for climate-responsible financing of deep-sea shipping, with 27 banks representing US\$185 billion in lending as signatories.³
- Popular sentiment appears to have shifted. Nearly two-thirds of the 1.2 million people globally surveyed by the UN Development Program in 2020 said that climate change was a “global emergency.”⁴ That rising concern extends to consumers. In one recent study, more than 60% of respondents said that “companies have the opportunity, due to the pandemic, to be more thoughtful about how they incorporate sustainability into their business models moving forward.”⁵ In a study of citizens across 14 countries conducted amidst the pandemic, more than 70% of respondents agreed that in the long term, climate change is as serious a crisis as COVID-19.⁶
- Activist pressure seems to be mounting, largely led by the youth climate movement. The climate strikes in 2019 and 2020, attended by millions, helped push the issue higher on the global agenda,⁷ and other highly visible actions from various groups have captured global attention and galvanized many opinions.
- Employees are an increasingly vocal and expectant stakeholder group across all geographies.⁸ While workforce activism appears more noticeable for some sectors such as technology, it seems to be expanding across the board.⁹ Nearly 40% of millennials cite employer sustainability as a factor in deciding where to work¹⁰; a recent Gallup survey shows that seven in 10 US job seekers care at least somewhat about a potential employer's environmental record.¹¹
- The regulatory environment is growing more stringent. Emissions requirements, clean energy standards, carbon pricing and border adjustments, and more are becoming increasingly commonplace, not only in Europe but in major markets in Asia and North

America.¹² Climate reporting and disclosure is also evolving quickly, with efforts underway to rationalize different standards and create an authoritative standard-setting body under the umbrella of the IFRS Foundation.¹³

As addressing the climate crisis becomes increasingly urgent, every business should be on a path toward mitigating its own environmental impact. That includes so-called “hard-to-abate” industries—carbon-intensive sectors with few clear, viable low-emission alternatives, such as road freight, steel and cement making, chemicals, aviation, and deep-sea shipping.¹⁴ For years, decarbonizing these industries was deferred as attention focused on easier-to-address emission

sources, such as electricity generation and passenger vehicles. But today, spurred by the potentially existential stakes of a planetary emergency, a range of stakeholders—from regulators and investors to downstream customers and activists—are increasingly turning their attention to hard-to-abate businesses, which account for roughly one-third of global CO₂ emissions (figure 1).¹⁵ Achieving the Paris Agreement goals is likely only possible if emissions in these sectors are also reduced. And doing so brings knock-on benefits throughout the supply chain and helps companies address Scope 3 emissions; green steel feeds into automaking and other manufacturing processes, just as low-carbon cement enables low-carbon construction.

FIGURE 1
Global carbon dioxide emissions by sector in 2018



Notes: 1) Including LCVs, MDTs, HDTs and 1.5% from buses. 2) Including power (46.5%), other transport (10.8%), buildings (8.6%), feedstock (1.9%), and other industries (1.6%).

Sources: International energy agency (IEA), Global energy review, report, 2021; IEA, Sustainable development scenario 2020-2030, report, 2021; Deloitte analysis.

In this environment, a “wait-and-see” approach is increasingly risky. Instead of adopting a defensive, reactive posture toward decarbonization that seeks to mollify stakeholders or comply with regulatory mandates, companies in hard-to-abate industries have an opportunity to proactively shape their low-carbon future through deep collaborations targeting the fundamental drivers of demand. There are manifold benefits to moving early: access to novel and differentiated insights; the ability to share risks and investments and to influence the direction of the transition in their favor; and the opportunity to strengthen relationships with customers and other ecosystem players during the early phases of the transition.¹⁶ Early movement

can also initiate a snowball effect—as a handful of leaders begin to decarbonize, others will likely quickly follow suit to remain competitive.

In the following section, we outline two key strategic challenges which face most businesses in hard-to-abate sectors—technical gaps and business model gaps—and explore why collaborative ecosystem approaches could be the most effective way to overcome them. Throughout, we draw on examples and case studies from our collaborative research with Shell looking at several hard-to-abate industries, namely deep-sea shipping, road freight, and aviation.¹⁷

Mind the gap: The strategic challenges facing most hard-to-abate businesses

WHILE EACH HARD-TO-ABATE industry faces its own idiosyncratic set of challenges in transitioning to lower-emission operations, from a strategic perspective such businesses typically face two dilemmas: *technical gaps* and *business model gaps*.

Technical gaps arise when direct electrification is structurally constrained, while other viable low-carbon alternatives do not exist or are not yet available at scale to replace current carbon-intensive processes or energy sources. For example, emissions from internal combustion engines in road freight could be reduced with the expansion of battery electric vehicles for some applications, but for many uses, fuel cell electric vehicles using hydrogen could be required. Hydrogen is also required to produce synthetic sustainable fuels for aviation, as well as synthetic methanol and green or blue ammonia for shipping. Producing such fuels at scale requires large amounts of renewable energy (to produce green hydrogen), but also widespread use of carbon capture technology (for blue hydrogen), each of which remains nascent and prohibitively expensive.¹⁸ Closing technical gaps often requires focused research, development, and deployment, all backed by patient capital. To get there, hard-to-abate industries can look to share development costs, foster more coordinated and sustained investment flows, and advocate for supportive policy moves that can catalyze early-stage technology development or create the regulatory or market incentives to accelerate progress.

Technical gaps can also bleed into business model gaps that forestall decarbonization efforts. In some cases, a viable low-carbon solution exists but is deficient on one or more relevant dimensions: It may be more expensive to implement or operate, it may be less productive, it may yield a lower-quality output, it may require changes in supplier or customer behavior, and so on. Implementing such solutions unilaterally could put the organization at a disadvantage relative to competitors. In aviation, bio sustainable aviation fuel (bio-SAF), for instance, is a biofuel produced from a variety of feedstocks that



can reduce life cycle carbon emissions from aviation by up to 80%.¹⁹ It is a “drop-in fuel” with a relatively mature production technology that can be used in existing aircraft to immediately reduce emissions. However, SAF currently costs two to four times more than conventional jet fuel and supply is extremely limited, making it uneconomic without additional investment.²⁰ Business model gaps can be addressed by enhancing market demand and demonstrating a willingness to pay for new solutions; evolving more agile and flexible approaches to deploying new products or services; and collaborating with new partners to share the risk in exploring novel business models. For example, because hydrogen-powered trucks are new to the market, there isn’t enough data

yet available on their longevity to predict their resale value and to demonstrate a clear return-on-investment. This makes it hard for individual business leaders to make the business case for fleet replacement. That in turn makes it complex to secure financing from lenders. Instead, some OEMs are exploring a new business model whereby they continue to own the vehicle but lease it out to carriers; essentially, trucking-as-a-service.²¹

Whatever the specific challenge hard-to-abate businesses face, the root cause is likely traced back to one of these twin strategic constraints. And in both cases, escaping those constraints likely requires working beyond the four walls of the business.

Assessing sector readiness

ECOSYSTEM APPROACHES COME in a variety of configurations, from joint ventures and consortia to closed platforms and “walled gardens,” and can extend to players far beyond traditional industry lines and the current value chain. Crafting an appropriate approach that targets the right bottlenecks, participants, and behaviors hinges on understanding a sector’s readiness to decarbonize. Assessing three core questions and the six factors that flow from them can help break a very large problem into manageable steps which can be executed upon.

To decarbonize a sector, companies should consider six factors concurrently, and should not focus only on technology.

Why should the sector change? What actions or conditions can trigger industry stakeholders to act?

- **Market and customer demand:** What sorts of pressures and incentives from society, customers, financiers, and investors can be invited and encouraged to create motivation and momentum for change?
- **Regulatory incentives:** Understand the key instruments applied by global regulators and regional and local authorities. These can include incentives such as tax cuts and disincentives like fines and carbon levies.

How fast can the sector change? What effort is required to implement change at scale?

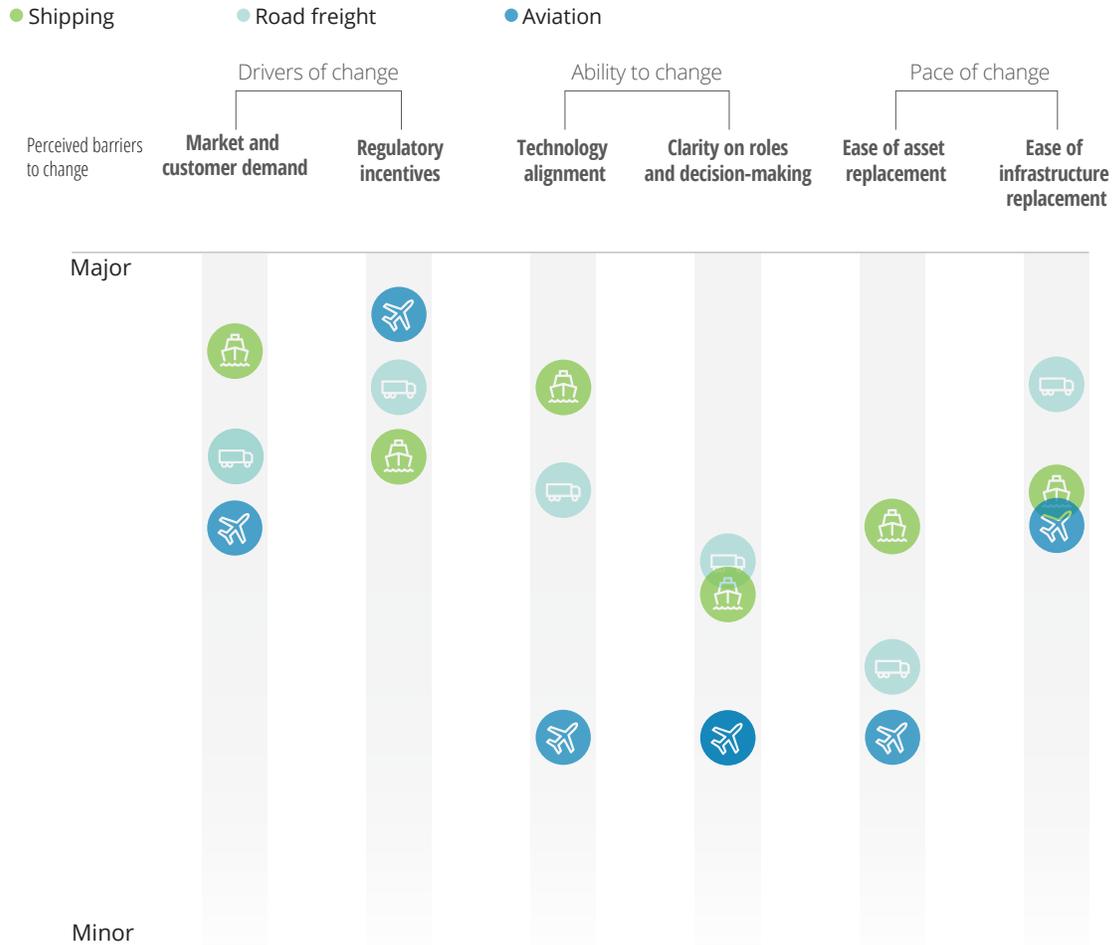
- **Ease and time horizon of asset replacement:** Consider the time horizon to replace or upgrade equipment where applicable or understand the rate at which alternative technologies are developed. The bigger and more expensive the assets and the longer their lifespans, the greater the challenge.
- **Ease of infrastructure replacement:** For example, what does it take to set up green production of new fuels at scale, deliver them to ports, and prepare for bunkering? The more production capacity needed and the more dispersed the infrastructure, the greater the challenge.

What are the best changes for the sector? What decarbonization accomplishments are most realistic and feasible in the near, medium, and long term?

- **Technology alignment:** Consider the technical and commercial feasibility of alternative fuels and other lower emission technology alongside clarity on how to further develop these.
- **Clarity on roles and decision-making:** The ease in making decisions, clarity on the roles and responsibilities of key groups in the industry, and alignment of priorities.

FIGURE 2

Market demand, regulation, and legacy infrastructure are common barriers to decarbonization across industries



Note: Based on interviews with more than 300 executives across the ocean shipping, road freight, and aviation industries. Aviation analysis based on usage of Sustainable Aviation Fuels only. Source: Deloitte analysis.

Assessing readiness, of course, is only the first step. Once you understand the current state and challenges to progress, you can embark on concrete

actions to catalyze progress—and remain anchored in a systems perspective with a focus on shaping the core drivers of demand.

Ecosystem solutions for the toughest decarbonization challenges

ADDRESSING THE TECHNICAL and business model gaps characteristic of many hard-to-abate industries requires first recognizing that decarbonization is a systems problem, and thus should be tackled through collective, ecosystem approaches. Accepting that decarbonization is a systems problem that demands multistakeholder approaches also necessitates a profound mindset shift for many. “Winning” no longer (only) means besting your competitors, but working collectively to achieve lower emissions.²² Adopting a systems view enables players to understand the bottlenecks and critical interdependencies on the path to decarbonization, and then design ecosystem solutions with specific behavioral targets for different players working across the entire value chain. Organizations can work collaboratively to remove barriers, reach critical tipping points, and accelerate adoption of new technologies and business models.²³

The key to moving the needle is to get past the typical points which lead some companies to a wait-and-see approach: The mistaken belief that technology development curves and policy shifts are fundamentally uncertain. In fact, neither is uncertain that it should preclude action today. We may not know everything we would like about future outcomes with respect to either technology or policy, but that doesn’t mean we should be paralyzed by ever-deepening analyses to try to better predict them.

Instead, we should move to do what we can to act on the fundamental drivers of demand conditions in any market-based domain: the needs, wants, and behaviors of people. No amount of technological innovation or policy shift is impossible if *people*—consumers, customers, business executives, government leaders, and beyond—align their voices in a way that sends demand signals. This can shift trends related to shift trends related to product attributes, investment capital flows, IP sharing, and standards setting. Demand by likeminded companies and organizations can kickstart and accelerate decarbonization change.

The ability to consolidate demand is a critical lever to break out of the chicken-and-egg dilemma that paralyzes so many hard-to-abate solutions. Too often customer demand for low-carbon products is fragmented and of uncertain longevity, which makes producers and financiers hesitant to invest in generating greater supply. A solution could involve identifying and working with key customers who value low-emission products or services and are willing to establish financial arrangements that make such solutions possible. Aggregating demand by pooling together numerous lower-volume customers to create critical mass can also be explored. That’s the logic behind groups such as the Clean Skies for Tomorrow Coalition, which aims to create “a mechanism for aggregating demand for carbon-neutral flying”²⁴—by extension, stimulating the market for sustainable aviation fuel (SAF).

Efforts to secure sufficient, long-term demand should extend beyond a single sector in many cases. A number of industries have an interest in sustainable biofuels, for example, including airlines (SAF), ocean shipping, and ground transportation providers. Working together can help reach critical mass, and also enable collaborative efforts to assure available supply goes to where it's most needed in the moment. Willingness-to-pay may not be the only

relevant metric for such demand aggregation efforts, either. Customers may be open to making other trade-offs for more sustainable goods—accepting marginally slower shipping times for their products if it reduces associated emissions, for example. In a B2C context, MIT researchers found that many e-commerce customers were willing to wait an additional five days on average for delivery when told about the environmental impact of their decision.²⁵

Action modes: Getting from small steps to big wins

THERE ARE THREE “action modes” that can be used individually or collectively to help create a flywheel effect for efforts to decarbonize hard-to-abate industries. The goal is to build momentum and create self-sustaining positive feedback cycles all in the service of effecting major changes.

- **Small wins contributing to big bets.** Small wins focused on “minimum viable moves” can be helpful to create momentum, but they should be clearly aligned to a bold vision. Too often companies get stuck in a seemingly endless cycle of pilot projects, but hard-to-abate sectors can’t just focus on small steps to decarbonize because progress will not come fast enough. Small win approaches, in isolation, assume that many incremental changes add up and that the cumulative results are ultimately, sufficient. Such thinking is dangerously misaligned with the speed and scale with which some of the best science says we need to reduce emissions, and with the pace of market transformation and rising stakeholder expectations. Working backward from 2050, there are not that many years to realize system-level changes—especially given the long lives of many assets in hard-to-abate industries. Converting a steel plant or turning over a fleet of ships or trucks takes many years. Big steps can be “derisked” through creative structuring of ecosystems, such as portfolio approaches. And big steps can provide necessary encouragement for others to act—in part by appealing to fears of being left out ... or behind.

- **Find a motivating insight.** In many cases, the standard analytic tools and decision-making mindsets deployed by business leaders can make low-emissions solutions appear unviable—if they are even considered at all.²⁶ To spur action, look for a motivating insight that can reframe what’s possible. New data—or old data couched in new ways—can allow leaders to consider solutions from new angles. For example, a focus on sticker price and higher upfront cost can deter adoption of battery electric vehicles for road freight use. But by considering duty cycles and total cost of ownership, the economics can become increasingly compelling for vehicles with relatively short and predictable runs.

Demonstration projects and proof points can also help show the “art of the possible.” For example, Shenzhen in China converted its entire bus fleet—around 16,000 vehicles—to electric, in the process illustrating the technology’s feasibility and utility at scale in a large, complex urban environment.²⁷

- **Empower an ecosystem architect.** Forging consensus among disparate actors and ensuring they abide by their mutual commitments—often in an environment of intense competition—can require the early and active participation of an entirely new type of player: the ecosystem architect. The ecosystem architect generally works to remove friction and create efficiencies across the network. That can mean identifying and coordinating data-sharing to eliminate

redundancies, bringing in new players to fill key gaps in capabilities, or creating standards or specifications that participants agree to adhere to. The architect is typically empowered to coordinate among and make some binding decisions on behalf of the ecosystem participants. It aims to solve the collective action problem that would otherwise prevent participants from working in ways they would mutually benefit from.²⁸ It does so by resolving disputes and breaking decision-making impasses. Where securing and sharing data is important, it can also hold that data in trust and serve as a secure, central repository. The precise powers delegated to the ecosystem lead can vary, but they generally fall on a spectrum somewhere short of unilateral authority but beyond mere convening; it is not top-down control.

The ecosystem architect's role can become especially important in instances where participants' preferences conflict or where short-term self-interest would cause them to opt out or act in ways that are counter to the ecosystem's vision. The most effective ecosystem architects typically exhibit a rare mix of attributes and capabilities. Most important, they should foster trust. The ecosystem architect should be seen by all participants as acting in good faith and in the best interests of the collective. Impartiality is key, but they should also have an incentive to participate and to care about outcomes. Often, a noncompetitive, neutral third party is best positioned to take on the role.

The challenge with effecting change in the face of uncertainty is that—almost by definition—the outcome is unknowable. Most organizations and individuals have grown up in a world in which “knowability” (a.k.a. the derisking of decisions) is both achievable and desirable. That is certainly the case in situations where data exists, and any player can make a rational trade-off between the cost of acquisition of that data and the likely risk mitigation it can help achieve. But we need a different mindset if we are going to make progress in decarbonizing hard-to-abate sectors.

Small steps forward which are designed either to test specific hypotheses or to catalyze a reaction from others can be a critical part of the solution. For example, consider the dilemma of an executive who knows that the *right* thing to do for society may have negative short-term consequences for their company—or their career—if they go on record as supporting it. A common reaction could be to retreat inwards and wait until policy shifts in a way that forces them and all their peers to take the step at the same time. An atypical—and better—reaction would be to go public with an anonymous quote which catches the attention of the rest of the ecosystem, giving others who may be similarly waiting-and-seeing the confidence to act themselves.

Even without all the data on hand to justify the decision, people should have the confidence to act quickly with these “minimally viable moves” in order to provoke a future which is increasingly desired by all.²⁹ Because the greatest risk of all is the risk of waiting too long to make progress.

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