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Life Sciences Practice

Accelerating the transition to net zero in life sciences

The majority of the industry's emissions are Scope 3. By working with suppliers, companies can achieve net zero with 60 to 70 percent abatement at cumulatively zero cost.

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The life sciences industry, which includes pharmaceutical and medtech companies, contract manufacturers, healthcare distributors, and others, has an innate purpose in society, providing life-saving therapies, medicines, diagnostics, and devices. And while safety and quality are critical priorities, an ever-increasing number of companies aim to deliver treatments in a manner that also considers the sector's broader social and environmental impact.

Environmental effects, in particular, have a significant impact on health outcomes, which decarbonization can help mitigate. Today, leading life sciences companies are looking at sustainability not only as a compliance requirement but also as a source of value to their patients, their organizations, and the planet. This value could differentiate their businesses by enabling additional volume gains, driving more efficient operations, and securing costs of materials with a supply–demand mismatch before green premiums increase.

Within sustainability, net zero has gained significant traction, aiming to strike a balance between the amount of greenhouse-gas (GHG) emissions generated and the amount eliminated from the atmosphere. In fact, McKinsey research found that, from 2019 to 2022, the number of life sciences companies that have committed to or set Science Based Targets initiative (SBTi)[1] emission-reduction targets increased from seven to 104. Life sciences companies typically focus on three areas on their decarbonization journey:

— *Ambition and investments.* This involves defining the ambition level and considering risks, benefits, and costs in line with SBTi requirements.

— *Road map and launch of execution.* This includes initiating planning on lower-carbon sourcing, green operations, circular business models, and sustainable product design, as well as engaging or partnering with key stakeholders across the value chain.

— *Operationalization and sustaining change.* This entails defining the right governance, building capabilities and processes, and supporting delivery.

McKinsey analysis has found that the majority of emissions in the life sciences industry fall under Scope 3, which means they occur outside the direct control of organizations.[2] Thus, the challenge moving forward will be crafting a successful Scope 3 emission-reduction approach to achieve these targets, which requires operational and technological improvements as well as buy-in from suppliers, distributors, healthcare providers, and other stakeholders in lowering life cycle emissions.

This article shows how life sciences companies can make both defensive and offensive plays to address carbon emissions[3]: playing defense by meeting regulatory requirements that extend the license to operate and playing offense by bringing lower-carbon products to market faster and securing the supply of green materials before green premiums spike. Doing so entails focusing on supplier selection, operating model and capabilities, product specification, partnerships and collaboration, and end-of-life solutions.

Carbon emissions in life sciences: An overview

For most industrialized nations, healthcare systems account for nearly 10 percent of national GHG emissions, a higher proportion than either the aviation or shipping industries.[4] If the global healthcare sector were a country, it would be the fifth largest GHG emitter on the planet, annually producing two gigatons of CO_2 equivalent.[5] And, according to McKinsey analysis, within the healthcare sector, the emissions intensity (in terms of tons of CO_2 per million dollars of revenue) for life sciences companies can be two to three times higher than that of healthcare delivery organizations.

[1] For more, see the Science Based Targets website.
[2] For more on Scope 3 emissions, see "The Scope 3 challenge: Solutions across the materials value chain," McKinsey, May 5, 2023.
[3] "Playing offense to create value in the net-zero transition," *McKinsey Quarterly*, April 13, 2022.
[4] Robert Metzke, "Here's how healthcare can reduce its carbon footprint," World Economic Forum, October 24, 2022.
[5] *Health care's climate footprint: How the health sector contributes to the global climate crisis and opportunities for action*, Health Care Without Harm and Arup, September 2019.

To better understand the cost implications of decarbonization, we provide deep dives on two industry subsectors, pharmaceuticals and medtech, to show what successful operationalization and execution looks like. The hope is that by focusing on the emissions baseline, decarbonization viability and cost, and major decarbonization levers, companies in these spaces can better understand how to set and achieve their ambitions in the years to come.

Case study one: Pharmaceutical companies

McKinsey analysis of approximately 40 pharmaceutical companies shows that about 75 percent of emissions across the value chain are Scope 3, with 50 percent of the total emissions coming from upstream, specifically the purchased goods and services category.

Decarbonization viability and cost

Using existing and emerging levers, a typical pharmaceutical company can abate approximately 90 percent of its total emissions at the cost of around $100 per metric ton of CO_2 by 2040,[6] which is within the range of projected carbon prices included in the EU Emissions Trading System (EU ETS).[7] Meanwhile, the remaining 10 percent will likely be difficult to abate with common levers and can therefore be addressed with short-term strategies, such as carbon offsets from the carbon market (see sidebar, "What are carbon offsets?").

One of the major concerns when setting ambitious decarbonization targets is cost. However, McKinsey analysis of the emissions profile of a representative pharmaceutical company shows that about 30 percent of emissions can be abated by levers with positive net present values (NPVs), meaning they

What are carbon offsets?

Carbon credits are essentially certificates showing that certain amounts of greenhouse-gas (GHG) emissions have been abated or removed from the atmosphere.[1] Some companies may need to purchase these credits to meet short-term emission-reduction targets or to fully eliminate emissions to achieve net-zero targets. In either case, the prices of carbon credits range from about $10 to $1,000 per ton of CO_2, with nature-based solutions (such as afforestation or reforestation and restoration of blue carbon, which refers to CO_2 absorbed from the atmosphere and stored in the ocean) at the lower end (about $10 to $25 per ton of CO_2) and tech-based removal (such as direct air capture and bioenergy with carbon capture and storage) at the higher end (about $100 to $1,000 per ton of CO_2).[2] Life sciences companies can consider these potential costs when deciding between funding and implementing decarbonization levers that permanently eliminate emissions and temporarily offsetting emissions via carbon credits, which would result in recurring costs.

[1] For more, see Christopher Blaufelder, Cindy Levy, Peter Mannion, and Dickon Pinner, "A blueprint for scaling voluntary carbon markets to meet the climate challenge," McKinsey, January 29, 2021.
[2] McKinsey analysis based on prices from the American Carbon Registry, the Climate Action Reserve, Gold Standard, and Verra.

[6] Cost assumptions are estimated based on the current price of energy (excluding supplier premiums) and on prices projected to 2040 based on historical trends and green technology feasibility.
[7] That is, around $75 to $130 per metric ton of CO_2 from 2030 to 2040. McKinsey analysis shows that average global carbon tax credits are expected to reach approximately $40 to $200 per metric ton of CO_2 by 2030 and $60 to $350 per metric ton of CO_2 by 2050.

lead to cost savings, and approximately 15 percent of emissions can be addressed by NPV-neutral levers. Cumulatively, around 60 percent of total emissions can be abated at net-zero cost (Exhibit 1).

Major decarbonization levers and impact

In the category of purchased goods and services (which accounts for 50 percent of total emissions), raw materials—including active pharmaceutical ingredients (APIs), excipients, and process chemicals—make up approximately 70 percent of emissions (and around 35 percent of total emissions), with the remaining 30 percent largely coming from packaging (Exhibit 2). For raw materials, switching to alternative fuel, alternative energy,[8] and carbon capture and storage (CCS)[9] are the major drivers to decarbonize the chemical production process for upstream suppliers.

Redesigning packaging or products can also help reduce the volume of materials required. Coupled with an effort to source lower-carbon packaging materials, such as recycled or bio-based plastics, this approach could help abate up to 90 percent of total packaging emissions by 2040.

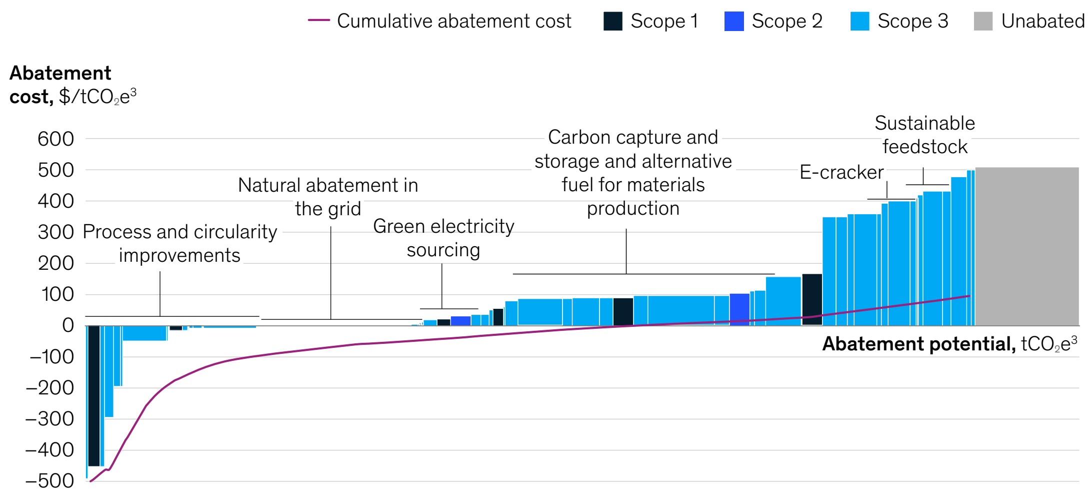
Case study two: Medtech companies

Based on McKinsey analysis of the emissions profiles of about 75 medtech companies, more than 90 percent of a typical player's carbon emissions fall under Scope 3. Of the major Scope 3 contributors to

Exhibit 1

Approximately 60 percent of emissions for pharmaceutical companies can be abated at near-zero cost by 2040.

Marginal abatement cost curve,[1] costs projected to 2040[2]



Note: While Scopes 1 and 2 emissions are under direct control, Scope 3 levers must be realized through supplier engagement. Costs and savings are determined by individual market power and negotiation between players involved along the value chain.
[1]Selection of abatement levers (nonexhaustive list); calculated as the levelized cost of production between existing technologies and alternative green technologies (ie, less carbon-intensive) from 2022 to 2040.
[2]Assumes current emissions volumes, not growth anticipated in the industry.
[3]Metric tons of CO_2 equivalent.
Source: McKinsey Catalyst Zero; McKinsey Decarbonization Lever Library; McKinsey analysis

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[8] For more on renewable energy in materials, see Marcelo Azevedo, Anna Moore, Caroline Van den Heuvel, and Michel Van Hoey, "Capturing the green-premium value from sustainable materials," McKinsey, October 28, 2022.
[9] For more on carbon capture, see "The world needs to capture, use, and store gigatons of CO_2: Where and how?," McKinsey, April 5, 2023.

Exhibit 2

Purchased goods and services make up approximately 70 percent of emissions in pharmaceuticals.

Abated-emissions matrix for emissions source vs decarbonization technology, 2040[1]

% of total emissions abated: 0 | 0–1 | 1–4 | 4–8 | 8–15

Net present value (NPV) effect[2]: + NPV positive / NPV neutral – NPV negative

Decarb technology (level of abatement contribution listed from high to low)		Scope 3: Upstream activity								Scope 3: Downstream activity		
		Purchased goods										
		Raw materials	Packaging	Capital goods	Fuel- and energy-related activities	Upstream transport and distribution	Waste generated in operations	Business travel	Employee commuting	Downstream transport and distribution	Use of sold products	End-of-life treatment of sold products
Alternative fuel (eg, biogas, hydrogen, biomass)		– (8–15)	– (0–1)	– (1–4)	– (0–1)	– (1–4)		– (1–4)		– (1–4)		
Alternative power	Natural abatement in power grid[3]	/ (1–4)	/ (0–1)		/ (1–4)						/ (1–4)	
	Green-electricity sourcing[4]	– (0–1)	– (0–1)								– (0–1)	
Carbon capture and storage		– (4–8)	– (1–4)				– (0–1)					– (0–1)
Process improvement in operations and design		+ (1–4)	(1–4)	+ (0–1)	(1–4)	/ (0–1)				/ (0–1)	– (0–1)	
Electrification (eg, BEV,[5] e-cracker, boiler, furnace)		– (1–4)	– (1–4)			+ (0–1)			+ (0–1)	+ (0–1)		
Circularity improvement (eg, recycled materials)			+ (8–15)	+ (0–1)			/ (0–1)					/ (0–1)
Sustainable feedstock (eg, bio or low-carbon feedstock)		– (1–4)		– (0–1)								

Note: While Scopes 1 and 2 emissions are under direct control, Scope 3 levers must be realized through supplier engagement. Costs and savings are determined by individual market power and negotiation between players involved along the value chain.
[1]Assumes current emissions volumes and not growth anticipated in the industry.
[2]For lever's NPV, green premiums are not accounted for in the value calculation, and this does not indicate how suppliers will split investments costs with customers.
[3]Assuming 75% of grid electricity comes from renewables in 2040 globally.
[4]Green-electricity-sourcing lever refers to switching to renewable power (eg, solar, wind, hydro) via grid or self-generation, and electrification lever refers to switching to electricity-powered machines in operation and transportation (eg, electrifying boilers, crackers, vehicles).
[5]Battery electric vehicle.
Source: "Explore CDP Data," CDP Worldwide, accessed August 1, 2023; McKinsey Catalyst Zero; McKinsey Global Energy Perspective 2022; McKinsey Life Sciences Sustainability service line

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medtech's carbon emissions, purchased goods and services account for approximately 45 percent of the total, while the use of sold products downstream accounts for about 28 percent.

Decarbonization viability and cost
Approximately 90 percent of total emissions across the value chain can be abated with available or emerging decarbonization levers, at a cost of about $70 per ton of CO_2 by 2040 (which is within the range of global projected carbon tax[10]). The remaining hard-to-abate emissions can be addressed by carbon offsets.

Approximately 11 percent of a typical medtech company's emissions can be addressed by NPV-positive decarbonization levers, and 30 percent can be addressed by NPV-neutral levers. Cumulatively, about 70 percent of the medtech industry's total emissions can be abated at net-zero cost (Exhibit 3).

Major decarbonization levers and impact
For purchased goods and services, raw materials such as metals and plastics usually account for 70 percent of emissions, with the remaining emissions coming from packaging (Exhibit 4).

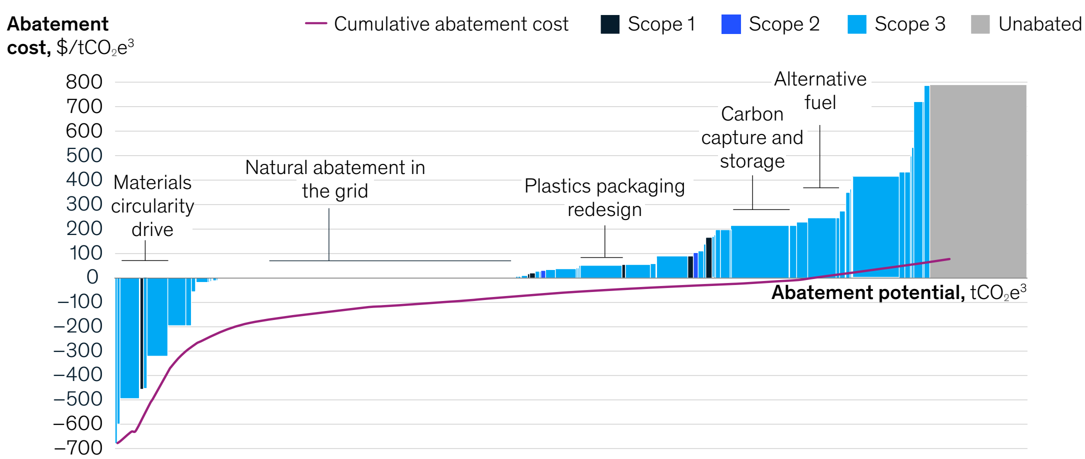
— For raw materials, key drivers to decarbonizing emissions include CCS in raw-materials manufacturing and the use of high-quality recycled raw materials (such as high-density polyethylene and stainless steel).

— Package or product redesign and the use of low-carbon packaging materials can help reduce up to 90 percent of total packaging emissions by 2040.

Exhibit 3

Approximately 70 percent of medtech emissions can be abated at near-zero cost by 2040.

Marginal abatement cost curve,[1] costs projected to 2040[2]



Note: While Scopes 1 and 2 emissions are under direct control, Scope 3 levers must be realized through supplier engagement. Costs and savings are determined by individual market power and negotiation between players along the value chain.
[1]Selection of abatement levers (nonexhaustive list); calculated as the levelized cost of production between existing technologies and alternative green technologies (ie, less carbon-intensive) from 2022 to 2040.
[2]Assumes current emissions volumes, not growth anticipated in the industry.
[3]Metric tons of CO_2 equivalent.
Source: McKinsey Catalyst Zero; McKinsey Decarbonization Lever Library; McKinsey analysis

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[10] McKinsey analysis shows that the average global carbon tax is expected to reach approximately $40 to $200 per ton CO_2 by 2030 and approximately $60 to $350 per ton of CO_2 by 2050.

Exhibit 4

Raw materials, which are used in purchased goods, account for about 70 percent of emissions for medtech.

Abated-emissions matrix for emissions source vs decarb technology, 2040,[1] %

% of total emissions abated: 0 | 0–1 | 1–5 | 5–10 | >10

Net present value (NPV) effect[2]: + NPV positive | / NPV neutral | – NPV negative

Decarb technology (level of abatement contribution listed from high to low)	Scope 3: Upstream activity: Purchased goods	Capital goods	Fuel- and energy-related activities	Upstream transport and distribution	Waste generated in operations	Business travel	Employee commuting	Scope 3: Downstream activity: Downstream transport and distribution	Use of sold products	End-of-life treatment of sold products
Alternative power: Natural abatement in power grid[3]	/ (1–5)		/ (0–1)		/ (0–1)				/ (>10)	
Alternative power: Green-electricity sourcing[4]	/ (0–1)									
Alternative fuel (eg, biogas, hydrogen, biomass)	– (5–10)	– (1–5)		– (1–5)		– (0–1)		– (1–5)		
Carbon capture and storage	– (>10)									– (0–1)
Circularity improvement (eg, recycled materials)	+ (5–10)	+ (0–1)								/ (0–1)
Efficiency improvement (eg, energy saving, heat integration)	– (5–10)	+ (0–1)	+ (0–1)	+ (0–1)			/ (0–1)	+ (0–1)		
Electrification (eg, BEV,[5] e-cracker)	– (1–5)			+ (1–5)			+ (0–1)	+ (0–1)		
Sustainable feedstock (eg, bio or low-carbon feedstock)	– (1–5)	– (0–1)								

[1]Assumes current emission volumes and not growth anticipated in the industry.
[2]While Scopes 1 and 2 emissions are under direct control, Scope 3 levers must be realized through supplier engagement. Costs and savings are determined by individual market power and negotiation between players involved along the value chain.
[3]Assuming 75% of grid electricity comes from renewables in 2040 globally.
[4]Green-electricity-sourcing lever refers to switching to renewable power (eg, solar, wind, hydro) via grid or self-generation, and electrification lever refers to switching to electricity-powered machines in the operation and transportation (eg, electrifying boilers, crackers, vehicles).
[5]For lever's NPV, green premiums are not accounted for in the value calculation, and this does not indicate how suppliers will split investments costs with customers.
[6]Battery electric vehicle.
Source: "Explore CDP Data," CDP Worldwide, accessed August 1, 2023; McKinsey Catalyst Zero; McKinsey Global Energy Perspective 2022; McKinsey Life Sciences Sustainability service line

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Sustainably addressing carbon emissions in life sciences

Several life sciences companies are already reporting on their progress to address Scopes 1 and 2 emissions,[11] and they are implementing green initiatives to reduce the emissions from their own operations. However, the challenge in the years to come will be tackling Scope 3.

Five bold actions can support life sciences companies in this journey (Exhibit 5). These actions work together to bring operational and technological improvements, and they require buy-in from suppliers, distributors, healthcare providers, and other stakeholders in lowering life cycle emissions.[12]

Exhibit 5

Life sciences companies have options depending on where they are in their sustainability journeys.

	Supplier partnership or selection	Internal operating model and capabilities	Product specifications	Partnerships and collaborations	End-of-life solutions
Starting out	Engage tier-1 supplier on disclosing carbon baseline	Invest in sustainability capability building for employees	Optimize emissions with design decisions not core to the product (eg, tertiary packaging) using levers such as materials substitution (eg, shifting to high strength and high performance, using low-emission materials)	Create greener alternatives for suppliers (eg, energize virtual power purchase agreement for renewable energy)	Create recycling programs for used products
Advanced	Help build supplier decarbonization capabilities Incorporate level of carbon emissions and progress toward science-based targets into supplier selection criteria	Gain visibility on tier-N value chain using digital twins Clear translation of overall decarbonization goals into KPIs for each employee Build digital solutions for internal carbon measuring, tracking, and reporting	Embed design for sustainability (eg, reducing material consumption, including circularity) into core product design	Directly finance innovation for low-emission materials by working with suppliers (eg, establishing purchase agreements)	Launch new circular business models that center on refurbishing products

Source: McKinsey Catalyst Zero; McKinsey Decarbonization Lever Library; McKinsey analysis

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[11] For more on individual company progress, see "Progress dashboard," Science Based Targets, accessed July 27, 2023.
[12] Organizations can take action based on their sustainability maturity in addition to building internal capabilities, such as building the partnership and ecosystem muscle and reskilling employees. For more, see Bob Sternfels, Anna Moore, Daniel Pacthod, and Humayun Tai, "A devilish duality: How CEOs can square resilience with net-zero promises," *McKinsey Quarterly*, November 1, 2022.

Supplier selection

The emission footprint of suppliers is considered a selection criterion for more than 90 percent of the leading life sciences companies, especially when quality, cost, and availability are comparable.[13] For example, as part of the Health Systems Task Force, several global life sciences companies have required their suppliers to set science-based targets for decarbonization by 2025.[14] The challenge, however, is ensuring that the commitment on decarbonization extends beyond tier-one suppliers (those in direct contact with companies) to tier n (those in the lower levels of the supply chain, which typically have unknown risk exposures). For example, in the API value chain, upstream suppliers such as oil and gas and basic-chemical producers have largely committed to decarbonization, while the suppliers between them and the life sciences companies (which contribute 50 percent of emissions) have not all committed to decarbonization.

Internal operating model and capabilities

McKinsey's recent sustainability benchmark survey shows that the areas with the most potential for improvement in life sciences are innovation (through R&D) and the supply chain (through procurement).[15]

Organizations can also invest in capability building so employees understand how their choices affect others beyond their own functions—for instance, how supplier choice could affect product innovation and overall carbon emissions. This can be done through workshops, digital classes, and training sessions, as well as by building internal carbon measuring, tracking, and reporting solutions to create transparency.

In addition, digital solutions, such as value chain twins, can help map where carbon emissions occur across multiple products and can also be traced back to source materials, effectively allowing life sciences companies to build a view of their tier-n value chain. In fact, by focusing on only three suppliers in the tier-n value chain, a company with five million metric tons of emissions and 2,000 suppliers could abate 35 percent of its emissions.

Product specifications

Product and packaging redesign has the potential to achieve the dual mission of reducing carbon emissions and lowering cost. In fact, McKinsey analysis of select products shows that carbon emissions can be reduced by 30 percent, with cost savings of 10 percent.

On this point, life sciences companies can adopt sustainable-by-design principles, including designing for higher recycled content and component-to-component recycling, decreasing material content in end products, developing better disassembly, and improving sorting approaches and technologies. For example, one company evaluated design levers through product analysis, identified initiatives to reduce its carbon footprint and costs at the same time, and validated the initiatives with R&D, procurement, and customer feedback. Based on the results, the company was able to reduce carbon emissions by approximately 40 percent and costs by 24 percent.[16]

Partnerships and collaborations

With more companies ramping up their net-zero commitments, the demand for low-carbon feedstock will outpace supply and result in a significant supply–demand mismatch as early as 2030.[17] On this point, McKinsey research has found that in 2035, the demand for sustainable methanol, a process chemical for many APIs, could be two to three times higher than the available supply.

To encourage investment in R&D or production capacity for lower-carbon materials, life sciences companies can work with their suppliers to establish purchase agreements for large quantities of materials or even directly finance innovation and production-capacity increases for the low-emission materials they require.

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[13] Sampled life sciences companies include the top 30 pharmaceutical companies and the top 30 medtech companies.
[14] "Joint supplier targets," Sustainable Markets Initiative, March 2023.
[15] Sample included ten companies across pharmaceuticals and medtech.
[16] For more on this approach, see Stephan Fuchs, Ruth Heuss, Stephan Mohr, and Jan Rys, "Design cost-effective, carbon-abated products with resource cleansheets," McKinsey, September 28, 2020.
[17] Anna-Christina Fredershausen, Eric Hannon, Stefan Helmcke, and Tomas Nauclér, "It's not easy buying green: How to win at sustainable sourcing," McKinsey, February 25, 2022.

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Life sciences companies can enhance circularity by developing refurbishments for second-life capabilities and zero-landfill or -incineration solutions.

End-of-life solutions

End-of-life solutions typically center on collaborations with healthcare delivery organizations, given the amount of waste generated in hospitals, and for this reason primarily apply to medtech companies. Here, materials recycling can abate approximately 10 percent of total emissions at relatively low cost or even with potential savings. On this point, some life sciences players are developing advanced-recycling capabilities.[18]

End-of-life solutions involve both new business models and circular modes of operation. On the business model end, life sciences companies can create value through buyback programs, for example. And on the operations side, they can enhance circularity by developing refurbishments for second-life capabilities and zero-landfill or -incineration solutions. For example, an American multinational medtech company provides reprocessing and remanufacturing services for single-use medical devices that optimize financial and environmental sustainability.

Although life sciences companies have to deal with near-term profit-and-loss pressures, they still need to accelerate their decarbonization efforts, given the long time to develop lower-carbon products, the limited ability to change product footprints, and the need to build up lower-carbon sourcing capabilities. In addressing sustainability in life sciences, there is potential to limit the negative impact of climate change and to ensure the continuity of supply. Based on the track records of other industries, the strategic benefits of being a first mover far outweigh the temporary cost of capital investment—in regard not only to social, patient, or environmental benefits but also to revenue (potentially by locking in additional volume) and managing cost (by securing contracts before green premiums significantly increase). Considering all these points, it is critical that life sciences companies take action today to accelerate the transition to net zero.

[18] For more, see Zhou Peng, Theo Jan Simons, Jeremy Wallach, and Adam Youngman, "Advanced recycling: Opportunities for growth," McKinsey, May 16, 2022.

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