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Insights

Reducing carbon, fueling growth: Lowering emissions in the chemical industry

To reduce industry carbon emissions, collaborating with partners across the chemical value chain will be crucial to developing holistic and sustainable solutions

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Executive summary

THE CHEMICAL INDUSTRY is crucial in building a sustainable global economy. The industry currently accounts for about 5% of global GDP and over 96% of all manufactured goods are directly touched by the business of chemistry.[1] The industry provides critical materials to other major industries, including health care, transportation, communications, and retail.[2] So even as the world faces the challenge of reducing greenhouse gas (GHG) emissions to "decarbonize," it is not desirable to "dematerialize," but rather to use materials most efficiently to sustain and advance the human condition. The chemical industry, however, also consumes over 10% of fossil fuels produced globally and emits greater than two gigatons of GHG emissions per annum globally.[3] The US chemical industry's GHG footprint itself is over 200 million metric tons of carbon dioxide equivalent ($MtCO_2e$) per annum.[4] The inherent growth of the industry adds to the challenge. Growth alone, absent abatement solutions, could lead to as much as a doubling of industry GHG emissions in about 30 years.[5]

So, the challenge is real, and the response is increasingly being catalyzed by consumers. Indeed, the GHG emission reduction ambitions of many customers further down the value chain are outpacing the implementation of abatement measures within chemical companies. To accelerate their pace of innovation, chemical and material producers will need to embrace new technologies, get closer to end markets, and take a lead role in working within—and across—value chains to deliver lower-carbon products and solutions.

Lowering carbon emissions is not only a challenge but also an opportunity—potentially opening pathways for chemical companies to capture additional value. For example, chemical companies can lead with innovation to develop advanced material systems and services in applications such as energy-efficient building products, energy storage, and materials for electric vehicles (EVs). The expertise that resides within the chemical sciences will also be required to solve the challenges associated with reducing the adverse effects of climate change. If successful, reducing GHG emissions in chemicals will also have the added benefit of reducing scope 3 emissions for all downstream customers.

To take advantage of this opportunity, chemical companies should actively work within their supply chains and with end-market customers to ensure their offerings are positioned to support sustainability targets. Their goal should be to bring increasingly low- and no-carbon products to market, which will help ecosystem partners transition to lower emission solutions and drive long-term growth.

Achieving net-zero emissions across the chemical value chain will likely require not only capital investment and business transformation, but also possibly new types of partnerships with key stakeholder groups. Chemical companies, through a coordinated effort across the value chain, can make great strides in developing a circular economy. They are in a unique position to aggregate demand (for postconsumer waste, alternative fuels, etc.) and supply (of advanced

recycled materials, clean hydrogen, etc.), thereby eliminating fossil-based inputs and reducing emissions. As with scope 3 emissions referenced above, this chemical "multiplier effect" highlights the importance of the industry.

There will be opportunities for new business models, and entirely new markets may be formed as the result of a more circular, lower-emissions economy. In fact, companies that are "sustainability leaders" are four times more likely to be recognized as innovation leaders in separate, independent rankings.[6] Indeed, there is great potential for chemical and materials companies to join those ranks.

The chemical industry has a "trifecta" opportunity to lower its scope 1 and scope 2 emissions and downstream end-market scope 3 emissions.

Rethinking conventional approaches

TO SUCCEED IN markets that demand lower-carbon solutions, chemical companies need to develop innovative chemical processes and materials that can credibly reduce emissions both upstream and downstream in the value chain: upstream, to lower the "carbon backpack" that grows with each sequential chemical manufacturing step, and far downstream, in end-of-life options.

For their part, consumers are increasingly willing to make changes to help drive sustainability. In a recent Deloitte survey of 23,000 people worldwide, it was found that over half are worried and anxious about climate change.[7] In fact, 72% believe that climate change is an emergency.[8] This anxiety is changing consumer behavior—Fifty-five percent of those surveyed have purchased a sustainable product or service in the last four weeks.[9] Food, beverages, and everyday household goods constitute two-thirds of those purchases. When asked about their last sustainable purchase, 32% said they paid significantly more, and 19% waited longer to get it.[10]

In another Deloitte survey, the 2022 Global Automotive Consumer Study, respondents said they are drawn to EVs because of an expectation of lower fuel costs, but also because they are concerned about climate change and want to reduce emissions.[11] A majority (56% of consumers) regard concern about climate change/reduced emissions as a key factor in their decision to acquire an EV.[12] Moreover, 59% of consumers said they would be very interested in acquiring an EV even if the electricity used for mobility were priced like current fossil fuels.[13]

ADVANCES IN MATERIAL SCIENCE HAVE ENABLED EV GROWTH

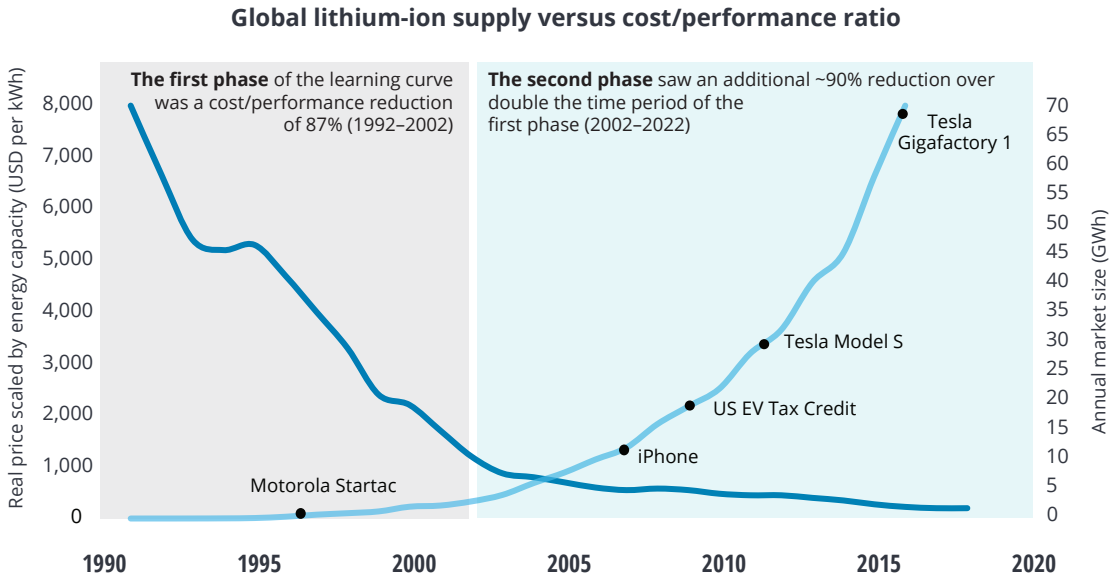
Are there historical precedents for technologies moving across innovation frontiers at the scale needed for abatement technologies in the chemical industry? When one thinks about exponential change and innovation, examples from IT or biology are often referenced. While they are appealing stories, these analogies are not sufficient as both the size and the scale of those technologies are orders-of-magnitude smaller than what one sees in chemicals.

Figure 1 is an example from chemistry and material science, which illustrates the significant changes in lithium-ion battery development. The graph plots both the learning curve and the adoption rate for lithium-ion batteries over a 30-year period. A combination of market signals and policy support then triggered an overall price-to-performance improvement of 97%—which is still improving today.

This learning curve is especially instructive in the current context—advancement in materials science and manufacturing is what will be required to start cutting into abatement gaps and moving to different performance frontiers.

FIGURE 1

Technology acceleration: The lithium battery journey offers insights and may inspire confidence



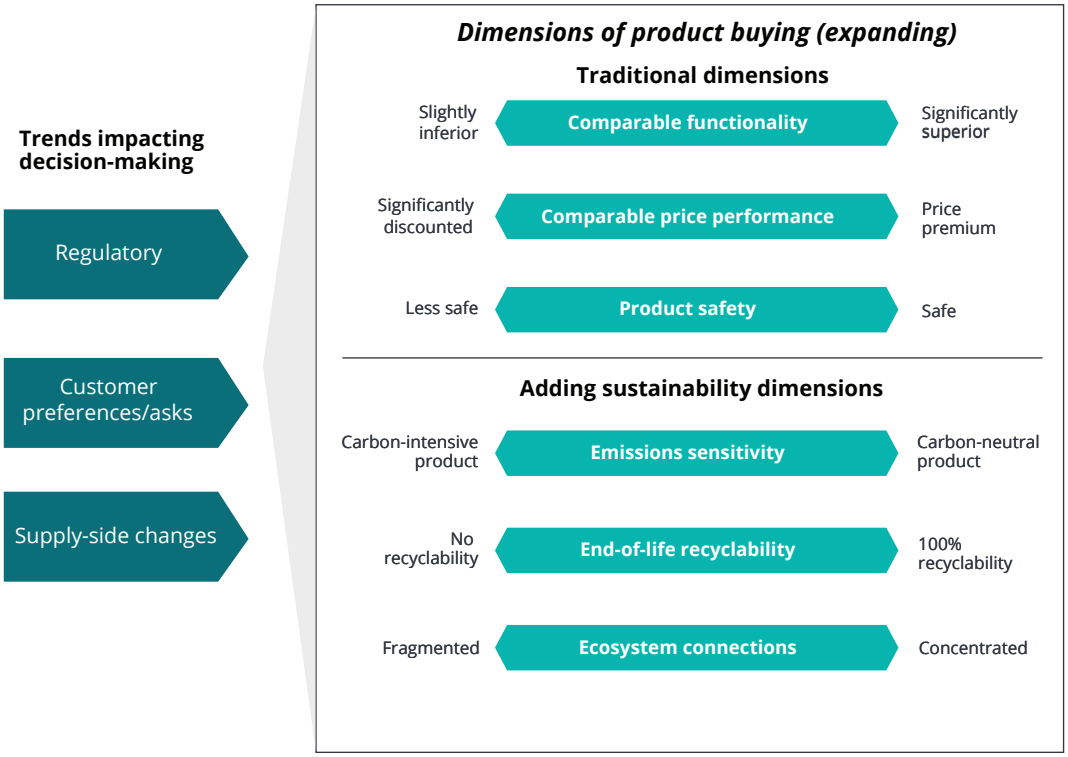
Source: Micah S. Ziegler and Jessika E. Trancik, "Re-examining rates of lithium-ion battery technology improvement and cost decline," *Energy Environmental Sciences* 14 (2021): pp: 1635-51.

In potential conflict with these emerging consumer expectations, however, is the current level of implementation of GHG abatement technologies. The path toward absolute reduction requires accelerating technologies and the infrastructure needed to reduce industry emissions. While there are promising early signs of an inflection point, current efforts are insufficient to deliver against the growing demands of direct customers, consumers, and governments around the world.

Chemical companies should, therefore, see sustainability as a critical component in their core business strategy and long-term success and invest to create more sustainable products. Historic buying decisions (figure 2) for chemicals and materials have been typically driven by a price-performance trade-off. As customers look to achieve their environmental, social, and governance (ESG) ambitions, this two-dimensional trade-off increases in complexity to include elements such as emissions sensitivity, end-of-life recyclability, and ecosystem connections.

FIGURE 2

Product selection decision-making by customers will likely see increased and more complex trade-offs



Source: Deloitte analysis.

Figure 3 highlights a specific example—the expanding array of choices between Polypropylene versus Polyurethane insulation materials and the options that customers will likely face. Both the products have an overlapping "range," tied to decisions made along the value chain. Innovations such as bio-based polyurethanes or advanced recycling of polypropylene offer the potential to further scramble the traditional narrow focus on price/performance.[14]

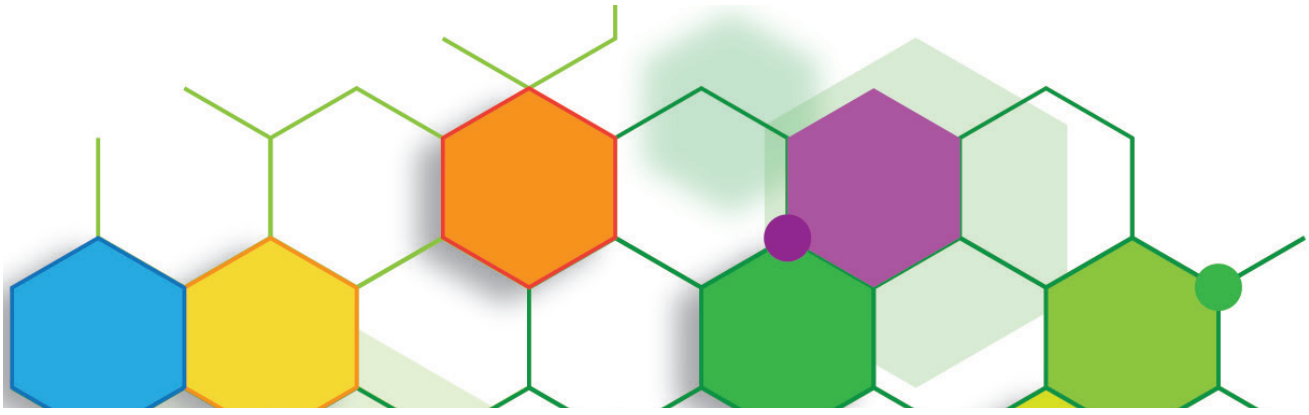
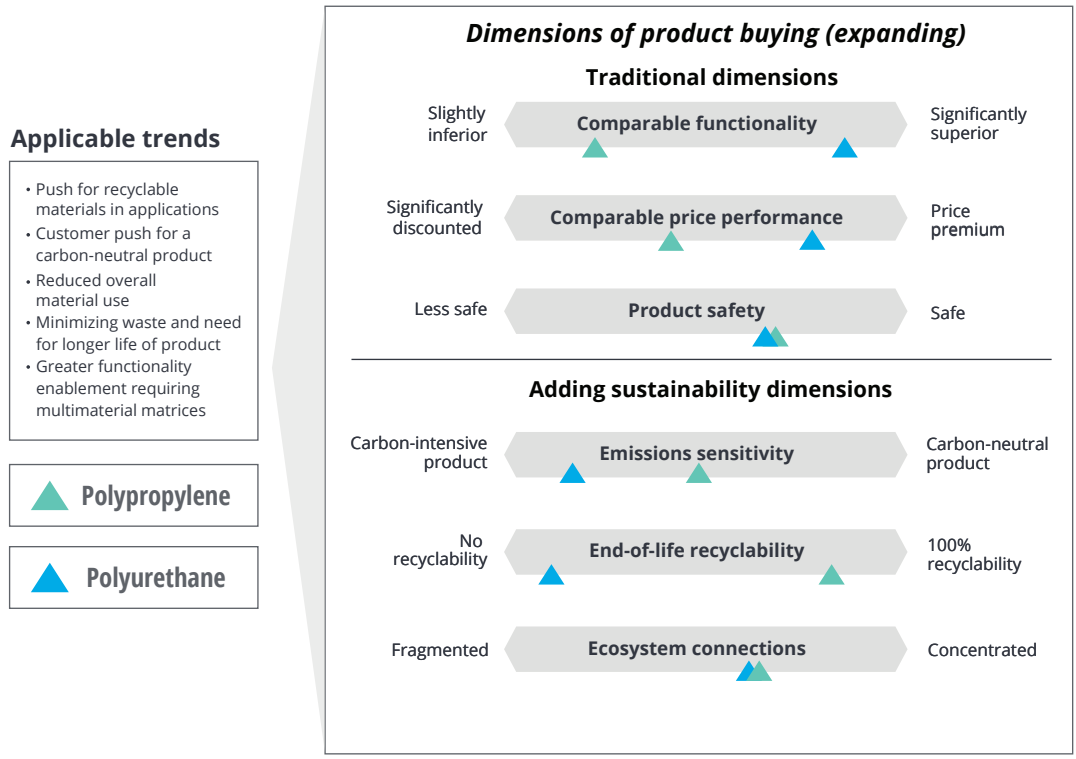


FIGURE 3

How polyurethane compares with polypropylene in rigid applications such as construction and insulation



Source: Deloitte analysis.

Complex trade-offs will drive innovation and investment choices for chemical companies, guiding how they could potentially shift the positioning of certain lower-carbon solutions.

These include:

- Testing relative importance on multiple sustainability dimensions (such as low carbon and waste management) against stated customer objectives.
- Leveraging digital tools to connect requirements to potential solutions (for example, using material informatics, i.e., the integration of material and computer science to accelerate R&D cycles).
- Considering the total life cycle value that the product provides versus near-term emissions reductions.
- Working with customers and competitors to look for ways to close the circularity loop—for example, in automotive, the catalytic converter markets are largely closed-loop in nature. Advanced recycling technologies (which include chemical recycling back to monomers and feedstocks) are showing great promise for similarly "closed loops."

Defining and capturing value from end markets

GIVEN THE GROWING momentum and support for reducing carbon emissions, chemical companies that don't adapt their product design and manufacturing practices will face increasing pressure from end-market customers.

This shift toward sustainable materials, along with a policy push, is an opportunity for chemical companies to explore and embrace new business models at scale. For example, in response to stakeholder pressure to reduce emissions, large consumer product manufacturers are reducing the amount of overall polymers used and increasing recycled content in packaging. But this only partially addresses the challenge.

An effective, holistic solution would mean addressing emissions over a product's complete life cycle—a cradle-to-cradle basis, i.e., design and produce products in such a way that at the end of their life, they can be truly recycled and upcycled. And while recycling is essential in packaging, other applications will require different approaches such as alternative feedstock or 24/7 renewable energy. Bottom line: There is no one-size-fits-all solution.

AS SUSTAINABLE TECHNOLOGIES GROW, CHEMICAL COMPANIES HAVE A CHOICE TO MAKE

Developing a sustainable product portfolio will be at the heart of a successful chemical company. Chemical companies should regularly review their product portfolio to realign transition to verifiable lower-carbon products. Industry leaders can build and manage a sustainable portfolio by addressing three critical questions:

1. What are the longer-term growth opportunities available to the company in different end markets?

2. Which product portfolio mix will likely give superior value to end-market customers?

3. Does the company have a robust sustainable product portfolio to perform well in the future?

Given below are some examples of the challenges and opportunities in reducing chemical product emissions by end market (figure 4).

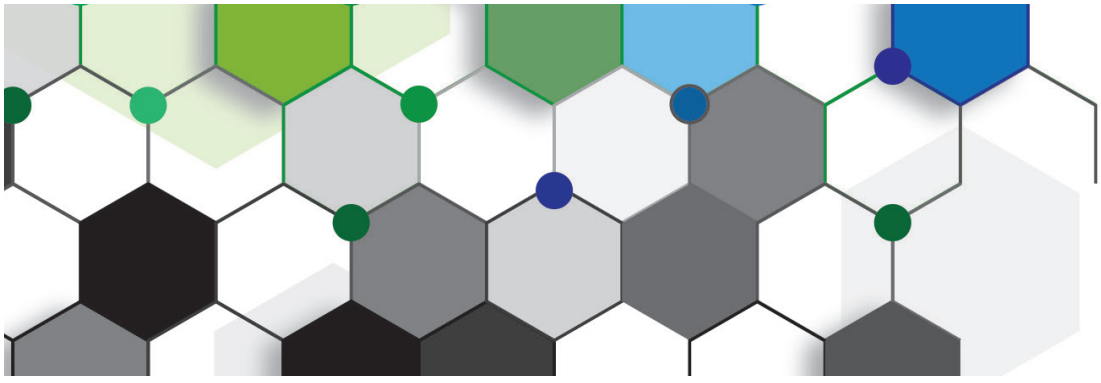


FIGURE 4

Key global chemical industry end markets which likely present the biggest opportunities for scope 3 emissions reduction

End market	2020 sales (US$ billion)	% share of total global chemical industry sales
Consumer	$1,294	30.6%
Transportation	$872	20.6%
Construction	$658	15.5%
Electronics	$440	10.4%
Other end markets	$971	22.9%
Total	**$4,235**	**100.0%**

Note: Other end markets include health care, pharmaceuticals, agriculture, oil and gas, and other manufacturing.
Source: Deloitte analysis based on data from Cefic, ACC, the U.S. Bureau of the Census, and the IMPLAN model.

Consumer

Consumer demand for sustainability is rising. Nearly half of the respondents in a Deloitte survey said they have altered their activities or purchase behaviors to help address climate change since the pandemic began.[15] Four in ten consumers now say they choose sustainable consumer goods often or whenever possible.[16] Leading consumer product companies are accelerating their climate commitment to cut emissions by 50% across operations by 2030.[17] About 45% of top consumer product companies have targeted to achieve net-zero emissions by 2030.[18]

PREPAREDNESS IN REDUCING EMISSIONS

- Consumer product companies are focusing on innovation to drive emissions reduction.
- According to Deloitte's recent survey, over half of industry executives believe consumer sustainability will be the most critical area for product innovation.[19]
- Top priorities are sustainable packaging and sustainably sourced new product offerings.

OPPORTUNITIES FOR CHEMICAL COMPANIES TO REDUCE EMISSIONS

- Advance innovation by developing common standards and metrics, coordinated R&D planning, and a forum to navigate and align emissions reduction levers and new technologies.
- Drive action by forming coalitions between policy, funding, and projects, and move at pace on investment and innovation.

INDUSTRY EXAMPLE

A global advanced materials and specialty additives company is collaborating with a multinational consumer goods corporation to accelerate the transformation of plastic packaging and collaborate on recycling solutions to enable a circular economy. The consumer goods company will use new advanced materials in select products and packaging, supporting companies' goals to reduce the use of virgin plastic from fossil resources.

Transportation

Transportation is one of the three largest sources of carbon emissions and this industry's emissions are increasing.[20] In 2020, the global transport industry was responsible for approximately 7.3 billion metric tons of carbon dioxide (CO_2) emissions.[21] The industry is changing at a pace not seen since 1970s-era oil crises. Many countries, businesses, auto manufacturers, and other stakeholders signed a declaration to reach 100% of all vehicle sales being zero-emission by 2040 or earlier.[22] About 10% of major original equipment manufacturers (OEMs) have targeted to achieve net-zero emissions between 2030 and 2040.[23]

PREPAREDNESS IN REDUCING EMISSIONS

- Electric transportation is laying the groundwork for the shift to net-zero transportation.
- Transportation companies are working with governments to establish the required infrastructure and set an end date for conventional fuel engines.

OPPORTUNITIES FOR CHEMICAL COMPANIES TO REDUCE EMISSIONS

- Lightweighting remains a critical need, perhaps even more so in EVs with heavy battery packs.
- Advances in new battery chemistries may increase vehicle range and reduce the amount of critical minerals needed for production.
- Ecosystem partnerships may improve methods for end-of-life EV battery-recycling, especially of so-called active materials.

INDUSTRY EXAMPLE

To allow automotive OEMs to improve the sustainability of their products, LyondellBasell has extended its suite of sustainable solutions to its Advanced Polymer Solutions (APS) segment. Its Circulen portfolio of compounds and solutions is derived from mechanical and advanced (molecular) recycled and renewables-based materials. The new compounds and solutions support the reduction of plastic waste through recycled content and a lower-carbon footprint using renewable-based content.[24]

Construction

The construction industry value chain accounts for about one-fourth of global carbon emissions.[25] Construction materials–processing and building operations together account for over 95% of the industry's emissions.[26] The building and construction industry is working toward halving emissions by 2030 and achieving net-zero emissions by 2050. Around 25% of top construction companies have targets to achieve net-zero emissions by 2040.[27]

PREPAREDNESS IN REDUCING EMISSIONS

- Construction companies are incorporating materials made using lower emission–generating processes, low-carbon cement, and steel, and reduced embodied carbon to meet the industry's net-zero targets.
- Many construction companies have begun increasing the use of more convenient end-to-end retrofit solutions.

OPPORTUNITIES FOR CHEMICAL COMPANIES TO REDUCE EMISSIONS

- Collaborate with the construction material sector to cut carbon emissions in cement and steel by leveraging common abatement solutions such as carbon capture utilization and sequestration (CCUS) and clean hydrogen.
- Increase the use of low-carbon synthetic materials ranging from insulation to adhesives.

- Reuse materials, including advanced recycling-designing products for reuse.

INDUSTRY EXAMPLE

Dow Building Solutions is collaborating with the US Green Building Council (USGBC) to support sustainable cities and promote energy efficiency. The partnership aims to develop carbon mitigation projects in built environments to measurably reduce emissions through improved energy efficiency in buildings.[28]

Electronics

The electronics industry accounts for about 4% of global carbon emissions.[29] The carbon output of data centers alone is equal to that of the entire aviation industry.[30] For instance, in the United States, data centers require 91,000 gigawatt hours (GWh) of electricity, the equivalent yearly output of about 34 power plants.[31] Leading semiconductor manufacturers aim to reach net-zero emissions by 2050, while major consumer electronics manufacturers such as smartphone producers intend to achieve net-zero emissions by 2030.[32] Around 30% of leading electronics manufacturers have targeted to achieve net-zero emissions by 2030.[33]

PREPAREDNESS IN REDUCING EMISSIONS

- Electronics manufacturers are working on designing products that continue to reduce power consumption and e-waste that is recycled and reused.

OPPORTUNITIES FOR CHEMICAL COMPANIES TO REDUCE EMISSIONS

- Work with electronics manufacturers to channel capital by making bigger bets on decarbonizing existing manufacturing assets at scale and partnering with new tech startups.
- Communicate the common need for true 24/7 renewable electricity.
- Collaborate on specific materials innovation needed to enable emerging climate technologies such as energy storage.

INDUSTRY EXAMPLE

Celanese Corporation developed and launched sustainable acetal plastic, also called polyacetal and polyoxymethylene (POM). The material widely used in industrial applications, consumer appliances, and consumer electronics allows customers to reduce carbon dioxide emissions in their end-use products and move closer to their renewable content goals.[34]

Abatement solutions to enable lower-carbon products

GENERAL, ECONOMYWIDE ANALYSES of GHG emissions inevitably list chemicals as a "hard-to-abate" industry. In fact, only construction materials (cement) and steel are in the same class. Why? The chemical industry produces products in volumes that are measured in millions of metric tons and the processes to produce those millions of metric tons are highly energy-intensive. And of course, today the industry relies almost exclusively on fossil hydrocarbons as inputs.

So what options are available to help abate GHG emissions in the industry?

Through our extensive research and surveys of industry, academia, and independent experts, a portfolio of 15 abatement solutions emerges. As shown in figure 5, these solutions are viewed through the lenses of technological viability, which comments only on the development of the technology and how deployable it is, and the commercial viability, or whether the technology is deployed at the relevant industry scale. A caveat: This is an industry view. There will be exceptions when one looks at the scale of smaller geographies or individual organizations.

The analysis contains good news. Within this portfolio, there are options that have the potential to address most industry scope 1 (direct energy and process emissions) and scope 2 emissions (indirect purchased electricity and steam). There are also options that address important scope 3 feedstock emissions.

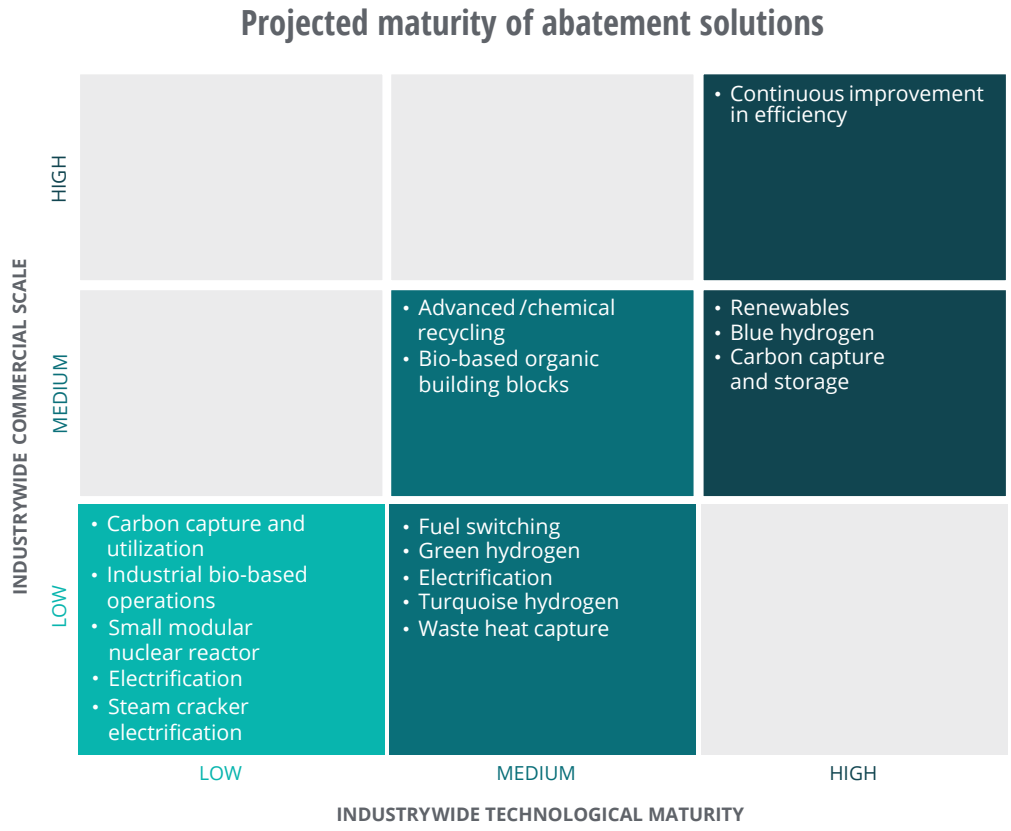
However, very few of these are fully technologically mature. Many options are scientifically possible—Scientific literature is rife with papers reporting on solutions to several climate issues, yet most of those are orders-of-magnitude too expensive or have only been demonstrated on a scale of grams or kilograms. Scale matters in an industry like chemicals and materials, where volumes are measured in kilotons and millions of metric tons and emissions are measured in millions of metric tons.

Most heavy industry abatement solutions bring added costs to a product's cost of goods sold (COGS). Unlocking demand for new sustainable chemicals and materials, therefore, will require solutions with a clear economic payback. By pivoting to a more circular economy, chemical companies can explore growth opportunities in two ways—by supporting their customers in reaching their emissions reduction targets and by extending their core business with new business models and offerings.

It's important to note that while companies will have to make certain choices, based on their capital and resource constraints, no singular technology or policy alone will lead to significant reductions.

FIGURE 5

Maturity and time to technological maturity of abatement solutions are crucial to emissions reduction



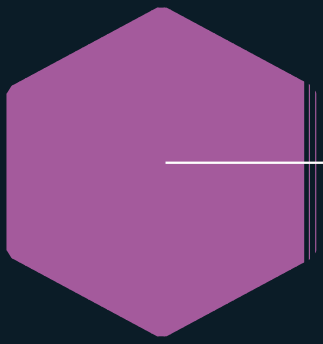
Source: Deloitte analysis.

Leading material DECARBONIZATION

The chemical industry has a "trifecta" opportunity to lower scope 1 and 2 emissions, as well as downstream end-market scope 3 emissions. A properly designed and optimally deployed core business strategy, with sustainability as a critical component, may represent one of the biggest-ever opportunities for chemical and materials companies. This strategy can help the industry decide where to play and how to win in lowering emissions and creating new sources of value.

Read the full report at www.deloitte.com/us/Loweringchemicalemissions

WHY IS THIS IMPORTANT?



96%
OF ALL MANUFACTURED GOODS

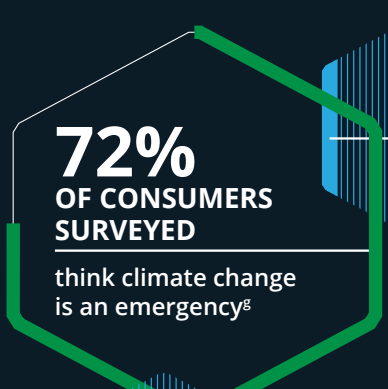
are directly touched by chemistry[a]

(e.g., chemicals make up <96% of the weight of a new vehicle but 50% of its volume)

13 OUT OF 17
OF UNITED NATIONS' SUSTAINABLE DEVELOPMENT GOALS[b]

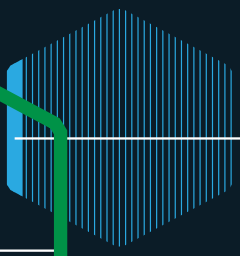
are attained by contributing factors from chemical products and R&D

THE CHALLENGE



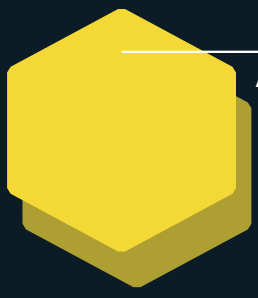
72%
OF CONSUMERS SURVEYED

think climate change is an emergency[g]



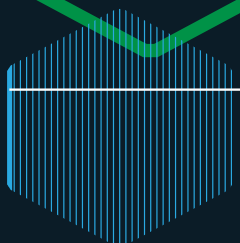
10%
OF ALL FOSSIL FUELS PRODUCED[c]

are consumed by the chemical industry



2X

As the need for materials continues to grow, emissions are expected to double by 2050 unless abated[h]



4%
OF TOTAL US EMISSIONS

comes from chemical industry scope 1 and 2 emissions (over 200,000,000 metric tons of carbon dioxide equivalent or MtCO2e)[d]

From 2005 to 2020, US chemical industry emissions grew by[e]

8.9%

despite an

11%

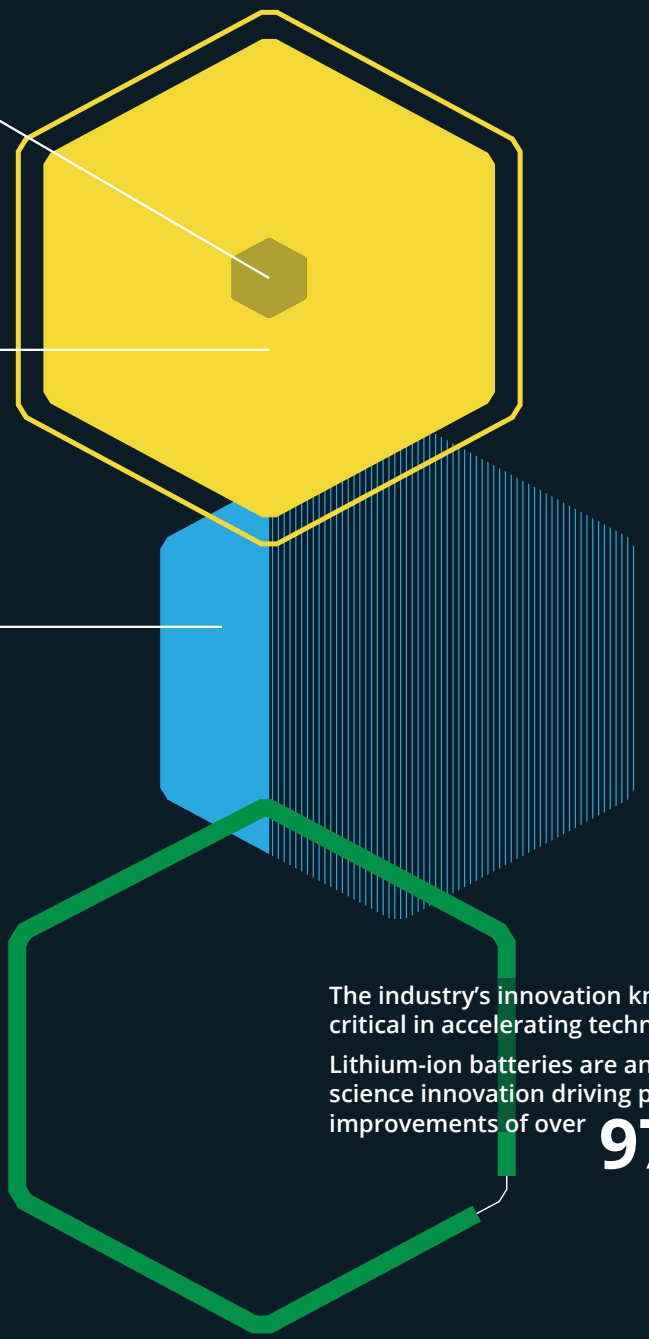
reduction in emissions intensity[f]

THE OPPORTUNITY

15%
OF EMERGING ABATEMENT SOLUTIONS

have the potential to address

90%
OF THE INDUSTRY'S SCOPE 1 AND 2 EMISSIONS



4
SOLUTIONS

will be ready in the next decade

11
SOLUTIONS

need further development to drive long-term impact

22%
OF US CHEMICAL COMPANIES

have targets to achieve net-zero emissions by 2050 in line with 20% of Fortune 500 companies[i]

The industry's innovation know-how will be critical in accelerating technology maturity

Lithium-ion batteries are an example of material science innovation driving price-to-performance improvements of over **97%**

Companies that are sustainability leaders are

4 TIMES

more likely to be recognized as innovation leaders[j]

$3 TRILLION
POTENTIAL US ECONOMIC GROWTH

from rapid decarbonization to 2070[k]

Sources: [a] American Chemistry Council (ACC), *Guide to the Business of Chemistry*, 2021; [b] Deloitte analysis based on United National Sustainable Development Goals; [c] Jeffrey Rissman et al., "Technologies and policies to decarbonize global industry: Review and assessment of mitigation drivers through 2070," *Applied Energy 266* (2020); [d] Deloitte analysis based on data from the Environmental Protection Agency; [e] Deloitte, "Global State of the Consumer Tracker", accessed May 4, 2022; [f] ACC, *Guide to the Business of Chemistry*; [g] Deloitte, "Global State of the Consumer Tracker"; [h] Deloitte analysis based on data from the Environmental Protection Agency; [i] Deloitte analysis based on company announcements data from Science Based Targets, accessed May 24, 2022; [j] Deloitte, *The turning point*, May 2022; [k] Rhonda Evans and Tony Seisfeld, *Measuring the business value of corporate social impact: Beyond social value to enterprise performance*, Deloitte Insights, July 31, 2020.

The way forward: An integrated ecosystem approach

REDUCING THE ADVERSE effects of climate change has significant implications for chemical companies' business strategies and investments. For many companies, it is an existential issue. At the same time, no single chemical company alone can address this challenge.

Chemical ecosystems are an opportunity for addressing emissions reduction and creating a powerful new competitive advantage:

- **Ecosystems are dynamic and coevolving communities of diverse stakeholders:** Ecosystems typically bring together multiple companies of different types and sizes to create, scale, and serve markets in ways beyond the capacity of any single organization—or even the entire chemical industry. Their diversity—and their collective ability to learn, adapt, and, crucially, innovate together—are key determinants of their longer-term success.
- **Ecosystems create and capture new value:** Enabled by enhanced connectivity across specialized capabilities and resources, ecosystems develop new, cocreated solutions that address fundamental market and consumer needs and growing societal challenges. While forging efficient ways to create new value, ecosystems also increase the importance of discovering new business models to capture enhanced value.
- **Ecosystems leverage both collaboration and competition:** Competition, while still essential, is certainly not the sole driver of sustained success. Participants are incentivized by shared interests, goals, and values and the growing need to collaborate to meet increasing customer demands and invest in their shared ecosystem's long-term health, from which all can mutually benefit.

Ecosystem thinking provides a framework that chemical companies can use to capture a profound shift in the economy and business landscape. The importance of relationships, partnerships, networks, alliances, and collaborations is not novel—but it is growing. Ecosystems can increasingly enable chemical companies to deploy and activate assets they neither own nor control, engage and mobilize larger numbers of participants, and facilitate much more complex coordination of their sustainability expertise and efforts (figure 6).

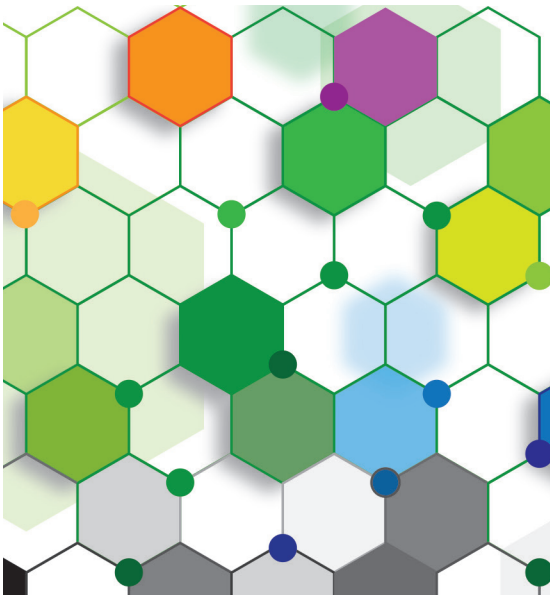
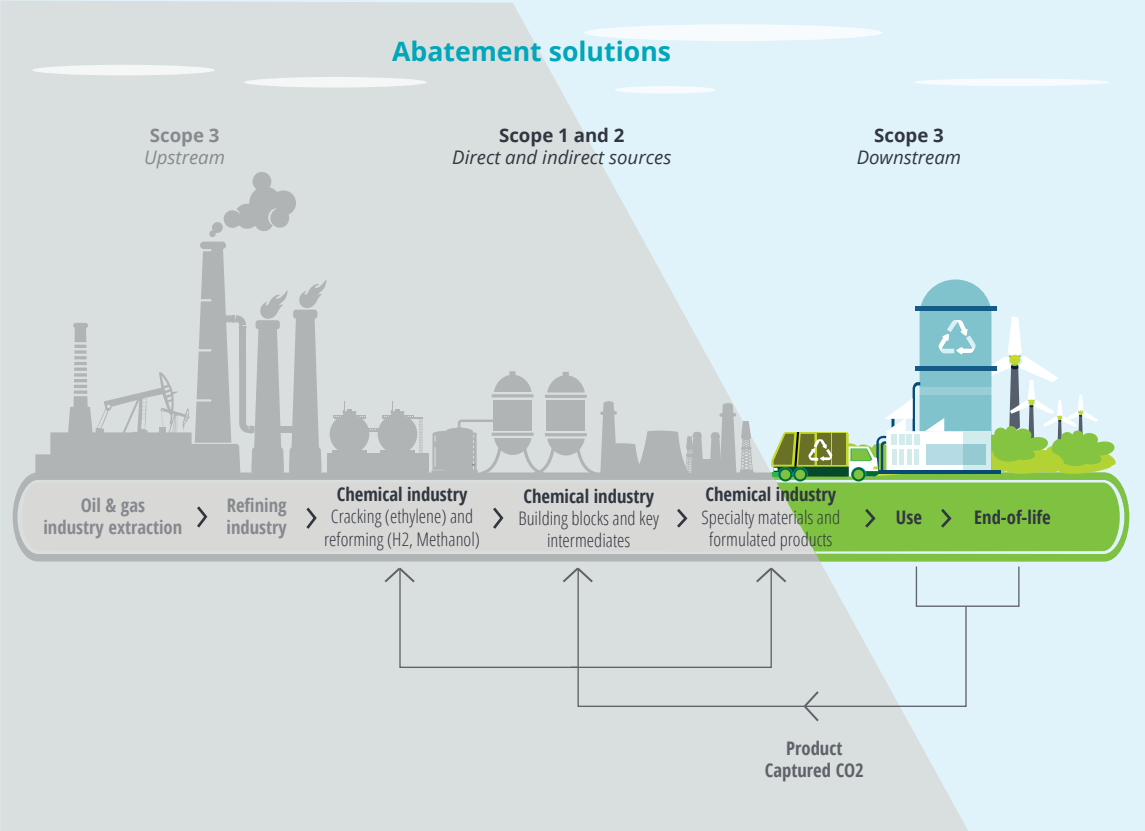


FIGURE 6

Chemical companies should work on reducing emissions on a cradle-to-cradle basis by focusing on the ecosystem as an important enabler of circular solutions



Source: Deloitte analysis.

A specific type of ecosystem is *open innovation*. This innovation ecosystem can unlock the potential of systems-level thinking in research, development, and commercialization. Accelerating innovation across the chemical ecosystem requires focus on four areas:

- **Share know-how:** Chemical companies can share knowledge on lowering emissions and the performance and efficacy of sustainable chemical and material substitutes. Knowledge-sharing is critical to addressing information gaps and discrepancies in understanding the issues and challenges among various stakeholders. Companies can draw upon experiences from multiple approaches to have a better understanding and collective overview.
- **Amplify demand signals:** Chemical companies could broadcast a more powerful demand signal that reaches wider and further, including innovators from all corners of the world, when they collaborate to scout new technologies and product ideas. Growing customer- and product-portfolio complexity and increasing cost pressure call for proactively sharing and responding to the demand signals across the value chain.
- **Pool resources and use digital to cut costs:** Companies can pool their resources (such as R&D funds) and use digital technologies to cut costs and time to market for new product ideas and technologies. With the emergence of disruptive technologies such as

ALLIANCES AND PARTNERSHIPS DRIVE TAILORED EMISSIONS REDUCTION STRATEGIES

The World Economic Forum and major global chemical companies entered into a collaboration called the Low-Carbon Emitting Technologies (LCET) initiative.[35] The purpose is to accelerate the development and upscaling of low carbon–emitting technologies for chemical production toward a marked reduction in GHG emissions in the chemical industry and related value chains. The initiative has prioritized a series of low carbon–emitting technologies and addresses technology, regulatory, funding, and market challenges to accelerate their deployment.

Another example is the Alliance to End Plastic Waste, a consortium of several international companies. The alliance has rallied over 90 member companies, project partners, and allies to work closely with policymakers, nongovernmental organizations, and local communities, to improve the collection, sorting, processing, and recycling of plastic waste.[36] Working with its members, partners, and governments, the consortium has accelerated its mission to develop a circular economy for plastics.

robotic process automation, analytics, and cognitive technology, chemical firms can use cost management as a strategic enabler with the power to disrupt the entire industry and fundamentally change how business is done.

- **Derisk new ideas:** Experts from diverse companies could review and discuss alternatives, as a robust screening process will help reduce the risk each company faces on its path to commercialization. Companies can derisk innovation by starting small and then playing big, with small steps or proof of concept, and failing fast.

Chemical companies hold the key to unlocking climate strategies across the global value chain by developing new sustainable materials, enabling end markets to meet sustainability goals. Industry players also have different roles and capabilities critical to solving some of the complex issues beyond just chemicals and materials.

With the changing industry and end-market landscape, no single chemical company can likely succeed without collaboration. Industry players aiming for feasible and scalable solutions should involve external partners and establish an ecosystem connection. For example, engaging ecosystems will help close the recycling loop.

Call to action

HOW CAN THE industry overcome current challenges to lowering emissions and capitalize on future opportunities?

The chemical industry has a "trifecta" opportunity to lower their scope 1 and scope 2 emissions and downstream end-market scope 3 emissions. A properly designed and optimally deployed core business strategy with sustainability as a critical component may represent one of the biggest-ever opportunities for chemical and materials companies to decide where to play and how to win in lowering emissions and creating new sources of value.

Collectively, this industry has the scientific know-how, innovation track record, connectedness with many end markets, and ability to scale new technologies needed to lead in solving the challenges associated with reducing the adverse effects of climate change, while at the same time using materials efficiently to sustain and advance the human condition.

This may seem daunting at first. However, the way in which chemical and materials companies respond to these challenges and opportunities will determine the winners and losers in the future. Developing a sustainable product portfolio of solutions to lower emissions—some yet to be discovered—will be at the heart of successful chemical and materials companies.

There will be opportunities for new business models, and entirely new markets may be formed as the result of a more circular, lower-emissions economy. In fact, companies that are "sustainability leaders" are four times more likely to be recognized as innovation leaders in separate, independent rankings.[37] Indeed, there is great potential for chemical and materials companies to join those ranks.

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