

A person is silhouetted on a wooden walkway, looking up at the Aurora Borealis in a starry night sky. The aurora displays vibrant green and purple streaks of light. The background shows a dark landscape with mountains and a body of water reflecting the light.

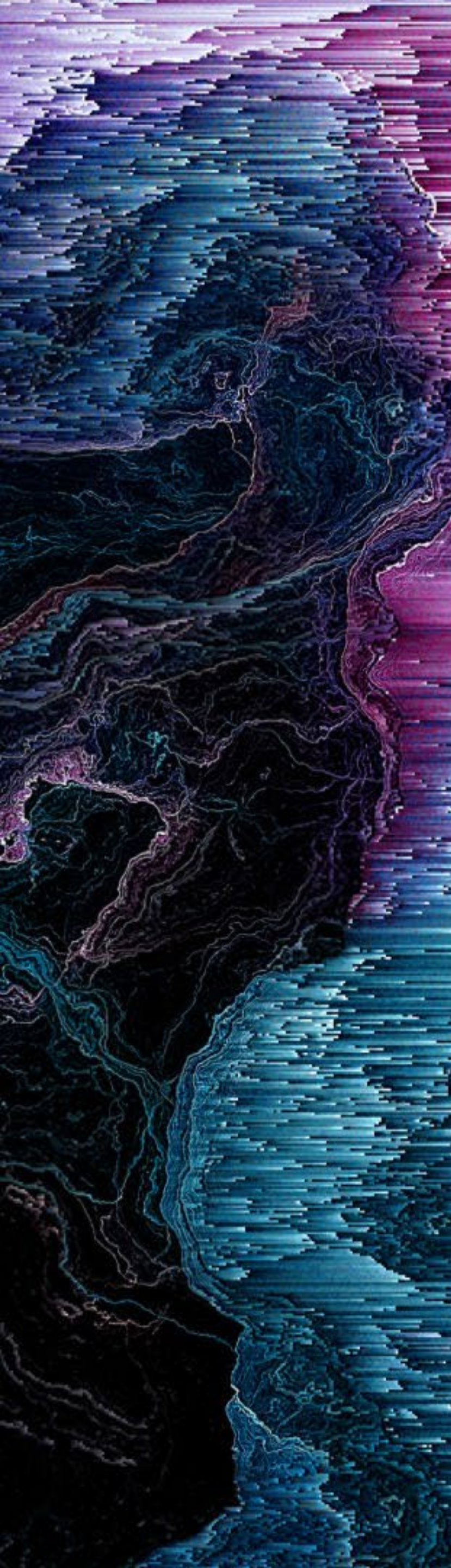
Powered for change

Working as one to
achieve growth and
decarbonization for all



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Imagine where we would be today if all the net-zero investments made to date were synchronized?

Imagine where we would be today if all the net-zero investments made to date were synchronized? Would we be further along to reaching our 2030 and 2050 goals? Our findings say yes. Would we have created new value and growth opportunities across industries, resulting in a virtuous cycle of reinvestment? Our findings also say yes.

Making meaningful progress toward the net-zero transition requires a new era of collaboration. One with the power to unlock opportunities for all parties involved. This collective effort will advance the creation of an equitable, affordable and sustainable transition. In fact, with the right actions, we can ^[SEP] make meaningful progress toward our goals in only three years.

Our research and experience show that a subset of leading companies is tackling the dual priorities of resilience and reinvention. Enabled by a strong digital core and new ways of working, ambitious leaders are advancing across traditional boundaries. These companies have embarked on a Total Enterprise Reinvention strategy that delivers 360° value to all stakeholders—treating sustainability as both a global imperative and a growth lever for the business.

Now, here is the other good news. While net zero represents a profound disruption to all industries,

there has never been greater access to an abundance of tools to take on this transition. Today's exciting portfolio of technologies goes beyond solving problems in isolation. Take generative AI, for example. It creates resilience across the value chain, helps find sustainable solutions, unlocks human potential and accelerates reinvention opportunities.

It is crucial that we move from commitment to action. Actors across the industrial value chain—from oil, gas and power providers to heavy industry such as steel, metals and mining, cement, chemicals, freight and logistics, to light industry that includes pulp and paper, aerospace and defense, automotive, industrial equipment, life sciences and consumer goods—^[SEP] need to come together to kick-start collaboration.

This report is action-oriented and provides a positive, economic pathway for the entire value chain. There are many ways that this research is unique. It includes a detailed cost analysis, using our proprietary S-curve methodology, as well as insight from our extensive cross-industry executive survey. Rather than a focus on single industry segments, we focus on the intersections between industries to show where ^[SEP] all stakeholders need to pull together to deliver ^[SEP] on net zero.

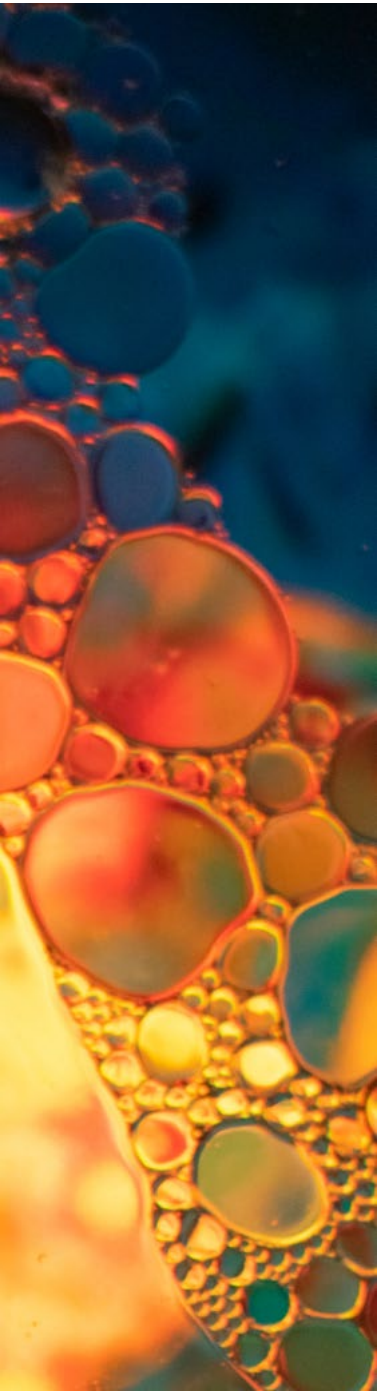
We continue our commitment to deliver on the promise of technology and human ingenuity to solve the world's net-zero challenge. This report provides actionable advice for each industry to advance their net-zero journey and foster sustainable growth opportunities for all key ecosystem players, helping businesses become **powered for change**.

Thanks to the many Accenture professionals around the world whose passion and dedication brought this research and perspective to life.



Stephanie Jamison

Global Resources Practice Chair &
Sustainability Services Lead



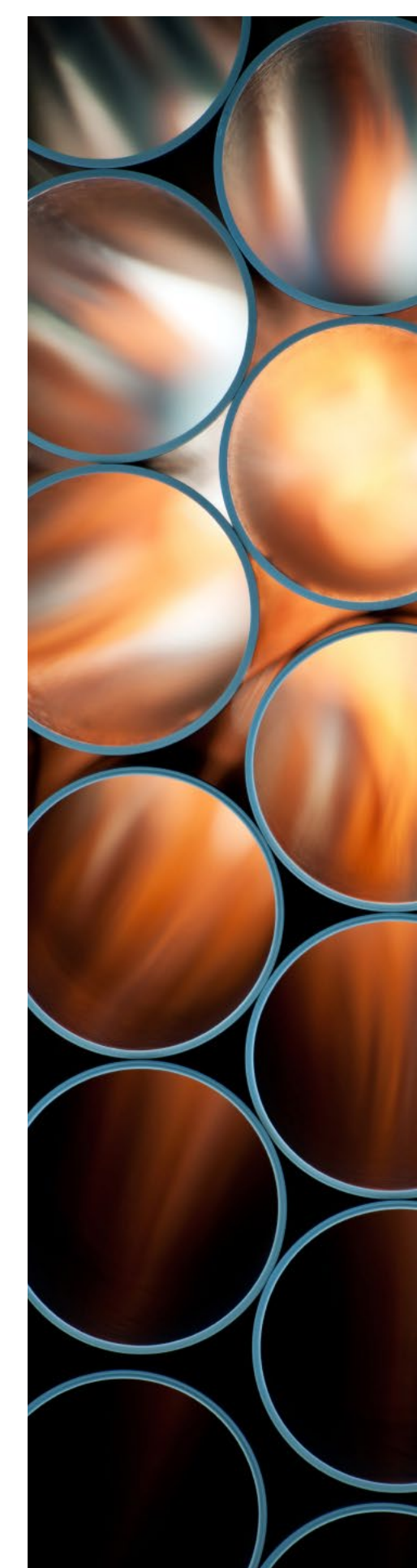
Executive summary





We're at the halfway point between signing the Paris Agreement and its first major deadline in 2030. While much has been achieved since 2015, heavy industry has made little progress.

Our research identifies what has held all industries back and seeks to highlight a pathway to rapid, economic industrial decarbonization.





Why is it so important to accelerate decarbonization of heavy industry?

The world relies on five energy intensive industries: steel, metals and mining, cement, chemicals and freight and logistics. Their products and services feed into the supply chains of virtually all others. But so do their emissions. Heavy industry's Scope 1 and 2 emissions become their customers' Scope 3 emissions. If heavy industry fails to decarbonize, all others fail.

If we understand the problem, we can develop a solution. At the heart of this problem lies a vicious cycle of inaction. If we can collectively flip this to a virtuous cycle of action, in just three years, we could set the foundations for a new economic pathway and an orderly transition to net zero.

Over the next three years, stakeholders must lay the foundation for transformation by pursuing three imperatives:

1. Target green premiums—higher charges for sustainable products and services—to finance the initial phase of industrial decarbonization.
2. Accelerate scaling low-carbon power and hydrogen to guarantee affordable, secure supply.
3. Drive down capital and operating expenses of low-carbon infrastructure.

This three-year period is important, as most organizations use a three-year strategic planning cycle. These imperatives won't by themselves achieve net zero. But what they will do is lay a foundation that makes net zero possible by breaking through the tradeoff between growth and decarbonization.

While this is a complex, thorny challenge, exacerbated by the economic and geopolitical environment, this report is focused on the art of the possible. It proposes actions across near-term horizons: 100 days, 12–18 months, and three years. And puts forward the questions leaders should be addressing to get started—at both an enterprise and system level.

This report has recommendations for multiple industries:

- Oil, gas and power providers
- Steel, metals and mining, cement, chemicals and freight and logistics; we refer to them as heavy industry
- Pulp and paper, aerospace and defense, automotive, industrial equipment, life sciences and consumer goods; we refer to them as light industry

There is a viable path to industrial decarbonization. By working together, industries can create the confidence that's needed to unlock investment and innovation and bring down costs.

The next three years will define heavy industry's long-term future and determine net-zero success for all players.




About the research

This report is based on:

A global survey with 1,000 executives across 14 key industries in April and May 2023. The aim was to understand near-term challenges and priorities of industrial decarbonization, expectations for Scopes 1 to 3 emissions, key revenue and cost levers for improving the financial business case for selected decarbonization solutions, regional priorities and partnership plans.

Qualitative interviews with 18 executives and middle management from selected industries, with the same aims as above.

Techno-economic modeling leveraging Accenture's proprietary S-curve analysis developed to quantify cost drivers across the industrial value chain. Accenture has quantitatively assessed eight solutions that are critical to achieving net-zero goals but require significant cost reduction through innovation and scale, namely:

- **Clean power supply**—onshore and offshore wind power, solar power, battery storage
- **Industry end use**—green hydrogen, green steel, green chemicals (ammonia)  and green construction

Technology cost evolution over time typically takes on an S-curve shape analysis driven by learning curve percentage improvements.

For instance, the cost and technology development of computer chips and electric vehicles has followed a similar S-curve shape. Accenture's S-curve methodology (patent filed in 2010) illustrates the impact on cost or time of not hitting a key technology or engineering milestone and enables pinpointing actions to accelerate cost reduction.

We have identified which actions should be taken and prioritized to further realize and accelerate these cost reductions across various parts of the energy transition landscape.



It's time to
accelerate industrial
decarbonization



According to our research,* we can set the foundation for achieving net-zero goals and harness the benefits for the planet, as well as for business growth.

*All data is sourced from the *Powered for change* executive survey unless otherwise noted.

We should not wait to achieve economies of scale organically. ^[L SEP] Nor should we expect the public sector to largely finance industrial decarbonization. Instead, a synchronized effort by all players is needed to break a vicious cycle of inaction.

It is now eight years since the Paris Agreement was signed. The end of 2023 represents the halfway mark to the agreement's 2030 deadline for its interim net-zero goals. The challenge to achieving those is both scale and pace. While there is continued momentum toward net zero, our research shows that less than a fifth of companies (18%) are cutting emissions fast enough to reach net zero in their operations by 2050. One third (32.5%) are cutting emissions but not fast enough, and half are presiding over rising emissions.¹

Our *Destination net zero* research also shows that the most successful decarbonizers have a very broad-based strategy, employing 15 or more of 20 best practices ("decarbonization levers") in parallel. But those businesses are in the minority, representing less than five percent of our sample of the world's 2,000 largest companies. Moreover, these decarbonization levers largely contribute to reducing company emissions; the impact is at an enterprise level. Industrial decarbonization is a system challenge, with potential benefits for the entire system. Business will need to operate at both an enterprise and system level to change the current dynamic.



Heavy industry holds the key to decarbonization

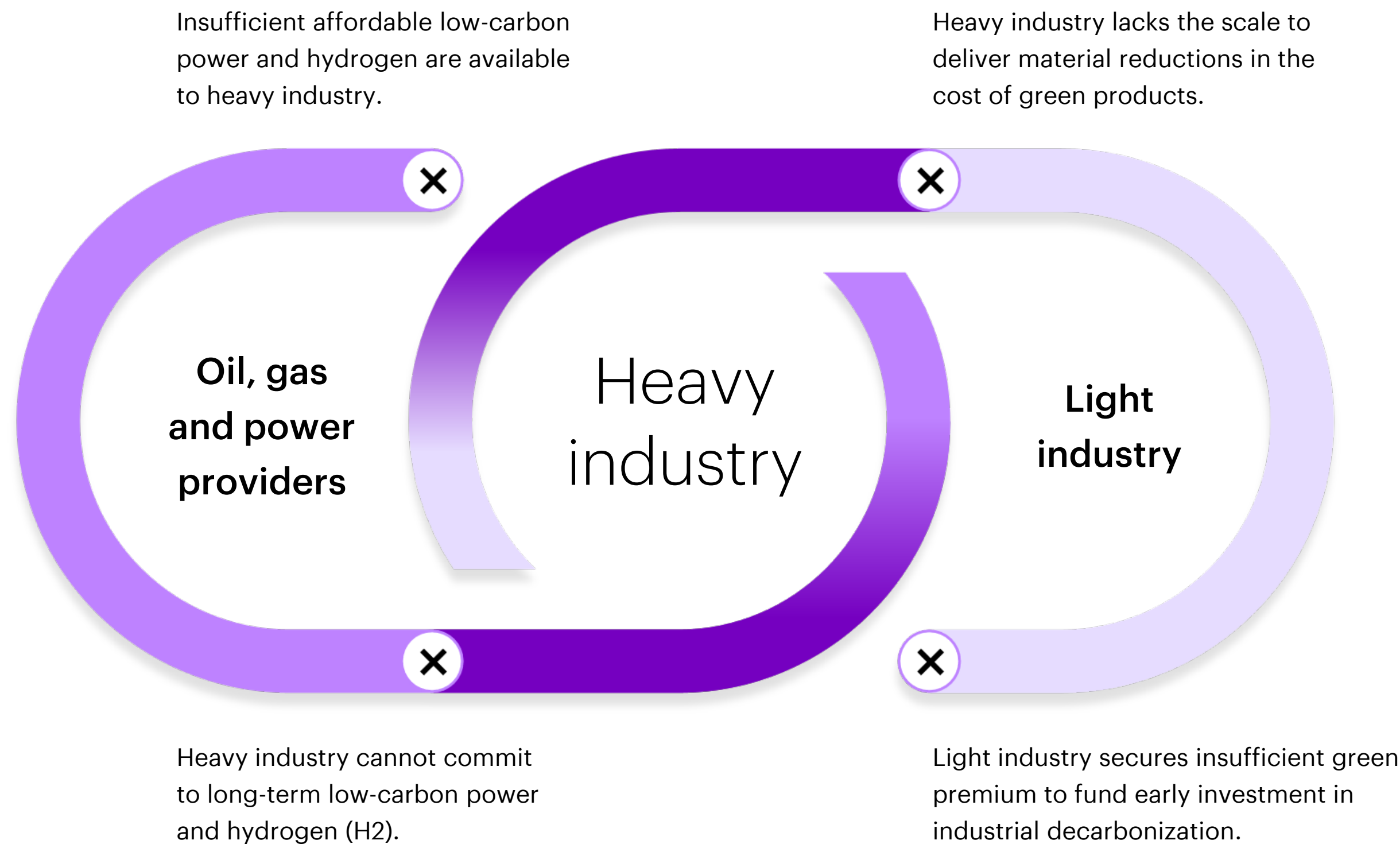


Figure 1: Vicious cycle of inaction

Source: Accenture analysis, 2023

At the center of the value chain is heavy industry (figure 1). The hardest to abate heavy industries—steel, metals and mining, cement, chemicals and freight and logistics—are responsible for up to 30% of global CO₂ emissions directly.² That figure can climb to more than 40% if their Scope 2 emissions from power consumption are factored in.³

On the supply side, a vital intersection exists between heavy industry and power providers. Until oil, gas and power fully decarbonize energy supply, heavy industry cannot decarbonize their own businesses.

On the demand side, light industries rely on the products and services of heavy industries. As a result, heavy industry’s Scope 1 and 2 emissions are light industry’s Scope 3. Light industry cannot decarbonize unless heavy industry does too.

Supply chain emissions by industry⁴

>60%
of construction
emissions come from cement.

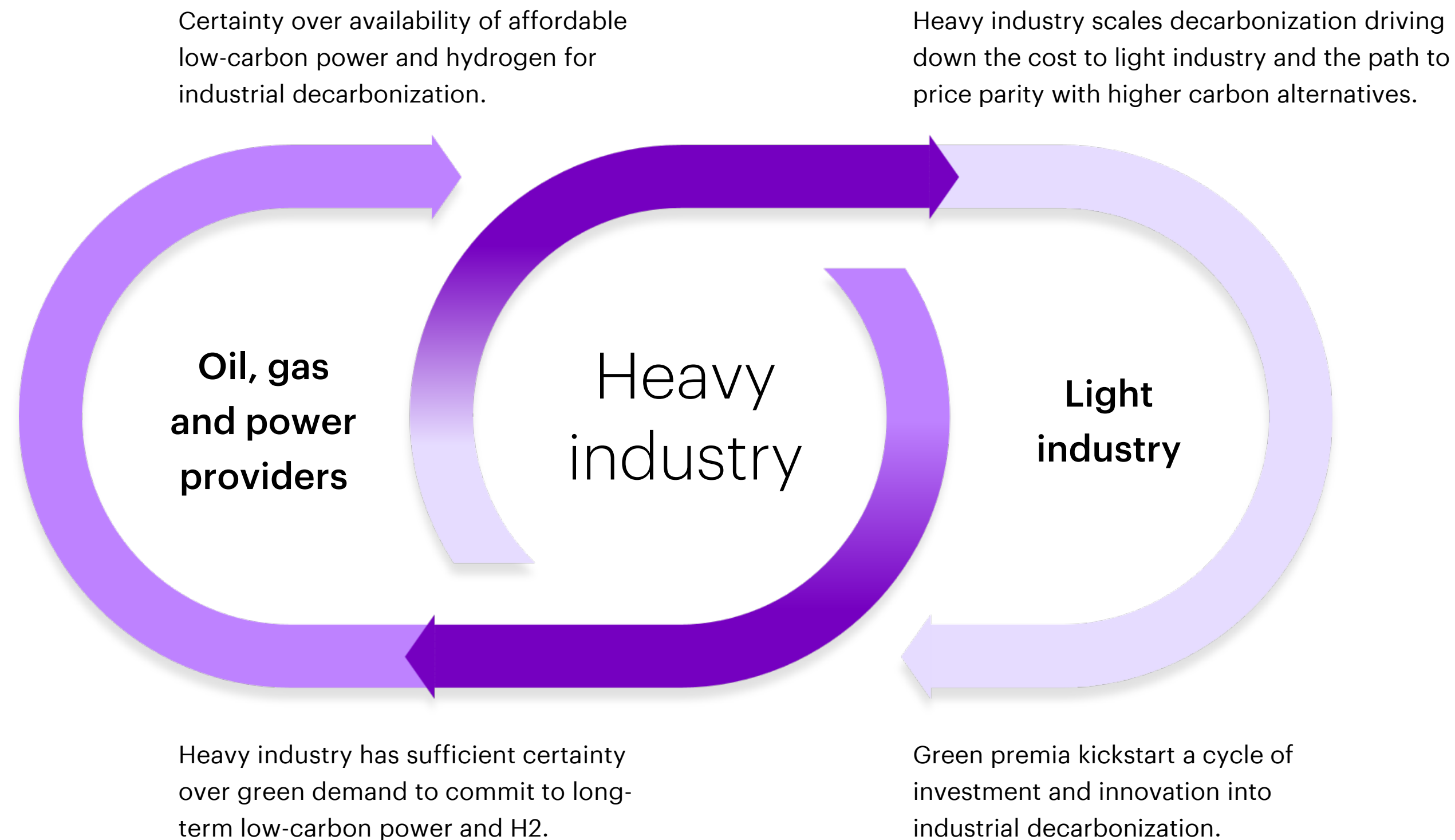
>30%
of automotive
and high tech derive
from steel.





A rapid, affordable approach to decarbonization is required

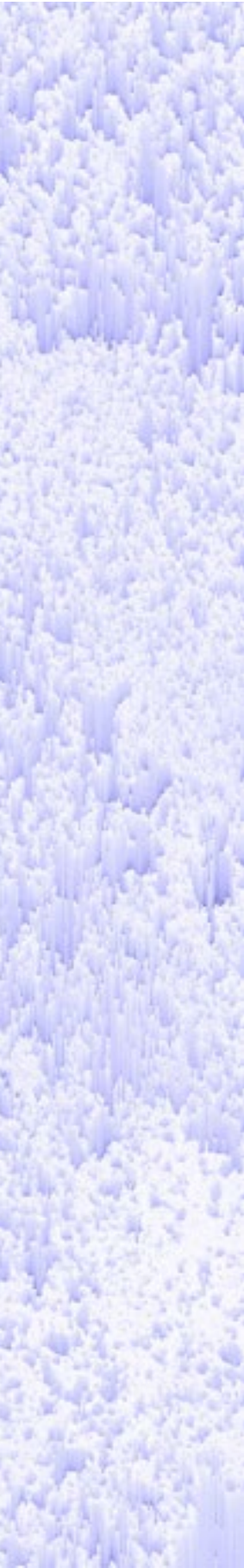
Our research and analysis suggest a more optimistic future where industries can collectively make meaningful progress in just three years with a focus on the right actions (figure 2).



According to Accenture S-curve modeling, price parity for green products could be pulled forward by four to nine years, depending on the product. This is contingent upon the availability of low-carbon power and further reductions to its price.

Figure 2: Virtuous cycle of collective action

Source: Accenture analysis, 2023





Reconciling growth and decarbonization

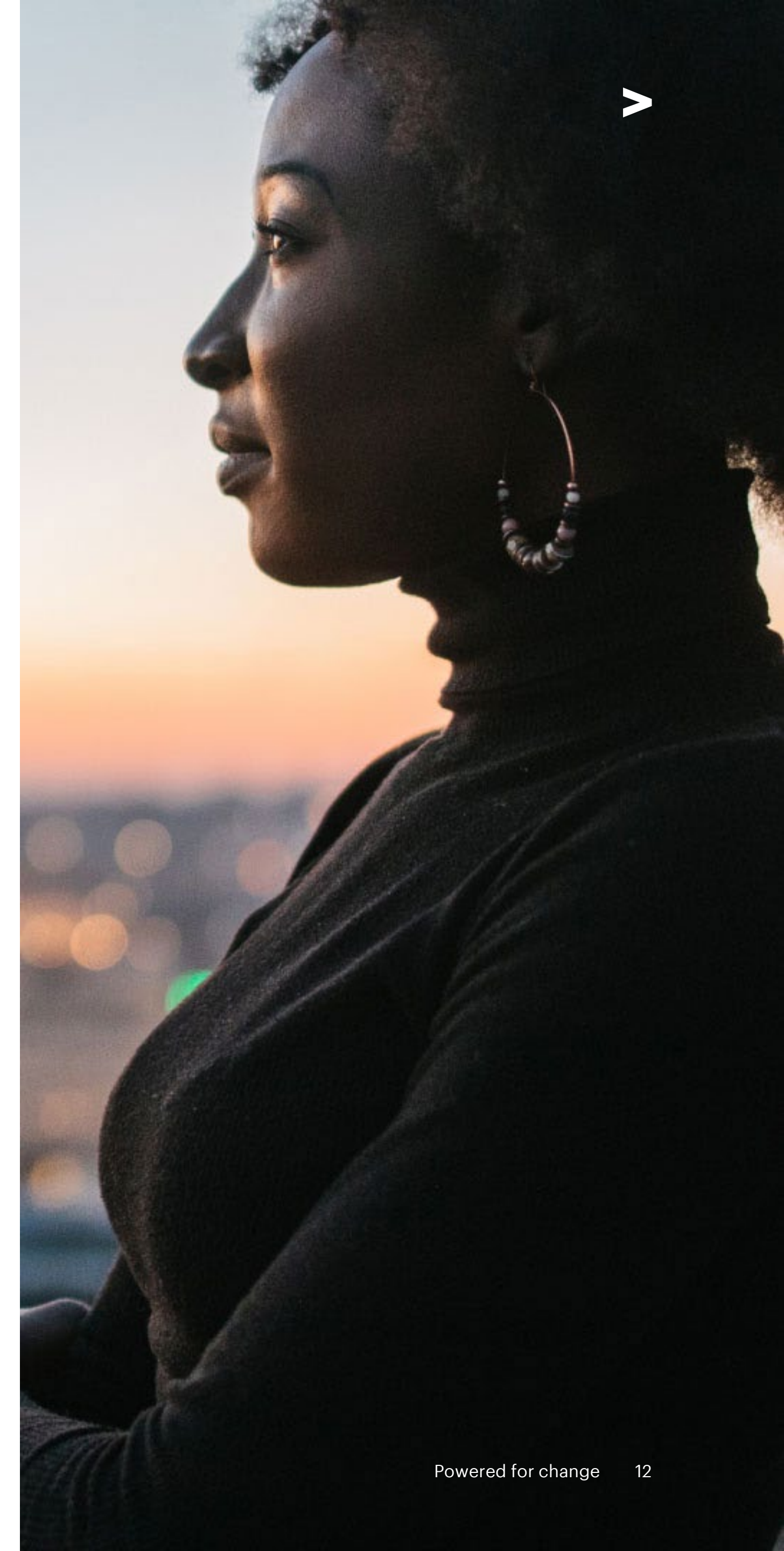
Heavy industry is currently in a similar place that power generation found itself 20 years ago, when wind and solar were the most expensive forms of power.⁵ Over time, renewable subsidies funded that ideal combination of investment and innovation. The resulting scale and learnings have driven down the cost of renewables to where it is now—the least expensive source of generation.⁶

Based on an initial three-year planning cycle (**2024–2026**) used by many organizations to determine strategy and investment, focused action holds the potential to get all industry stakeholders pulling together to achieve net-zero goals (figure 3).

Thereafter (**2027–2035**), scaling green premia with the first phase of power and heavy industry investment can kickstart a cycle of innovation and funding that triggers prices falling down the S-curve. It signposts a pathway to where low-carbon choices are as good as, or better than, high-carbon alternatives.

In the **2030s** and **2040s**, there would be three to four major investment cycles across low-carbon power and hydrogen, and low-carbon industrial infrastructure, with each cycle bigger than the last. This would enable stakeholders to achieve a new performance and cost frontier, bringing price parity (for low-carbon alternatives) forward by between four to nine years versus current market projections.

Scaling low-carbon power and hydrogen, specifically for industrial decarbonization, needs to start at the end of this decade, ramping quickly. In the 2030s, there are material efficiency gains across investment cycles, with a diversity of technologies including renewables, nuclear and carbon capture, utilization and storage (CCUS).

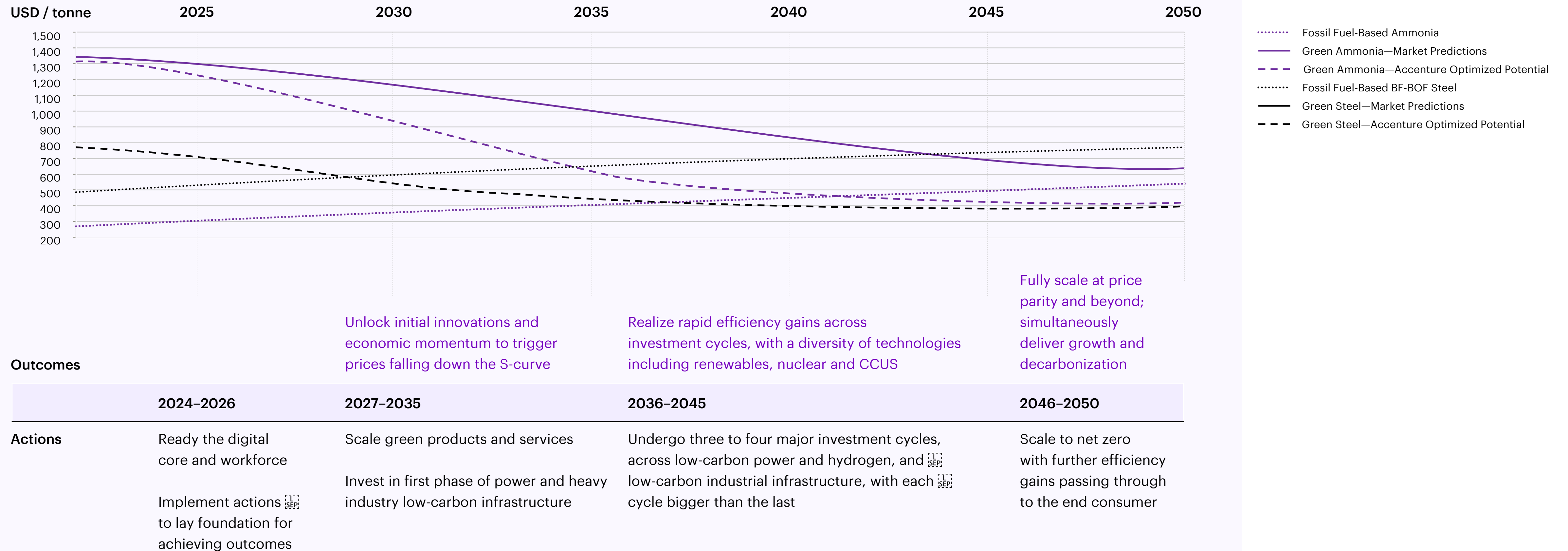




Changing the economics of industrial decarbonization

Figure 3: Driving price parity for green products over time

Source: Accenture S-curve modeling.





Orchestrating a collective endeavor

While investment and innovation will reduce decarbonization costs, these investments simply aren't happening at the scale or pace net zero requires. The reason: the value chain is not collectively working together. The siloed approach we are currently seeing means leaders are focusing on their own organizations, rather than actively working across the wider value chain.

This has created an investment standoff, where all parties are waiting for others to move first. Delivering on net-zero goals must be a collective endeavor. It starts when there is cooperation between heavy industry and oil, gas and power and their customers down the supply chain.

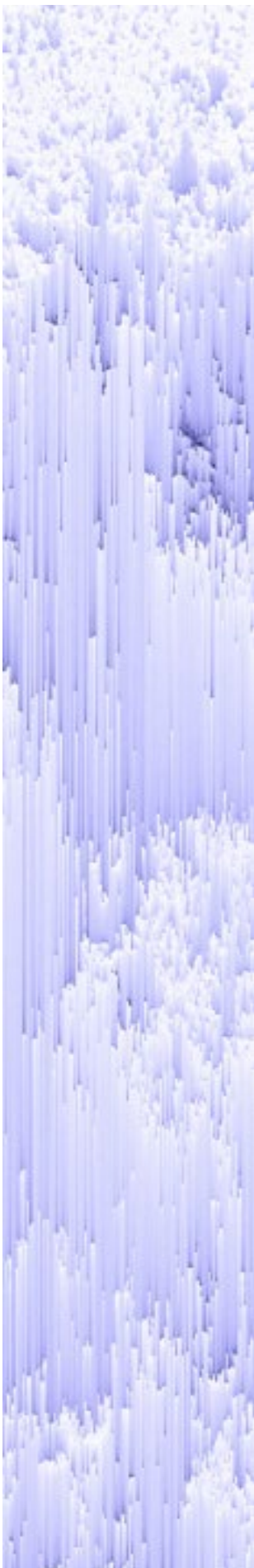
High risk and uncertain commercial viability were cited as the most common challenges to decarbonization for heavy industry in the first ^[1]_[SEP] half of 2023.⁷

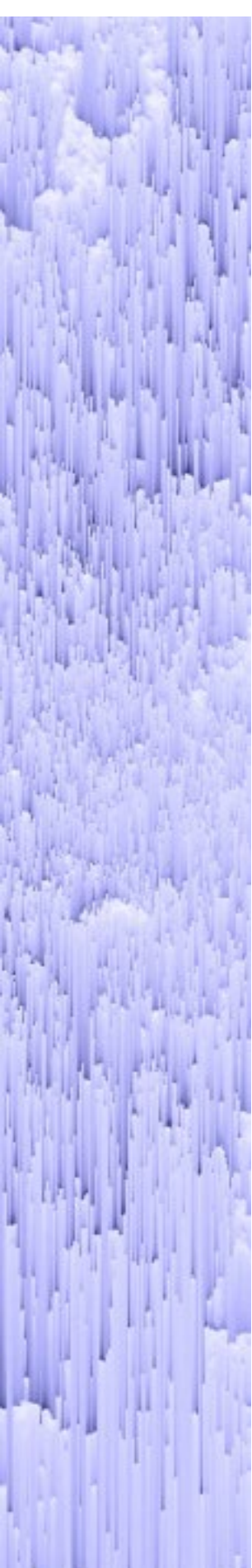
Oil, gas and power providers can jump-start heavy industry decarbonization at scale

By the 2030s, heavy industry will need access to plentiful supplies of low-carbon electricity and hydrogen to decarbonize.⁸ According to our analysis, for example, European Union chemicals companies will require approximately nine times the current total low-carbon demand to meet 2050 net-zero targets. The total clean energy demand of EU cement, steel and chemicals manufacturers, plus the power requirements for electric vehicles, equates to 836 nuclear plants, up from 101 today, or an onshore wind farm capacity of 1900 GW—ten times the capacity today—equivalent to the size of Spain.⁹

“For organizations to achieve their goals they have to depend on one another. There needs to be collaboration both up and down the value chain—including partnership deals with clients, partners and customers. We believe the future of sustainable road transport is linked to a non-traditional, multi-energy mix supported by all parties.”

Luis Gomez
President Europe, XPO Logistics¹⁰





Some oil, gas and power providers are actively engaged in helping heavy industry decarbonize. However, the scale is insufficient. Despite the massive impending increase in power demand, oil, gas and power providers are still primarily focused on decarbonizing their own operations.

Almost all heavy industry respondents expect to meet their Scope 1 and 2 targets by 2050. However, only 5% of oil, gas, and power providers say they expect to shift from decarbonizing their own business to support the decarbonization of heavy industry before 2043.

There is a huge risk of insufficient affordable, low-carbon power to meet heavy industry's demand.¹¹ On our current path, we are set to be five to 10 years too late. As supply shortages threaten price rises,¹² the economic case for decarbonization will be further weakened. In addition, these shortages will create another risk since power consumption by heavy industry will be the first to be curtailed.

Light industry needs to take the long view

Heavy industry relies on long-term commitments from light industry to commit to long-term energy contracts. But too few light-industry companies are able to make long-term commitments at sufficient scale for fear of being priced out of the market by high-carbon alternatives.¹³

At present, many light-industry companies have assumed that heavy industry will bear the cost of decarbonization investments and deliver low-carbon solutions at the same price as high-carbon alternatives.¹⁴ However, heavy industry will not commit to decarbonization without light industry agreeing to pay a green premium to finance investments in the initial phase of innovation. Light industry may regret not pursuing green premiums earlier: the slow pace of industrial decarbonization will eventually affect light industry's ability to deliver Scope 3 reductions.

We have seen in the past how other ecosystem transitions have reshaped customers' demand and their willingness to pay. The rapid shift to electric vehicles is evidence of the power of this dynamic.¹⁵ In this example, early adopters willing to pay a premium have triggered the cycle of investment and innovation that brings down cost, as well as providing more certainty for relevant and favorable public policy, which together underpin mass adoption.

Only 48%

of light industry executives say they are effective in working with their supply chain to develop joint decarbonization plans.

80%

of heavy industry executives believe they will have to charge a price premium of +20% on average if they are to make low-carbon products and services commercially viable in the next five to 10 years.



Governments are stepping in, but subsidies alone will not suffice

Governments often step in to fill gaps when markets fail to act in required ways. We saw it with renewables growth, which relied on government support in its early development. At the beginning, customers had little appetite to pay a premium for wind or solar. The public sector provided the investment and innovation by socializing its high, early costs through consumers' energy bills.

Decarbonization of heavy industry needs a similar stimulus, especially in the early stages when the economics are most challenging. Someone needs to shoulder the early costs to unlock future savings. So far, the public sector has been less effective in its support of industrial decarbonization. The current economic environment makes widespread, long-lasting subsidy programs even less likely.

Governments are starting to play a more active role in addressing the residual risk of industrial decarbonization by directing grants and subsidies at capital investments in green infrastructure.¹⁶

The Biden administration's Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA) interventions—which include “buy American” provisions—will stimulate new green economies that support economic growth and create jobs.¹⁷ The European Union's amended state aid rules, Green Deal Industrial Plan, and Recovery and Resilience Facility will do the same.¹⁸

Financing requires transparency across the industrial value chain

Companies will leverage various financial mechanisms for decarbonization projects: from government through subsidies and incentives, from public/private partnerships or from private institutions. Institutional investors and multilateral banks will play a crucial role by providing access to low-cost capital.

A stable and predictable market will attract increased investments in decarbonization initiatives. Investors will want to advance in a context of confidence. To improve access to capital and generate sustainable returns, companies will need to demonstrate strong ROI on early  moves with quantifiable benefits. Demand signaling will need to be strengthened, particularly for new technology applications.

All players in the industrial value chain will need to be transparent about their plans for low-emission and low-carbon alternatives. They will need to exhibit detailed emissions reporting and clear emission reduction targets. They will also need to demonstrate their ability to deliver capital projects on time and on budget, in line with plans.

The good news is that more private capital is coming to decarbonization projects. Financial institutions, increasingly judged on their ability to fund sustainable business-type projects, are looking carefully and more positively at these programs to round out their portfolios.



How Braskem set a new standard for the petrochemical industry

30%

Braskem estimates a 30% reduction in carbon emissions by 2030

Despite efforts to reduce carbon emissions, petrochemicals are projected to drive nearly half of the increase in oil demand over the next three decades. To tackle this issue, Braskem, the biggest petrochemical company in Latin America, teamed up with Accenture to create a plan for decarbonization.

The collaboration began with the onboarding of client stakeholders through technical workshops focused on Environmental, Social and Governance (ESG) concepts, decarbonization strategies and competitor initiatives. Next, a multi-day ideation workshop was conducted to identify carbon-reducing initiatives.

Individualized scenario plans were built for Braskem's six main facilities. These plans outlined business cases and implementation strategies for 18 proactive decarbonization pathways. A Roadmap Prioritization Tool was developed to consolidate decarbonization data, providing insights on project maturity and cost-effectiveness.

At the end of the engagement, more than 160 initiatives were approved for Braskem's 2050 net-zero roadmap. Seventy of these have been prioritized for its 2030 goals, where an estimated 30% reduction in carbon emissions is expected at the company's six major complexes. One of these initiatives involves the management of more than 5,500 hectares of eucalyptus plants to help power one of its main facilities. It is designed to use renewable steam energy sourced from plant biomass to reduce emissions at the site by about 50% annually.

Through its partnership with Accenture, Braskem is setting a new standard for the sector, promoting sustainability in the petrochemical industry and positively impacting the world.



There is a clear path to industrial decarbonization

By working together, industries can create the confidence that's needed to unlock investment and innovation and bring down costs.

To do this they must focus on resolving a small number of the most difficult barriers to decarbonization.

Tackling these barriers in the next three years will set heavy industry on the right path to decarbonization and accelerate the world's progress toward its net-zero targets.

Three interdependent imperatives can help industry flip from a vicious cycle to a virtuous one.

- 1. Target green premiums to finance the initial phase of industrial decarbonization.**
- 2. Accelerate scaling low-carbon power and hydrogen to guarantee affordable, secure supply.**
- 3. Drive down capital and operating expenses of low-carbon infrastructure.**

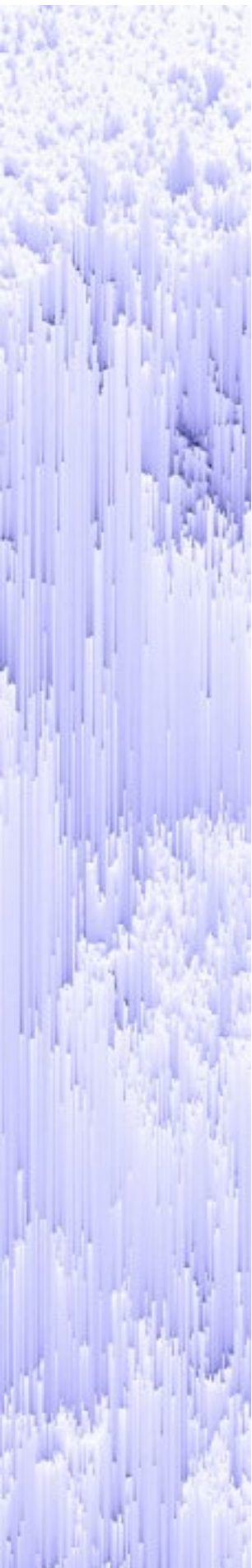
Addressing these imperatives will boost the revenue potential of green products and reduce the costs of low-carbon power generation and low-carbon production. This will quickly lower the price of green products, making them competitive with high-carbon alternatives.

These imperatives should be executed in parallel. And while all stakeholders have a responsibility to deliver all three, different industries will take the lead on each:

- **Light industry will lead the drive to develop new green premiums.**
- **Oil, gas, and power providers will accelerate the scaling of low-carbon power and hydrogen.**
- **Heavy industry will drive down costs in low-carbon infrastructure.**

Once the power of innovation and investment is unleashed, efficiency will follow. It will create opportunity and momentum for the next three years.

Tackling these imperatives requires bold, collective leadership across organizations and entire industries.



Given the urgency of industrial decarbonization, companies will need to pivot to a strategy of continuous reinvention centered around a strong digital core and new ways of working to maximize investment in the net-zero transition.

Build a strong digital core

Leaders who prioritize resilience and reinvention will be able to manage the complexity, cost and pace of decarbonization. A strong digital core is the foundation of resilience and reinvention. It leverages the power of cloud, data and AI through an interoperable set of systems across the enterprise, and it will allow companies to better manage their costs and their productivity. These companies will use the resulting savings to innovate and develop new capabilities that enable them to achieve the three imperatives laid out in this report.

Many companies in light and heavy industries and oil, gas, and power have made major investments in cloud and the application layers of the digital core. Going forward, as we enter the decade of AI, a strong data foundation will become essential.

Generative AI will be transformational in two ways—it will provide centralized access to all the organization's knowledge across operations and information technology, and it will create dramatic speed, productivity and efficiency gains across operations and supply chains.

Generative AI democratizes complex value chains that previously would have needed years of experience and know-how to acquire. This can facilitate cross-industry collaborations that simply didn't exist before; from finding new ways to reuse waste, to coordinating clean energy procurement, to optimizing a diverse portfolio of energy assets and capitalizing on energy markets.

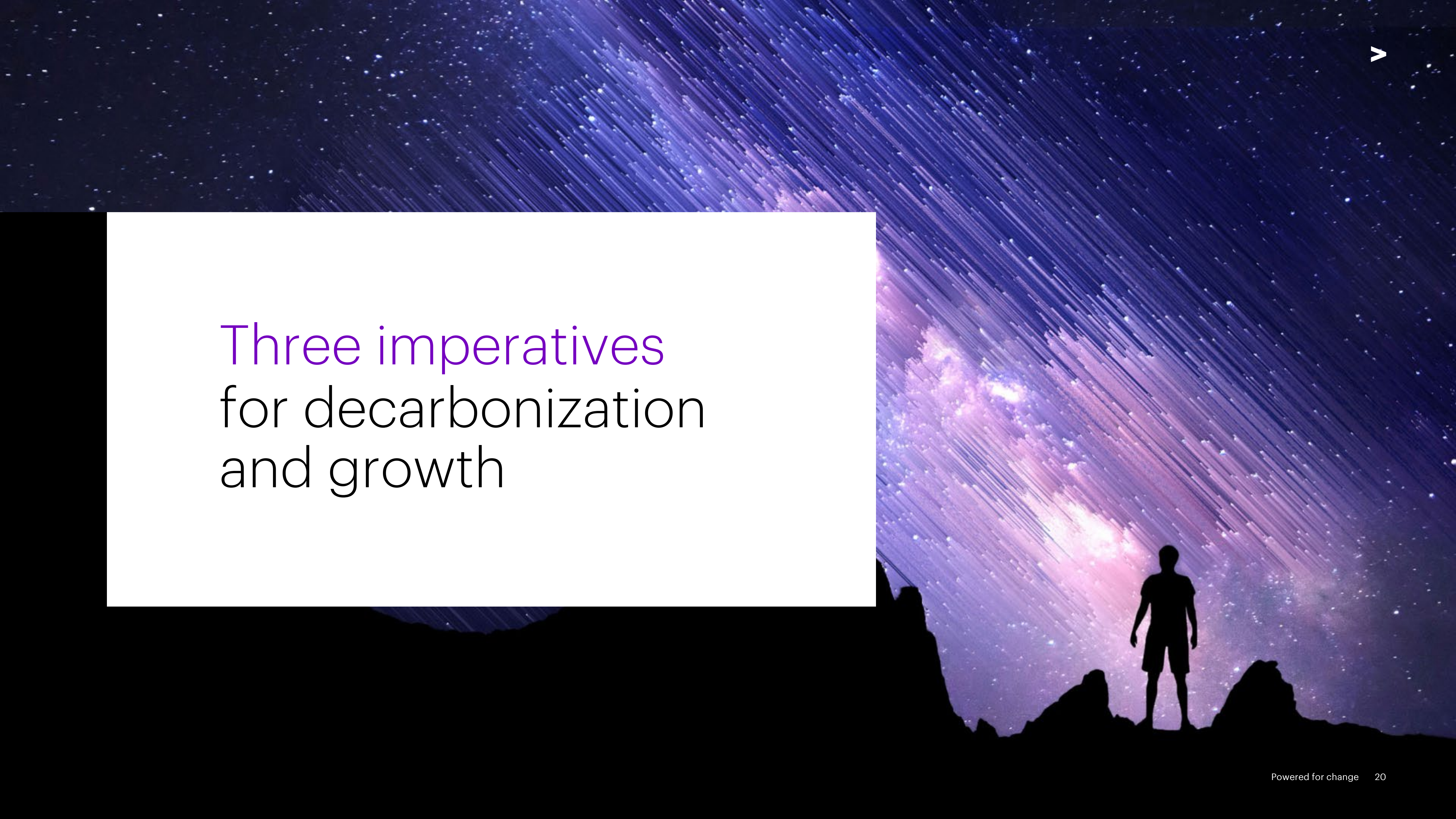
Invest in new ways of working and change

People will be critical to delivering the three imperatives described in this report. All organizations will need to radically rethink how work is done—from the task up—since many of those tasks will be new. Likewise, they will need to work through how the related skills are sourced and developed. The resulting skills roadmap will be as detailed as that for decarbonization itself.

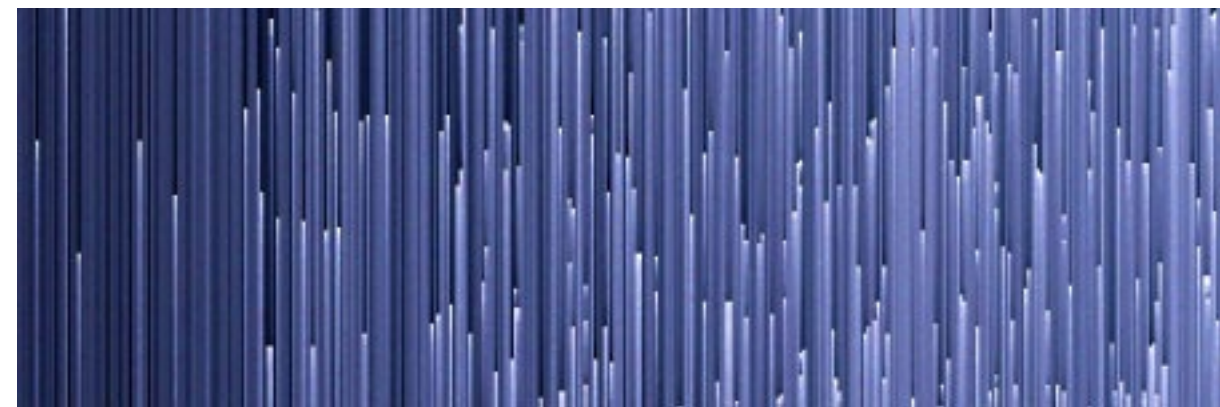
As the very nature of work changes, organizations must understand the current skills they have, what future skills they need and formulate plans to close the gaps through mobility, rapid skilling or acquisition. Generative AI, automation and growth of the green economy will cause roles to emerge, evolve or decline in volume. Teams will need to be rebuilt with a more granular understanding of skills and through sophisticated combinations of people and technology.

Investing in a culture of skilling, where pursuit of new and evolving skills is a strength, will be critical for organizations to achieve a future-ready workforce able to deliver at the speed needed for decarbonization.

The essential role of leadership will be to create a shared purpose, along with a culture that embraces change and empowers the workforce to deliver the strategy and co-create the future.

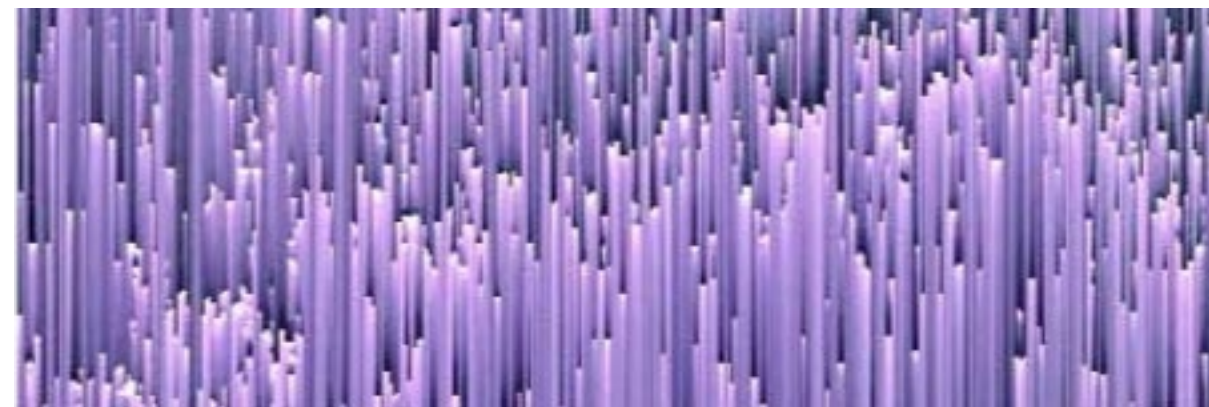


Three imperatives
for decarbonization
and growth



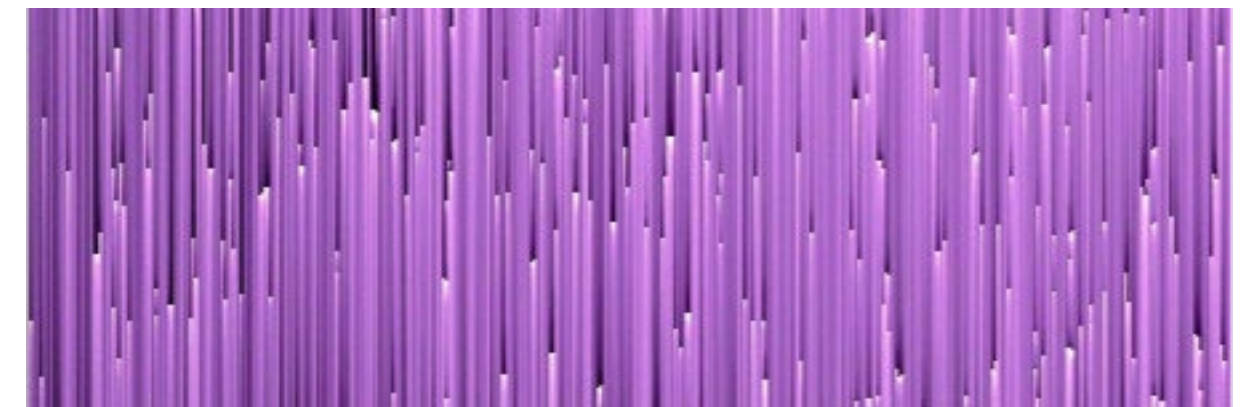
Imperative 1

Target green premiums to finance the first phase of industrial decarbonization



Imperative 2

Accelerate scaling low-carbon power and hydrogen to guarantee affordable, secure supply



Imperative 3

Drive down capital and operating expenses of low-carbon infrastructure

Imperative 1




Target green premiums to finance the first phase of industrial decarbonization

Implementing ‘green premiums’—higher charges for sustainable products and services—will be an essential first step toward industrial decarbonization. These premiums will fund the first phase of efficiency gains in low-carbon power and hydrogen and green industrial infrastructure.

Early adopters of any technology typically shoulder high costs. They pay a premium that finances the scale and enables learnings that bring costs down for others. Any new technology is adopted only if there are sufficient customers willing to pay this premium to use the technology before others.

With less than 1% of cement or steel produced today being “green”,¹⁹ heavy industry has a long way to go to achieve the scale that will bring down costs.

Light industry needs to help fund a solution by identifying segments and developing propositions for early adopters of low-carbon products and services willing to pay  green premiums.

Accenture research identified a subset of light industry’s customers who are willing to do this.²⁰ Fifty percent of consumers, for example, are willing to pay a premium for more sustainable delivery options. With changing customer demands and legislation, retailers for example are adopting greener and more sustainable fulfillment strategies. There could be enough of these customers to provide the confidence boost necessary to unlock value-chain-wide decarbonization investments.

By paying green premiums, early adopters will provide the investment necessary to fuel innovation and drive prices down. As prices for sustainable products and services become competitive with high-carbon alternatives, it will lead to mass-market adoption.

52%

of heavy industries believe revenue growth is the primary path to improve the economic business case of decarbonization.²¹



Imperative 1

What will it take?

Drive traceability for higher green premiums

Green premiums must be credible, and credibility is built on traceability. Consumers should be able to see the emissions from raw materials, manufacturing, and shipping.

Manufacturing relies on heavy industries for green inputs. Reliable emissions data from across the supply chain can offer increased transparency and boost the development of green premiums. When people trust the green credentials of what they are buying, they are more willing to pay a higher price. Digitalization will play an important role, creating the foundation for data sharing across the value chain.

Boost green premiums by creating new green products and markets

While visibility helps improve trust in green products, heavy industry needs to monetize this visibility. Entire processes must be digitized, and data shared across the industrial value chain.

For monetization to work, end customers will need to value green products more than high-carbon alternatives. Not all of them will be prepared to ¹¹ pay extra. In the early stages of industrial decarbonization, companies will need to match

each frontline green product with a group of willing early adopters. Finding these customers relies on good quality data to perform accurate segmentation analysis. Heavy industry should also better explain how increased volumes and long-term commitments can lower costs over time.

Heavy industry will need to collaborate with light industry to identify the right green products and services and develop new business models that target customer segments willing to pay these premiums. In automotive, for example, targeting the premium vehicle segment with green steel will be more successful than for the mass market, where price competition is important. Unlocking this opportunity requires new approaches to product branding and smart pricing strategies.

Petrochemical company Braskem created the I'm green™ brand in 2010, the first bioplastics to be produced on an industrial scale. Braskem confirmed its global leadership position in biopolymer production and continued to invest to meet the growing demand for these sustainable materials. The company's ambition is to increase the production of biopolymers to 1 million tons by 2030—a fivefold increase compared to current capacity.²²

Support green premiums through digital certification

Another way heavy industry could make green premiums more attractive is by selling digital 'green certificates' alongside low-carbon products. This decouples products and premiums, which provides greater visibility to the end customer. This transparent approach lays out both the baseline cost and the details of green premiums charged by each supplier and backs it up with green certification that customers can use to validate their own sustainability credentials. In the automotive industry, for example, a green certificate provides tangible support to a green car brand, while the added cost of the premium is shared across the value chain, including with the end customer.

The good news is that there are already pockets of customer demand and a willingness to act.

Innovation from heavy industry in product design and premium traceability—particularly in markets planning to levy a carbon emissions tariff on goods that create environmental damage during their production—will be a growth opportunity for light industry.

50%

of executives in light industry say they are effective in working with their supply chain to measure and trace carbon.

51%

of heavy industry executives plan to launch or expand products and services with a lower carbon footprint in the next 3–5 years.



Imperative 1

Powered for change: In action

Drive traceability for higher green premiums

European energy company

Launched a digital platform dedicated to promoting sustainability in industrial supply chains. The platform enables measuring sustainability performance and comparing it with industry benchmarks; gaining awareness of strengths and areas for ESG-related improvement; involving suppliers and improving the sustainability of the procurement processes.²³

Support green premiums with digital certification

Global metals producer

Launched a new branded product line to innovate the steelmaking industry towards carbon-neutral steel by 2050. An additional measure taken was to introduce green steel certificates. By purchasing green steel certificates, customers can officially receive the CO₂ savings achieved by the producer. This allows light industry to report a corresponding reduction in their Scope 3 CO₂ emissions in accordance with the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard.²⁴

Boost green premiums by creating new green products and markets

Shell, American Express Global Business Travel (AMEXGBT), Energy Web Foundation (EWF) and Accenture create new green fuel platform

Launched a digital solution to scale up the sustainable aviation fuels (SAF) market. This is the first commercially available blockchain-powered, digital book-and-claim solution bringing together airlines, corporates, cargo players, and SAF suppliers in one secure environment.²⁵

Imperative **2**



Accelerate scaling low-carbon power and hydrogen to guarantee affordable, secure supply

Build the confidence needed for scale

Reducing the cost of low-carbon power and hydrogen is crucial to reducing the costs of green industrial products. Today, heavy industry lacks confidence in the future availability of sufficient, secure and affordable low-carbon energy and hydrogen. At the same time, oil, gas and power providers lack confidence that heavy industry will pay higher prices for low-carbon power and hydrogen. Neither is prepared to invest without the other.

Boosting this confidence will depend on shepherding an orderly energy transition. This will reduce costs for low-carbon power, while maintaining security of supply through a diverse range of energy sources. These will include renewables, nuclear (including small modular reactors), conventional generation with CCUS and various types (or “colors”) of hydrogen.

The price of low-carbon power and hydrogen makes up a large portion of the total cost of many green industrial products. These costs are then passed on through the value chain. For example, in 2020, green power constituted 61% of the cost of green hydrogen.²⁶ In turn, green hydrogen accounted for 46% of the cost of green steel,²⁷ and 87% of that of green ammonia. Any cut in the costs of low-carbon power translates into cheaper green hydrogen and green industrial products.



Imperative 2

What will it take?

Drive down the cost of low-carbon power and hydrogen

The good news is that reducing the costs of low-carbon power and hydrogen is possible. Our S-curve analysis shows that by using a range of cost-cutting measures, costs can be lowered well beyond current market expectations. These measures include reducing construction and equipment costs, improving asset design and cutting power costs for hydrogen.

According to our analysis, if clean energy prices drop to \$30/MWh by 2050, green hydrogen will achieve cost parity (in 2039) with gray hydrogen eight years earlier than current market expectations.²⁸ And, if clean energy and green hydrogen prices drop to \$30/MWh and \$1.6/kg by 2050, green steel will achieve cost parity with gray steel four years earlier (2030 instead of 2034), and green ammonia with gray 10 years earlier in 2041.

How can we turn these estimates into reality? By scaling early and fast.

Technology	Reduction of CAPEX		Reduction of OPEX		Overall potential cost reduction by 2050*	
	Reducing construction costs	Reducing equipment costs	Asset design optimization	Reducing power costs	Market projection	Accenture optimized potential
Onshore wind	43%	17%	41%	0%	42%	59%
Offshore wind	38%	40%	23%	0%	48%	64%
Solar	70%	28%	2%	0%	63%	77%
Battery storage	35%	34%	24%	7%	33%	40%
Green hydrogen**	35%	36%	35%	22%	59%	74%

Figure 4: Potential low-carbon energy and hydrogen cost savings by 2050.

Source: Accenture Research S-curve modeling, based on inputs from multiple market studies; further detail included in the About the Research section.

*Third-party market study projections, vs. Accenture S-curve analysis

**Proton Exchange Membrane (PEM) electrolysis route in Europe



Imperative 2

What will it take?

Accelerate scale of low-carbon power and hydrogen

The economics of supply and demand for low-carbon energy are currently fragile. Greater efficiency can reduce both capital and operating expenses and therefore the unit cost of low-carbon energy. However, if heavy industry's demand for low-carbon energy exceeds available supply, this cost benefit could be cancelled out.

Furthermore, heavy industry's demand cannot be considered in isolation. Other industries are electrifying quickly and artificial intelligence alone could drive 5% share of global electricity consumption growth,²⁹ further pushing up demand. Our research shows a potential gap between the growing low-carbon energy demands of heavy industry and oil, gas and power providers' ability to meet them.

Modeling the European power system, we see a risk of the hourly electricity supply being up to 14% short of demand by 2030 during unfavorable weather. This is an urgent reason for heavy industry to take immediate action to secure sufficient, stable green electricity.³⁰

There are several ways to mitigate insufficient low-carbon power and hydrogen. First, oil, gas and power companies should take the lead on energy-system design and planning. This will require working with governments, communities, and engineering and construction firms. Digitalizing processes such as system planning, design and engineering, project permitting, construction, and asset and market operation—will improve their speed and efficiency. It creates the opportunity for innovative solutions such as flexibility arrangements and optimized network and system design.

Second, achieving an affordable and secure energy supply will require more diverse energy sources than renewables alone. Decarbonizing heavy industry will also require nuclear power, conventional generation with carbon capture, utilization and storage (CCUS) and blue hydrogen produced through CCUS.

Another critical factor in achieving the necessary scale in these projects is hiring enough people and providing them with the right skills. Companies will need to pursue diverse strategies for this. For example, they can establish shared service capabilities such as Centers of Excellence, or outsource certain operations. These models not only help to fill skills gaps but can also help workforces become more efficient by automating processes and performing certain tasks remotely.

Expanding non-traditional talent pools and creative collaborations such as partnerships with community organizations, trade schools and community colleges will be another way of filling skills shortages. For example, Accenture and the Greater Houston Partnership worked with a collective of local companies, educational and non-profit partners, to create a program that trains members of historically disadvantaged communities to work in the hydrogen industry.³¹

We look at whether there's enough power generation capacity, whether there's enough network capacity and whether the energy is affordable."

Mark van Loon

Senior vice president for Sustainability and Innovation, Wienerberger³²



Imperative 2

What will it take?

Forge win-win partnerships

Many heavy industry companies have historically sited themselves in clusters, close to resources and labor. These industrial clusters provide an opportunity to scale ^[1]_[2] low-carbon technologies by aggregating demand and forming a captive market.

For example, the World Economic Forum, in collaboration with Accenture and the Electric Power Research Institute (EPRI), is connecting private and public stakeholders ^[1]_[2] through its industrial clusters initiative to meet individual ^[1]_[2] and collective decarbonization goals. The approach, powered by digital technologies, focuses on building ^[1]_[2] cross-industry and cross-cluster partnerships. This helps individual companies and entire clusters to implement ^[1]_[2] low-carbon technologies and access public funding frameworks and blended-finance options.

Companies in these clusters are looking outside their industries for ideas as well. They are fostering and funding hubs, bringing together associations, start-ups, and/or academic partnerships to further innovate and support ^[1]_[2] their decarbonization agenda.³³

Oil, gas and power providers can create new, compelling profitable propositions for their industrial customers. They have a strong competitive advantage because they have already scaled renewables and deployed CCUS. This drives value from scale and shared infrastructure; in fact, our analysis shows that CCUS, together with further carbon-management solutions³⁴ present a revenue opportunity of more than \$250 billion by 2035.³⁵

To make these long-term commitments work, heavy industry must secure long-term demand for green products from light industry customers. Oil, gas and power providers must strike long-term partnerships with heavy industry that combine low-carbon energy supply with decarbonization services.

The use of existing market instruments such as power purchase agreements (PPAs) and feed-in tariffs need to be extended. In addition, companies and industries must work together to develop wider decarbonization services, such as CCUS as-a-service,³⁶ and the commercial arrangements that support them.

64%

of oil, gas and power providers believe their industrial and logistics customers are willing to enter into long-term decarbonization partnerships.

24%

revenue contribution is expected, according to oil, gas and power executives, for services that enable industrial and logistics decarbonization in five to 10 years.



Imperative 2

Powered for change: In action

Accelerate scale of low-carbon power and hydrogen

Multinational energy corporation

With renewable fuels being an important alternative that can help reduce the carbon intensity of transportation fuels, this oil and gas provider is committed to supplying 100 million barrels per day of renewable fuel by 2030. Their primary ^[1]_[SEPP] focus is on renewable diesel but also developing partnerships for renewable natural gas (RNG) ^[1]_[SEPP] and biodiesel.

The company has partnerships and completed investments that will support the focus on hydrogen hubs with CCUS in the US and is assessing the development of hydrogen production hubs in Asia Pacific, with a view to delivering on a commitment to 150 million tons per annum of hydrogen capacity (green, blue, and gray) by 2030.³⁷

North American utilities company shaping a clean hydrogen future

The company actively partners with research experts in the energy, academia, and related sectors to invest nearly \$140 million in research, development, and R&D projects related to innovative hydrogen programs. Investing in clean hydrogen initiatives is a company priority to ensure a safe and clean energy of the future. An example of investment includes a project to deliver a renewable hydrogen energy pipeline system. If successful, it could replace up to 3 million gallons of diesel and eliminate 25,000 tons of smog per year.³⁸

Forge win-win partnerships

Enel, Italian multinational power company and major renewables player

To advocate support for zero emissions targets, Enel collaborates with 20 national / regional and international associations and has created a startup ecosystem to scale-up innovative technologies to advance the energy transition. Their methodology has helped +130 startups by giving access to the global network, hubs, and laboratory.³⁹

Basque SuperCluster

The Basque Industrial SuperCluster is a collaboration involving the Basque Government, energy companies Iberdrola and Petronor-Repsol, and the Industrial Cluster Association which represents multiple heavy industries. Launched in 2021, the SuperCluster aims to decarbonize energy supply, improve energy efficiency in industry sectors and scale-up new technologies and services.

Part of the SuperCluster project is the use of AI ^[1]_[SEPP] to improve modeling techniques that optimize decarbonization. The BIDERATU Project has created its comprehensive E3S (Energy, Economy, Environment) modeling environment to assess the suitability of different decarbonization strategies, provide action plans, estimate investment needs, and suggest new business models.⁴⁰

Imperative 3

Drive down capital and operating expenses of low-carbon infrastructure

Understand the opportunity of direct cost levers

Heavy industry needs to squeeze capex and opex to release investment dollars for the transition to low-carbon infrastructure, and to sustain the viability of their product lines. In our survey, 90% of heavy industry respondents expect more than 20% of their global company revenues to come from low-carbon products or services within five years. However, 40% say their organizations cannot afford to invest more in decarbonization in the current economic climate. Accenture research shows how costs can be cut, especially for green steel and green ammonia.

Reduced construction and equipment manufacturing capital spending contributes to more than 30% of green steel's cost reduction.⁴¹ Improvements to asset management and feedstock quality contribute a further 15%.⁴² Figure 5 shows the potential cost reductions between 2023 and 2050. Our analysis uses a discounted saving method to estimate for the time value of money over the long lifecycle of low-carbon assets.

Capex savings constitute 50% of green ammonia's potential cost reduction. Asset design optimization contributes a further 20%.⁴³

Technology	Reduction of CAPEX		Reduction of OPEX		Overall potential cost reduction by 2050*	
	Reducing construction costs	Reducing equipment costs	Asset design optimization	Reducing power, hydrogen & feedstock costs	Market projection	Accenture optimized potential
Green steel**	5%	26%	4%	66%	36%	49%
Green ammonia	10%	40%	20%	30%	53%	69%

Figure 5: Cost savings potential for selected industrial low-carbon pathways by 2050

Source: Accenture Research S-curve modeling, based on inputs from multiple market studies; further detail included in the About the Research section.

*Third-party market study projections, vs. Accenture S-curve analysis in scenario 2 with more company actions realizing greater cost reduction.⁴⁴

** Direct Reduced Iron (DRI)-Electric Arc Furnace (EAF) route using green hydrogen in Europe.



Imperative 3

What will it take?

Digitalize infrastructure and capital projects

It is essential to standardize how infrastructure is built through modular and lean construction techniques that improve construction speed and quality. These techniques rely upon digital capabilities across the capital-project process. It starts in the planning phase, with digital design and testing to optimize construction specifications and mitigate risk. Then using generative AI can augment decision making during construction.

Using digital technologies can lead to significant gains. For example, connected construction solutions can increase productivity by up to 25% while improving worker safety.⁴⁴ Collaboration is key throughout the process, with seamless data sharing—including engineering data and documentation so that projects benefit from capabilities and innovation from across the engineering and construction ecosystem.

Production automation and design optimization, which drives standardization of components—are important levers to reduce the cost of equipment. Industrial equipment gigafactories could combine many of these elements at massive scale, enabling rapid efficiency improvements such as those observed in electric vehicle battery manufacturing.

While heavy industry can benefit from low-cost equipment and construction, it's essential that these gains are not eroded by tightened supply chains and subsequent price increases. To avoid this, companies must work with their supply chain partners to ensure the long-term predictability that allows supply chains to scale.

38%

of heavy industry executives see decreasing capex as a primary lever to improve the decarbonization business case by 2026.⁴⁵

51%

of heavy industry executives believe advanced manufacturing of standardized equipment at scale will have a high impact on improving the decarbonization investment business case by 2026.



Imperative 3

What will it take?

Scale intelligent operations

Overall, digitalization can help organizations increase yields and efficiency, and reduce downtime. Firstly, operational data can be analyzed for forecasting, improving energy efficiency and predictive maintenance. Additionally, AI-based automation can enhance operations in real time, increasing feed continuity and regularity. Going forward, generative AI, virtual reality and augmented reality technologies will help improve labor efficiency in both core and back-office operations.

To benefit from these process improvements, heavy industry should establish long-term partnerships with the technology industry to combine tech's leading digital technologies with heavy industry's deep engineering experience.

Deploy commercial optimization

Connected commercial optimization can improve feedstock quality and identify more efficient ways to transport and store feedstocks. Challenges surrounding the production, transport and storage of hydrogen will likely drive heavy industry to source feedstock locally, and/or develop on-site production and storage facilities.

Nearshoring feedstock procurement has the added benefit of reducing transport-related emissions while increasing supply-chain resilience.⁴⁶ The circular economy can bring further cost savings, as by-products can either be sold or recycled and heat can be recycled using process heat integration.

48%

of heavy industry executives believe “intelligent operation and asset management” will have a high impact on improving the decarbonization investment business case by 2026.

10%–20%

of working hours in heavy industry can be augmented by generative AI.⁴⁷

More than 65%

of cost reduction potential in green steel is about optimized costs for energy and material feedstock costs.⁴⁸



Imperative 3

Powered for change: In action

Scale intelligent operations

Global leader in the mining sector

This mining company seeks reliable alternatives to conventional fuel. As part of decarbonizing steel and aluminum, the company has successfully trialed its low-carbon iron-making process, which uses raw biomass instead of metallurgical coal. This process has the potential to support near-zero CO₂ steelmaking and can result in net negative emissions if linked to carbon capture and storage. The process is now being tested at scale at a specially designed pilot plant.⁴⁹

Deploy commercial optimization

Multinational chemicals producer

In addition to signing Power Purchase Agreements for renewable energy coming from wind farms, the company has created a subsidiary focused on ensuring electricity supply from renewable sources to plants, including a stake in a major European offshore wind farm. It also manages renewable electricity trading in Europe.⁵⁰


Accelerate digital in infrastructure and capital projects

Braskem, Latin American petrochemical company

Outlined a multi-phased approach to engage stakeholders at each of the company's major industrial complexes that account for more than 90% of Braskem's Scope 1 and Scope 2 emissions—about 11 million tons of CO₂ equivalent (tCO₂e) per year. Braskem developed a new Roadmap Prioritization Tool to consolidate decarbonization data from across the company's industrial complexes into a central database. They approved more than 160 decarbonization initiatives for their net-zero roadmap. Nearly half of those projects are currently being prioritized to meet near-term 2030 goals. Braskem estimates that priority decarbonization projects will be able to reduce carbon emissions at the six major complexes by nearly 30% (based on 2018–2020 averages).⁵¹

Scale intelligent operations

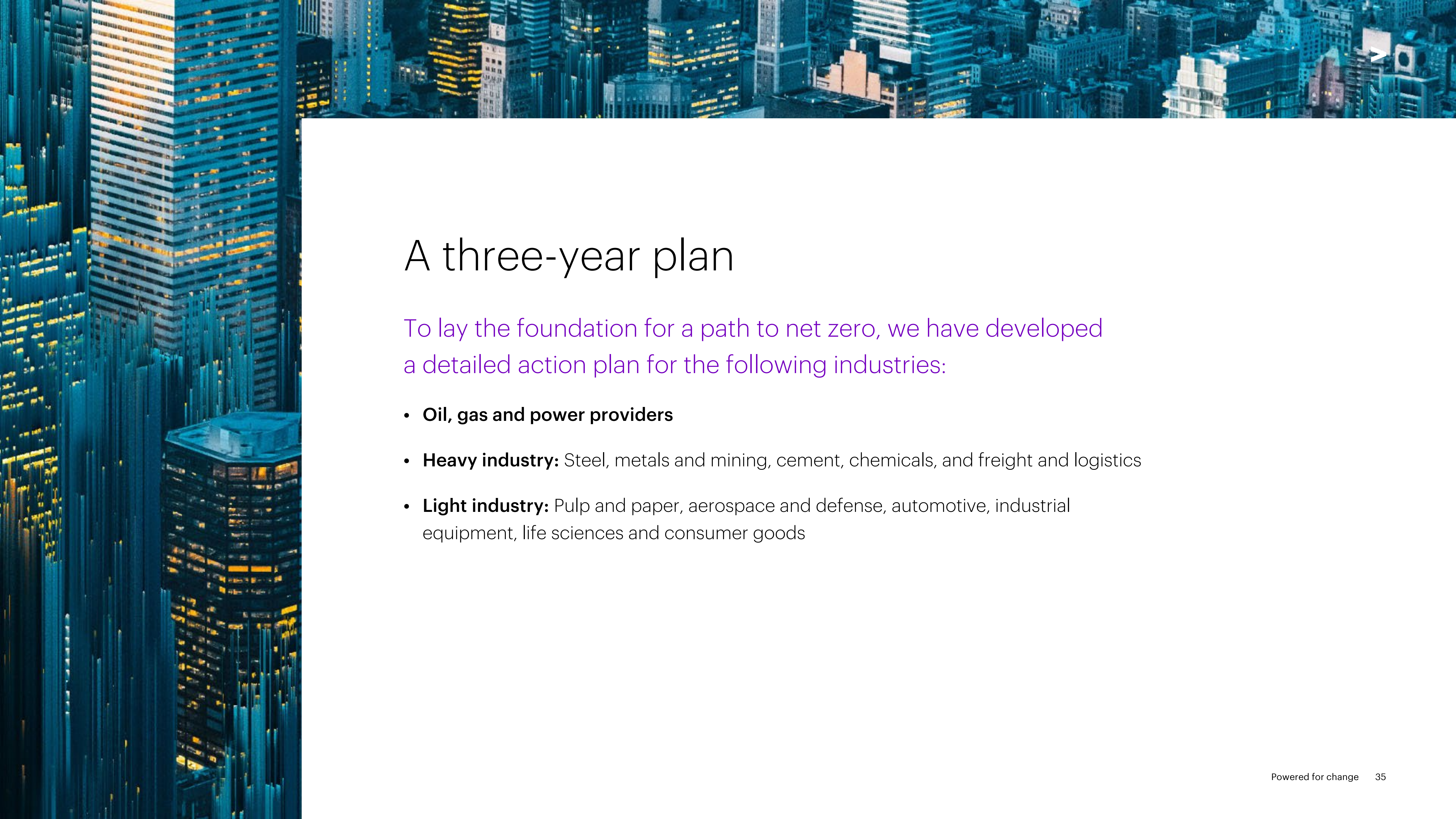
National fully integrated energy company

Developed in partnership with Accenture, a  cloud-based logistics solution and service platform helps this energy company manage marine and port operations to significantly optimize cost, while reducing carbon emissions. It offers a vessel marketplace to monetize unutilized logistics resources, monitoring performance and looking for areas of improvement by providing interactive dashboards with real-time data visualization.⁵²



A viable
decarbonization
pathway





A three-year plan

To lay the foundation for a path to net zero, we have developed a detailed action plan for the following industries:

- **Oil, gas and power providers**
- **Heavy industry:** Steel, metals and mining, cement, chemicals, and freight and logistics
- **Light industry:** Pulp and paper, aerospace and defense, automotive, industrial equipment, life sciences and consumer goods

Action plan for imperative 1

Target green premiums to finance the first phase of industrial decarbonization



What will it take? Drive traceability, create new green products and markets and implement digital certification.

Imperative 1 should be addressed holistically and **led by light industry.**

Industry	Next 100 days	Next 12–18 months	By year 3
Light industry Pulp and paper, aerospace and defense, automotive, industrial equipment, life sciences and consumer goods	<ul style="list-style-type: none"> Build out an understanding of scope 3 supply chain emissions Analyze supplier green price premiums against current cost structure and market positioning Engage with key industrial suppliers to understand economic drivers and opportunities Assess brand and market positioning and identify early adopters across products and customers Set leadership direction and develop a clear narrative to communicate actions needed, empowering organizations to prioritize as a part of business strategy 	<ul style="list-style-type: none"> Develop and communicate targets and a strategy to address scope 3 emissions coming from heavy industry Define green brand positioning and pricing Secure long-term low carbon supply aligned to green growth Build green into customer intelligence Define new green customer experiences and campaigns Assess future talent and skill needs and develop a plan to close the gap through mobility, rapid skilling or acquisition to support near-, mid- and long-term requirements Build understanding at all levels for workforce actions needed and reskill accordingly 	<ul style="list-style-type: none"> Create a trusted and differentiated green brand position Optimize the application of premiums through pricing and customer value proposition Embed end to end carbon measurement and management for scope 1,2 and 3 into the digital core Develop digital certification schemes for green premiums in partnership with heavy industry Build teams with the skills required to deliver on the strategy, embracing sophisticated combinations of people and technology
Heavy industry Steel, metals and mining, cement, chemicals, and freight and logistics	<ul style="list-style-type: none"> Understand the level of green premiums necessary to scale decarbonization investment across existing and new plants Engage with customers to understand potential to stimulate green demand and educate on the decarbonization cost curve Define a commercial construct that allows customers to benefit from cost reduction over time while providing the longer-term commitment necessary to underpin decarbonization investment Segment customer by willingness and ability to pay Set leadership direction and develop a clear narrative to communicate actions needed, empowering organizations to prioritize as a part of business strategy 	<ul style="list-style-type: none"> Work collaboratively to define a shared decarbonization roadmap with key customers Build enterprise-wide carbon intelligence and management into the digital core Build the capability to optimize decarbonization portfolio decisions against green demand Secure long-term contracts with strategic customers Develop robust measurement techniques for measuring and certifying embodied carbon working with regulators, governments, NGOs and partners Understand the implications of certification criteria for low-carbon power and hydrogen and industrial decarbonization technologies Assess future talent and skill needs and develop a plan to close the gap through mobility, rapid skilling or acquisition to support near-, mid- and long-term requirements Build understanding at all levels for workforce actions needed and reskill accordingly 	<ul style="list-style-type: none"> Evaluate impact of green premium to strategic planning and investment decision-making and plan for impacts Work together with customers to market certification and build trust and awareness Build teams with the skills required to deliver on the strategy, embracing sophisticated combinations of people and technology
Oil, gas and power providers	Identify opportunities to support heavy industry green premiums through net-zero construction on new assets: <ul style="list-style-type: none"> Assess capital plan for green premium potential (e.g., steel and cement for new electricity transmission) Calculate the embodied carbon associated with current asset designs and construction techniques to create a baseline Assess the opportunity to move to net-zero construction and the balance between embodied carbon reduction and offsets Engage with materials suppliers (heavy industry) and industrial manufacturing (provide equipment e.g., transformers) to jointly understand the opportunity Set leadership direction and develop a clear narrative to communicate actions needed, empowering organizations to prioritize as a part of business strategy 	<ul style="list-style-type: none"> Work with regulators and policymakers to support the funding of reduced embodied carbon in new infrastructure Build support for industrial decarbonization and the associated job creation into the strategy to earn community consent for hosting new low-carbon energy infrastructure Pilot innovations to reduce embodied carbon (e.g., factory production) Source low-carbon materials and equipment for new infrastructure build Establish EPC commercial relationships that embed net-zero construction as a key outcome Assess future talent and skill needs and develop a plan to close the gap through mobility, rapid skilling or acquisition to support near-, mid- and long-term requirements Build understanding at all levels for workforce actions needed and reskill accordingly 	<ul style="list-style-type: none"> Optimize net-zero construction by steadily increasing the reduction in embodied carbon through iterating and scaling engineering and construction innovation in parallel to sourcing lower carbon equipment and materials Embed carbon traceability and optimization into the capital projects digital core Execute on strategic partnerships to pair new energy infrastructure with in-community growth and jobs from industrial decarbonization Build teams with the skills required to deliver on the strategy, embracing sophisticated combinations of people and technology



Action plan for imperative 2

Accelerate scaling low-carbon power and hydrogen to guarantee affordable, secure supply

What will it take? Reduce the cost of scaling low carbon power and hydrogen; consider diversity of energy supply, system planning and talent; and promote win-win partnerships.

Imperative 2 should be addressed holistically and **led by oil, gas and power providers.**

Industry	Next 100 days	Next 12-18 months	By year 3
Oil, gas and power providers	<ul style="list-style-type: none"> Define the strategy and operating model to achieve the next performance frontier in low-carbon energy infrastructure Connect the strategy to decarbonize operations with growth from decarbonizing industry Define a growth strategy for industrial decarbonization services and partnerships Define commercial arrangements with heavy industry that support investable and affordable low-carbon power and hydrogen Create enhanced portfolio optimization capabilities linked to models of industrial decarbonization Understand the regulatory context and opportunities and a plan to maximize value from secured or available regulatory funding Set leadership direction and develop a clear narrative to communicate actions needed, empowering organizations to prioritize as a part of business strategy 	<ul style="list-style-type: none"> Transform OEM and EPC relationships to drive collaboration and innovation in low carbon energy infrastructure e.g., alliances, enterprises and joint ventures Design future intelligent energy assets with lower life-cycle costs and higher performance Enhance community engagement to support consenting and planning with a broader value proposition Develop strategic relationships with heavy industry to co-create joint decarbonization roadmaps Create new and enhanced capabilities to drive low-carbon growth from industrial customers with new propositions building on sources of competitive differentiation Understand the potential for global low-carbon energy supply chains, e.g., increased transmission interconnectedness and the shipping of ammonia to shape global portfolio optimization 	<ul style="list-style-type: none"> Create the digital core to reinvent capital project delivery and asset operation Secure long-term contracts with strategic customers Secure talent and supply chain to execute at increased scale Work with policymakers to enhance planning rules to accelerate the delivery of low carbon infrastructure and overcome key constraints, e.g., electricity network capacity Identify opportunities for whole-system solutions that enhance the economics of industrial decarbonization e.g., CCUS and industrial clusters Have in-market a set of industry tailored industrial decarbonization offerings backed by the ability to make long-term investments
Heavy industry Steel, metals and mining, cement, chemicals, and freight and logistics	<ul style="list-style-type: none"> Quantify future low-carbon and hydrogen demand and understand target cost to support green growth Understand the financial implications of making long-term low-carbon energy commitments, align with decarbonization roadmap and forecast green demand Set leadership direction and develop a clear narrative to communicate actions needed, empowering organizations to prioritize as a part of business strategy 	<ul style="list-style-type: none"> Build strategic relationships with energy providers Develop enhanced capabilities for procuring and managing low-carbon power and hydrogen supply Integrate energy efficiency with low-carbon energy supply Understand the role of CCUS and circularity in conjunction with decarbonization through low-carbon power and hydrogen to develop an integrated roadmap Assess future talent and skill needs to develop a plan to close the gap through mobility, rapid skilling or acquisition to support near-, mid- and long-term requirements Build understanding at all levels for workforce actions needed and reskill accordingly 	<ul style="list-style-type: none"> Enter into long-term strategic partnerships with energy providers that optimize risk sharing and collective value Enable shared infrastructure planning and development to support whole system solutions Secure physical capacity for increased power supply (i.e., new electricity network capacity) Build teams with the skills required to deliver on the strategy, embracing sophisticated combinations of people and technology
Light industry Pulp and paper, aerospace and defense, automotive, industrial equipment, life sciences and consumer goods	<ul style="list-style-type: none"> Scale efforts to address scope 1 & 2 emissions through low carbon energy supply and energy efficiency 		



Action plan for imperative 3

Drive down capital and operating expenses of low-carbon infrastructure

What will it take? Digitalize infrastructure and capital projects, scale intelligent operations and deploy commercial optimization.

Imperative 3 should be addressed holistically and led by heavy industry.

Industry	Next 100 days	Next 12–18 months	By year 3
Heavy industry Steel, metals and mining, cement, chemicals, and freight and logistics	<ul style="list-style-type: none"> Build decarbonization s-curves for existing and planned plant Determine how scale and learning effects can be maximized through cycles of infrastructure development Create an integrated set of decarbonization initiatives to optimize the journey by combining measures (e.g., energy efficiency) with economics that are currently attractive with longer-term bets that will achieve net zero Define a strategy for circularity and identify opportunities for partnering Set leadership direction and develop a clear narrative to communicate actions needed, empowering organizations to prioritize as a part of business strategy 	<ul style="list-style-type: none"> Transform OEM and EPC relationships to drive collaboration and innovation in decarbonized industrial infrastructure (e.g., alliances, enterprises and joint ventures) recognizing the specific challenges of retrofitting existing infrastructure Create standardized and modularized designs for key decarbonization technologies Design future intelligent decarbonized plant with lower life-cycle costs and higher performance Identify opportunities for circularity and increased feedstock quality Assess future talent and skill needs and develop a plan to close the gap through mobility, rapid skilling or acquisition to support near-, mid- and long-term requirements Build understanding at all levels for workforce actions needed and reskill accordingly 	<ul style="list-style-type: none"> Create the digital core to reinvent capital project delivery and asset operation including digital twins of existing plants to support lowest-cost retrofit and AI capabilities for optimized production Secure talent and supply chain to execute at increased scale and use Augmented Reality and Virtual Reality to equip the workforce with the skills to operate new equipment and assets safely and efficiently Make supply chain commitments that support OEM gigafactory investment Work with policymakers to enhance planning rules to accelerate the delivery of low-carbon infrastructure and overcome key constraints (e.g., electricity network capacity) Secure higher quality feedstock and circular supply chains through contracts and partnerships
Oil, gas and power providers	<ul style="list-style-type: none"> Understand the economics of industrial decarbonization to shape offerings for industrial customers Set leadership direction and develop a clear narrative to communicate actions needed, empowering organizations to prioritize as a part of business strategy 	<ul style="list-style-type: none"> Work with strategic industrial customers to establish ecosystem partnerships Assess future talent and skill needs and develop a plan to close the gap through mobility, rapid skilling or acquisition to support near-, mid- and long-term requirements Build understanding at all levels for workforce actions needed and reskill accordingly 	<ul style="list-style-type: none"> Have a comprehensive set of propositions that combine low-carbon energy supply with wider support for industrial decarbonization Build teams with the skills required to deliver on the strategy, embracing sophisticated combinations of people and technology
Light industry Pulp and paper, aerospace and defense, automotive, industrial equipment, life sciences and consumer goods	<ul style="list-style-type: none"> Made possible by light industry leading on targeting green premiums to create new markets for green products and services 		



Questions to assess readiness



Questions to help C-suite executives assess their current ability to activate the three-year plan

Ambition and strategy

- How advanced are your decarbonization plans?
- Does your plan include a collaboration approach across the value chain?
- Do you fully understand the needs of your customers, and their customers for green products and services?
- Have you defined ways to drive down decarbonization costs for your organization and those of your supply chain?
- Are you going beyond current ^{[[1]]}_[SEP] benchmarks, matching industry leaders, ^{[[1]]}_[SEP] or playing catchup?

Digital core

- How mature is your digital core?
- How well integrated is it to support an enterprise-wide decarbonization strategy?
- Can your digital core support operating as a fundamentally interconnected boundaryless organization?
- Does the digital core drive resilience?
- What is your approach to evaluating ^{[[1]]}_[SEP] and adopting new technologies to ^{[[1]]}_[SEP] progress decarbonization?
- Do you have the breadth and depth of data needed to effectively leverage AI, and more specifically, generative AI?

Transformational initiatives

- Do you have net-zero transformation initiatives for infrastructure, plants, operations and new products and services?
- Do these initiatives include a partnership strategy that extends ^{[[1]]}_[SEP] beyond your organization?
- Do your transformation initiatives have ^{[[1]]}_[SEP] a clear approach to monitor and ^{[[1]]}_[SEP] measure performance?
- Do your initiatives build enterprise carbon intelligence through carbon measurement and accounting, as well as approaches to carbon removal?

Talent and leadership

- Have you assessed your workforce's skills and knowledge, what will be required to deliver on your decarbonization strategy, and identified actions to close those gaps?
- Are you ready to invest in a culture of innovation to achieve a future-ready workforce?
- Have you developed a vision, set leadership direction and clearly communicated actions?
- Do you have a plan to engage your workforce and empower them to take ownership in driving the change ahead?
- What is your plan for leadership accountability to drive the transformation?



How Accenture can help

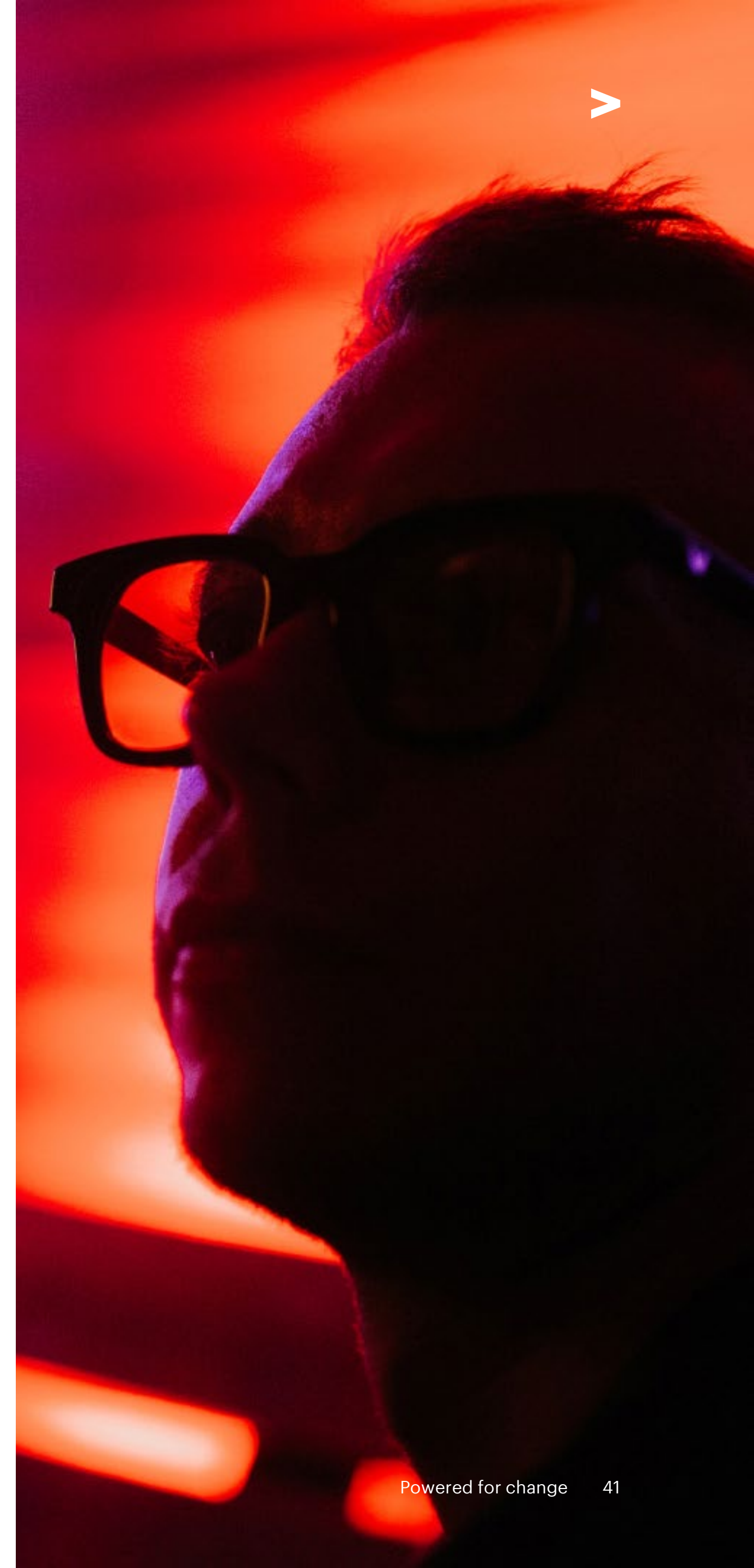
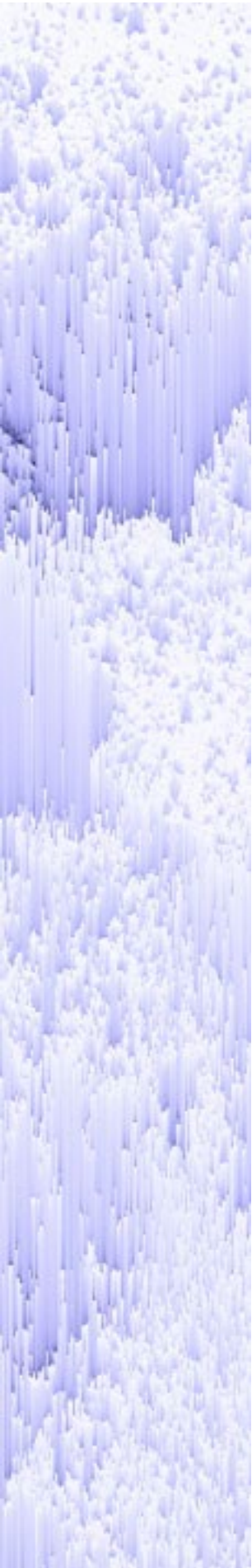
We create sustainable value and impact for our clients as they strive to achieve net-zero carbon emissions.

We help companies formulate and advance their net-zero transition by focusing on:

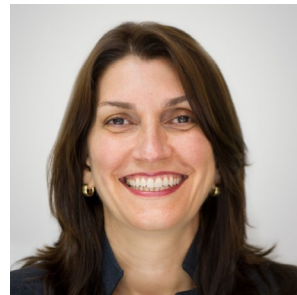
- **Net-zero strategy** to set the decarbonization strategy, monitor and measure performance
- **Net-zero infrastructure** to increase capital efficiency for the build of large low-carbon projects, including green finance approaches
- **Net-zero plants and operations** to transform existing infrastructure and operations including energy efficiency, green energy procurement and connected energy
- **Net-zero road transportation** to implement strategies and logistics including fleet management, green finance, and net-zero driver experience
- **Net-zero products** to ensure green product and market design, including eco-design, circularity and net-zero customer adoption
- **Net-zero finance** to support assessment of net-zero projects, including reporting and industry benchmarks, as well as optimizing access to funding and subsidies
- **Carbon intelligence** to build enterprise carbon intelligence through carbon measurement and accounting, as well as approaches to carbon removal

Contact us to learn more:

www.accenture.com/us-en/about/contact-us



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About the research

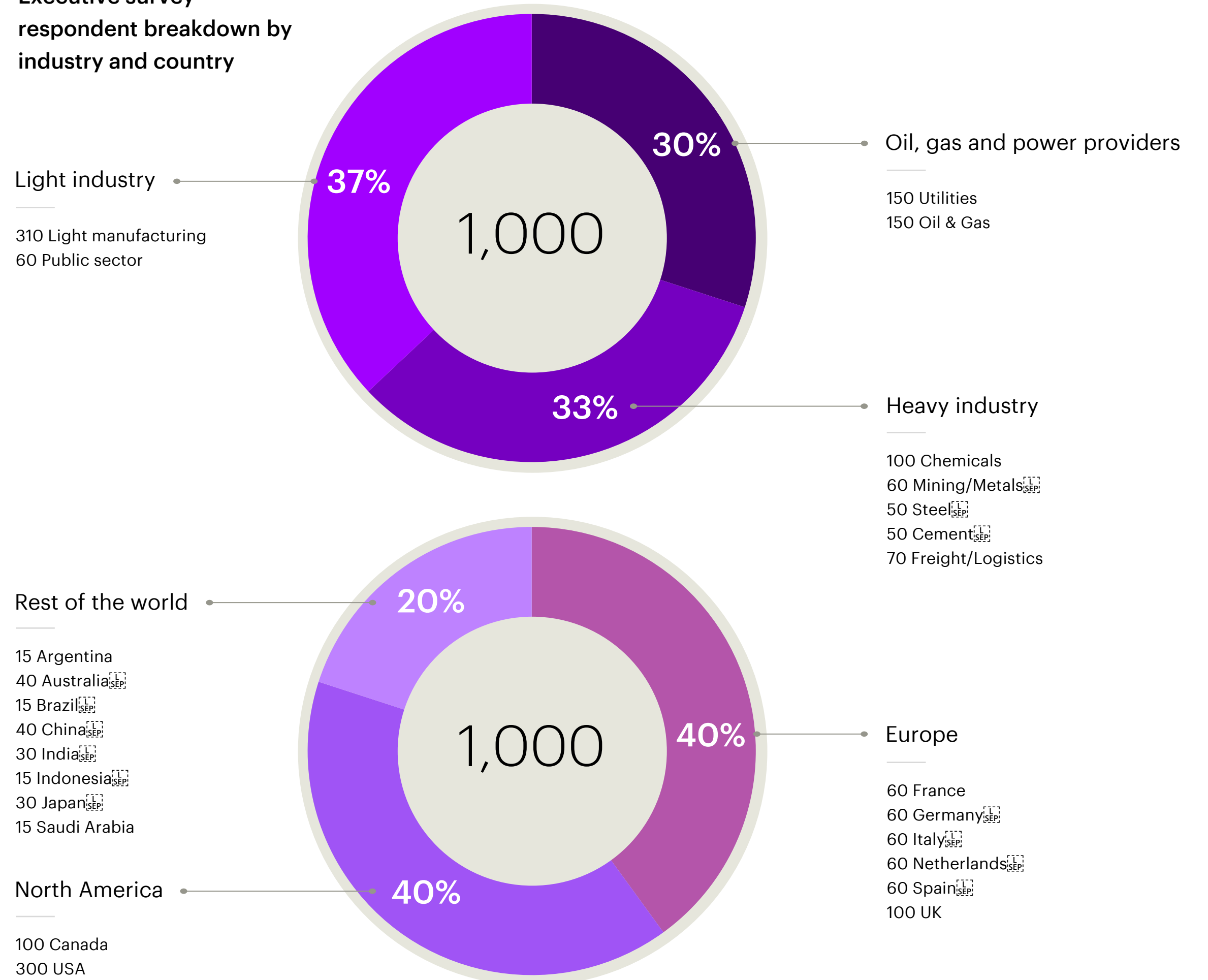
A global survey with 1,000 executives across key industries in April and May 2023. C-Level or C-1 Level respondents included COO, CSO, CFO, directors of strategy, operations, strategy, finance, sustainability and production. Surveys were conducted with a maximum of two respondents per company. Companies included in the survey had revenues of greater than \$10 billion (30%), \$1 billion to \$9.9 billion (50%), \$250 million to \$999 million (20%), and were headquartered in Europe (40%), North America (40%) and the Rest of the world (20%). The aim was to understand near-term challenges and priorities of industrial decarbonization, expectations for Scopes 1 to 3 emissions, key revenue and cost levers for improving the financial business case for selected decarbonization solutions, regional priorities and partnership plans.

Qualitative interviews with 18 executives and middle management from selected heavy industry and energy providers.

Special thanks to Luis Gomez from XPO Logistics and Mark van Loon from Wienerberger for their insights.

Techno-economic modeling leveraging Accenture's proprietary S-curve analysis methodology to quantify cost drivers for selected decarbonization pathways in selected scenarios for the selected industries to estimate the greatest achievable savings with energy transition technologies including wind, solar, battery storage, green hydrogen, green steel, green ammonia and green construction. The key cost lever categories include "reduce construction costs," "reduce equipment costs," "asset design optimization," "reduced power, hydrogen and feedstock costs," each consisting of multiple sublevers feeding the input-output model (e.g., improved capacity factor, enhanced, process automation and higher-quality material feedstock).

Executive survey respondent breakdown by industry and country

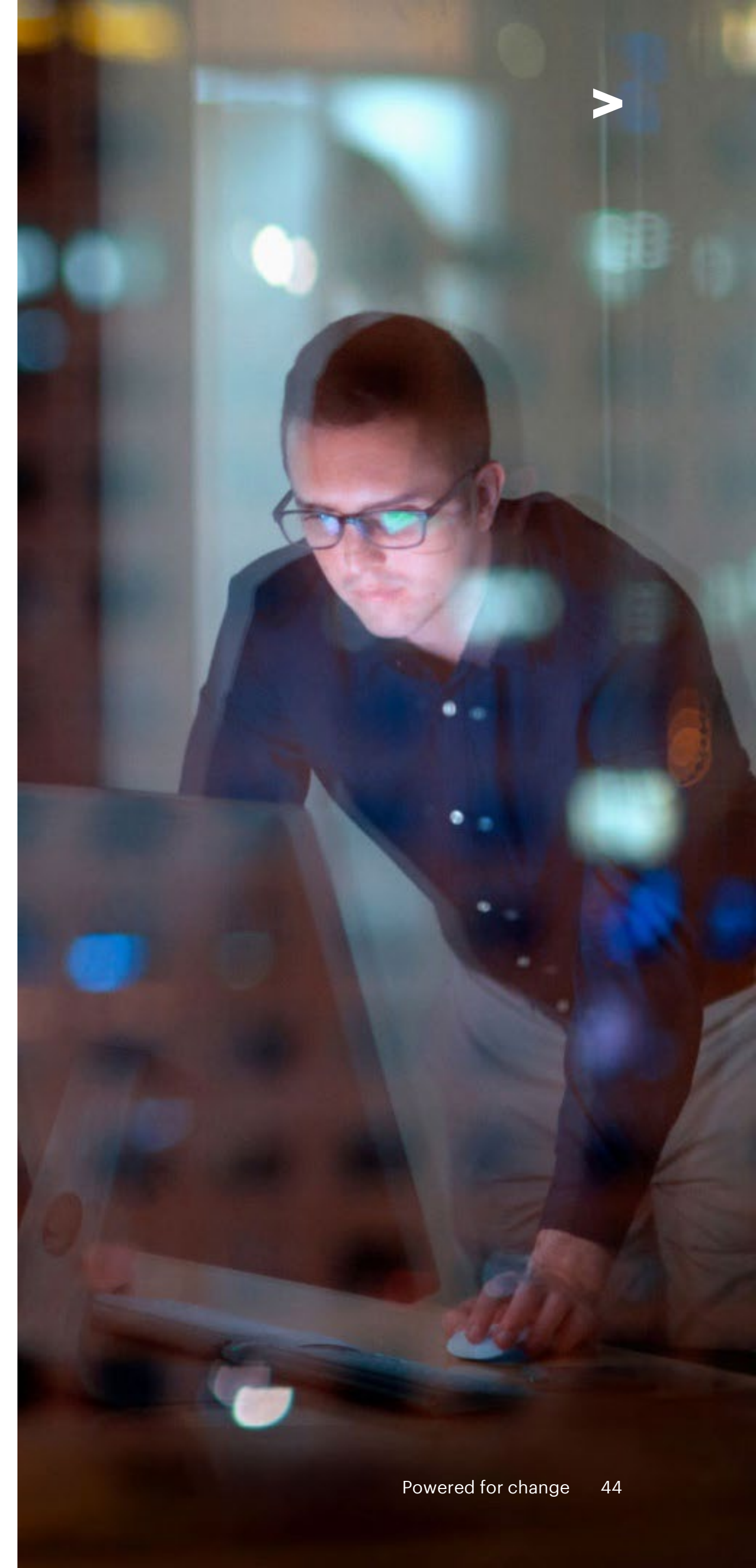


Related research

Accenture embeds sustainability into everything it does and is committed to helping its clients through the net zero transition.

Our thought leadership is designed to help to lead the way.

- [Destination Net Zero](#) focuses on steps individual businesses can take to accelerate their progress toward net zero. (November 2023)
- The 2023 Edition of the Net Zero Industry Tracker, published by the World Economic Forum, in collaboration with Accenture provides a comprehensive analysis of the progress hard-to-abate industrial sectors are making in their efforts to achieve net zero emissions by 2050. (November 2023)
- [The Private Sector SDG Stocktake](#), created through our partnership with the United Nations Global Compact, looks at the broader context of the Sustainable Development Goals and the practical steps business can take to help accomplish them. (September 2023)





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Accenture is a leading global professional services company that helps the world's leading businesses, governments and other organizations build their digital core, optimize their operations, accelerate revenue growth and enhance citizen services—creating tangible value at speed and scale. We are a talent- and innovation-led company with 732,000 people serving clients in more than 120 countries. Technology is at the core of change today, and we are one of the world's leaders in helping drive that change, with strong ecosystem relationships. We combine our strength in technology with unmatched industry experience, functional expertise and global delivery capability. We are uniquely able to deliver tangible outcomes because of our broad range of services, solutions and assets across Strategy & Consulting, Technology, Operations, Industry X and Accenture Song. These capabilities, together with our culture of shared success and commitment to creating 360° value, enable us to help our clients succeed and build trusted, lasting relationships. We measure our success by the 360° value we create for our clients, each other, our shareholders, partners and communities.

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