Powered for Change 2025

Industrial decarbonization in the age of gen AI

accenture

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Preface

Every year to 2050 counts—for the planet, and for the industries reshaping it.

To meet net-zero goals, we must significantly reduce emissions in the oil, gas, power and heavy industries. At the same time, we must continue to meet growing energy and consumer demand while sustaining profitable growth.

In our original *Powered for Change* report, we set out three imperatives for industrial decarbonization: targeting green premiums to finance early-stage solutions, scaling low-carbon power and hydrogen and reducing capital and operating costs for net-zero infrastructure. These priorities remain essential. But knowing what must be done is not the same as knowing how to do it—faster, more consistently and at significantly lower cost.

In Powered for Change 2025, we show how to achieve those ambitions by reinventing the massive build-out of net-zero infrastructure. This includes renewable energy, nuclear power, green hydrogen, carbon capture, lower-carbon manufacturing and the transmission and distribution networks that connect them.

Our insights and recommendations are informed by AI-augmented research. We analyzed over 200 companies' communications with the help of AI, synthesized expert interviews and applied proprietary inverse S-curve modeling. This blend of machine intelligence and executive insight allowed us to detect emergent patterns and model real-world decarbonization strategies with unprecedented depth.

Based on these findings, we recommend a multigenerational approach to decarbonization. It's a shift from bespoke projects to repeatable systems; from singular firsts to continuous improvements; from cost escalation to compounded advantage. Rather than treating each infrastructure project as an isolated effort, a multigenerational approach connects them—technically, financially and strategically—so that each project builds on the last.

Our research shows that bold reinvention changes the economics of decarbonization. Companies can drastically reduce capital expenditure across iterations. And AI and gen AI can amplify its effects by capturing learnings across projects and delivering exponential returns.

The success of the multigenerational approach hinges on four levers: resilient supply chains, community engagement, workforce reinvention and a strong digital core for AI-powered learning. Together, they unlock a faster, more cost-effective path to large-scale industrial decarbonization.

The question is no longer whether we can act, but how well we can learn—and how fast we can scale what we've already started. To be powered for change, we need to turn momentum into impact.

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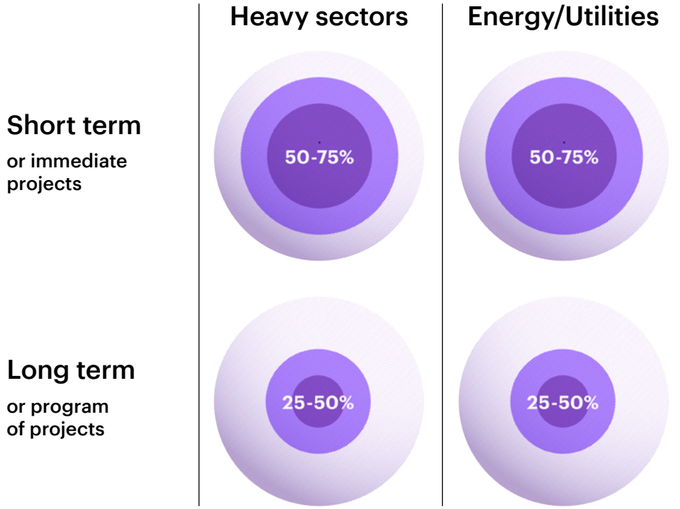
From bespoke projects to a multigenerational approach

Our first *Powered for Change* report introduced three imperatives for industrial decarbonization: targeting green premiums to finance early-stage solutions, scaling low-carbon power and hydrogen to support an affordable and reliable transition, and reducing capital and operating costs for low-carbon infrastructure. The latter two are not possible without a more effective way to build and operate net-zero infrastructure.

Today, most infrastructure projects are treated as one-off efforts, planned, financed and executed in isolation. Given their cost, duration and complexity, each is delivered as a bespoke effort, with limited connection to others. In our work, we have found that 90% of projects follow this pattern, with only 10% benefiting from repeatable teams or supply chains. Our research also reveals a prevailing short-term orientation in how heavy industries and energy providers articulate their current decarbonization project plans. Up to 75% of these plans are currently focused on discussing short-term projects that yield immediate results (see Figure 1). This fragmented approach increases risk and cost—especially in the context of industrial decarbonization.

Figure 1

Energy, utilities and heavy sector companies are more focused on short-term than long-term projects

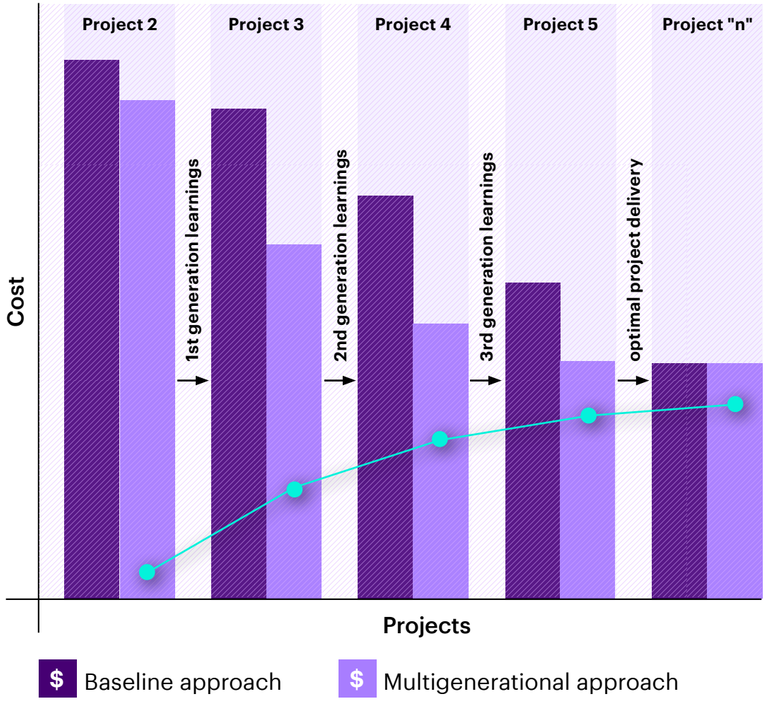


Notes: Based on the share of companies discussing their actions and projects related to the set context. Long-term/program of projects refers to strategic initiatives and programs, in contrast to current, ongoing or otherwise imminent projects related to the set context of industrial decarbonization.

Source: Accenture Research analysis augmented with AI, using data from earnings calls and company publications.

Figure 2

Costs decline and savings rise when you take a multigenerational approach



Notes: proportions based on an inverse S-curve and NPV calculation for levelized cost of green hydrogen in Europe in base and optimized "multigenerational" scenario.

Source: Accenture S-curve model.

A multigenerational approach offers a way forward. It is a shift from bespoke projects to repeatable, iterative designs. Instead of reinventing the wheel each time, companies develop products, services or technologies once, then improve them with each deployment.

This approach is not new. Just as carmakers gain efficiency by using modular platforms, enabling multiple vehicle models to share standardized chassis and engine designs, the technology sector does so by investing in standardized architectures and scalable platforms. Imagine the needless cost and complexity if they designed each new product completely from the ground up.

A multigenerational approach creates a flexible, repeatable process, designed for continual upgrades and scalable production.

Whether modernizing brownfield assets or building greenfield capacity, a modular, standardized approach improves enterprise resilience and accelerates time-to-value. It allows organizations to absorb innovation continuously, without resetting project timelines or disrupting broader decarbonization strategies.

To truly scale decarbonization, companies must adopt a mindset of continuous learning, looking beyond individual projects to consider how today's efforts will evolve over the next 10, 20 or 30 years. Many companies already have 10-year capital plans; what's needed now is to embed multigenerational thinking and new capabilities into those plans for long-term impact. The accumulated learnings over individual project generations will drive cumulative savings, dramatically accelerating the pace of cost reduction, especially during the first few cycles (see Figure 2).

Figure 3

The “From/To” of a multigenerational approach

From	To
Controls mindset to mitigate single-project risk	Performance-driven approach focused on long-term value
Turn-key engineering, procurement and construction (EPC) model	Collaborative contracting and shared accountability
Project-by-project delivery	Repeatable delivery model across teams and supply chains
Bespoke designs and construction mindset	Modular, standardized designs and pre-built components
Change during construction	Early-stage collaboration to reduce costly changes later
Outreach and local content a requirement	Active community and stakeholder engagement
Fragmented backwards-looking data	Predictive insights for better planning and decisions, driven by AI
Good people overcome broken processes	Digital systems that standardize and streamline work
Meet asset standards (design and operation)	Smart assets built for lower cost and stronger performance
Narrow local talent pool	Globally sourced talent empowering local teams
Organized by project and technology	Shared processes and expertise across multiple projects

Impact story

How shipbuilding reshaped capital efficiency

Industries that have adopted a multigenerational mindset are already seeing compounding returns. One of the most powerful examples comes from shipbuilding.

Historically, shipbuilding was a bespoke craft. Each vessel was designed and built from scratch, resulting in significant inefficiencies—from high production costs and extended timelines to minimal learning across projects. Generational learning, or the systematic accumulation and reuse of insights, was nearly nonexistent.

Modern shipbuilders have reinvented their approach by embracing flexible, modular design principles. This transformation is characterized by:

Standardization and modularization. Adopting standardized components and modular designs allows shipbuilders to reuse parts across multiple projects, streamlining production and dramatically reducing engineering time and costs.

Vertical integration. Rather than treating each ship as a standalone project, modern shipbuilders now manage design, production and supply chains holistically, optimizing entire portfolios and driving efficiencies at scale.

Harnessing the learning curve. By sequencing production to align with multiple-unit orders, shipbuilders fully capitalize on continuous learning.

Together, these shifts have transformed shipbuilding from a series of isolated projects into a compounding system of performance gains. For instance, the fifth ship in a series can cost *50% less* to produce than the first, with subsequent builds becoming more profitable.[1]

This shows how adopting a repeatable approach can drive down costs through repeated iterations—particularly when design standardization and production modularity reach critical mass.

Compounding benefits from the multigenerational approach—lower costs, faster delivery, higher quality—aren't limited to shipbuilding. They reflect a broader dynamic that plays out across heavy industry, from hydrogen production to steel and cement manufacturing, as scale and learning accelerate.

Insights from our research: Repeatable delivery redefines the cost curve

These compounding returns follow a recognizable pattern, one that can be modeled, forecasted and scaled. Our inverse S-curve analysis reveals how cost reductions evolve as companies move from first-of-a-kind efforts to repeatable delivery.

Where a typical S-curve shows gradual adoption accelerating before stabilizing, an inverse S-curve, or cost-curve, flips that view: costs start high with early low-carbon investments, then drop sharply once a critical threshold is reached, driven by continuous learning and economies of scale.

The inverse S-curve, therefore, unfolds in three phases:

1. **Initial phase.** Early projects bring modest savings as the learning process begins.
2. **Tipping point.** Experience and scale effects drive significant cost reductions, accelerating decarbonization and improving ROI.
3. **Sustained cost reductions.** As companies apply continuous learning across multiple projects, capital expenditures decline, creating a strong incentive for sustained action.

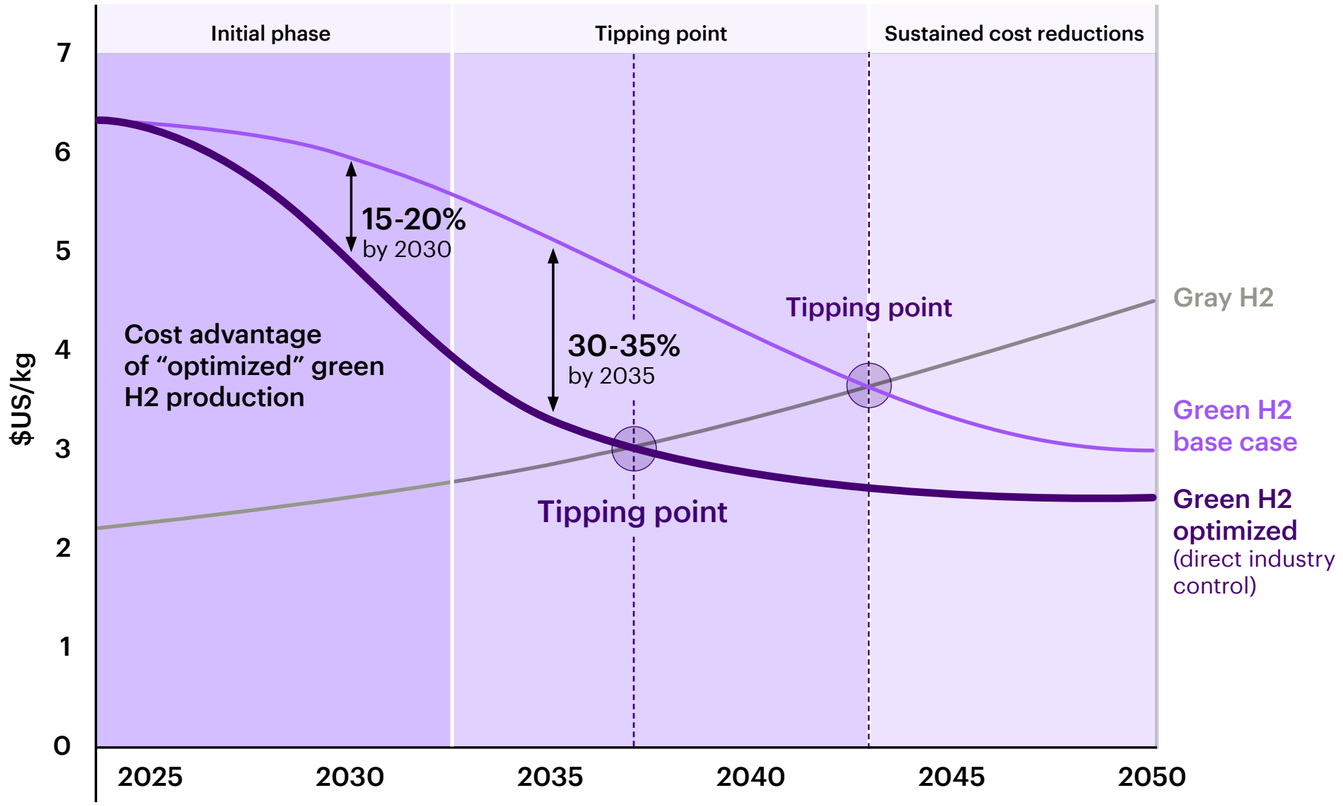
Green hydrogen, a blueprint for cost-efficient scaling

Green hydrogen offers a compelling demonstration of how a multigenerational approach delivers its positive cascade of benefits.

Our analysis shows that by applying a multigenerational approach, green hydrogen production could achieve a 35% cost advantage by 2035, reaching cost parity nearly a decade earlier than a project-by-project approach. Even earlier on, accumulated project learnings can drive up to 20% cost savings in sequential green hydrogen projects within five to six years.[2] Critically, this structured, multigenerational strategy could generate up to $60 billion in net present value (NPV) by 2050, based on capturing just 5% of global green hydrogen demand (see Figures 4–5).

Figure 4

Taking the multigenerational approach and modeling it on green hydrogen, using an optimized inverse S-curve

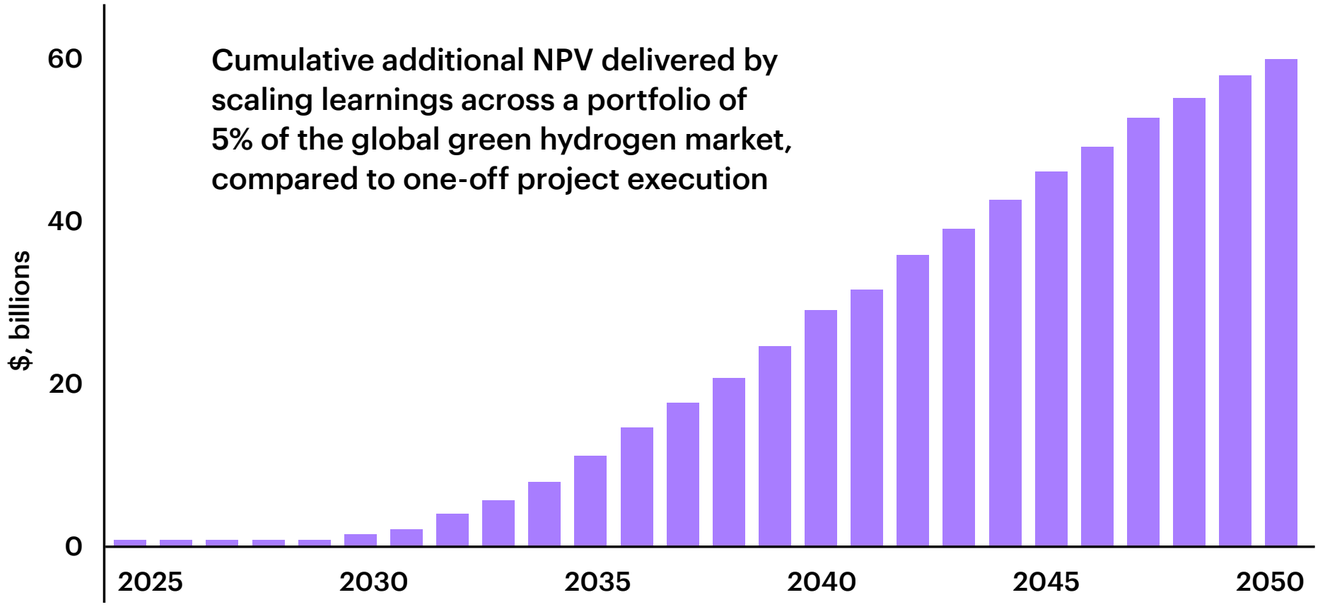


Notes: 7% WACC, discounted from 2025-2050, for Europe. The cost of fossil-fuel based gray hydrogen is expected to increase in line with EU carbon tax, at $70-80/t CO2 today, $150/t in 2037 and $300/t in 2050.

Source: Accenture S-curve model.

Figure 5

Taking a multigenerational approach with green hydrogen is a >$60 billion opportunity



Notes: H2 demand based on IEA WEO 2024 NZE 2050 scenario. NPV calculation based on delta LCOH between base and optimized scenario, 7% WACC, discounted from 2025-2050. The cost of fossil fuel-based gray hydrogen is expected to increase in line with carbon tax, at $70-80/t CO2 today, $150/t in 2037 and $300/t in 2050.

Source: Accenture S-curve model.

This cost-reduction dynamic holds true across sectors like steel, cement, chemicals, mining and refining. Whether it is electrolytic hydrogen, process electrification, carbon capture, utilization and storage (CCUS), co-locating steel mills with natural hydrogen deposits or shifting from traditional blast furnaces to electric arc furnaces (EAF) and direct reduced iron-electric arc furnaces (DRI-EAF),[3] companies that pursue a coordinated, multi-project strategy will move faster down the cost curve. Our analysis of cost curves for advanced nuclear power generation reveals similar dynamics: small modular reactors (SMRs) can realize substantial upfront cost reductions through SMR design and standardization.

AI can be a force-multiplier

AI is poised to play a transformative role in industrial decarbonization, not by accelerating individual projects alone, but by embedding continuous learning across entire portfolios.

By analyzing vast amounts of project data, AI extracts insights with speed, depth and precision beyond human capabilities, accelerating the learning curve and amplifying returns across successive projects.

Companies that harness this capability effectively in capital projects can both outperform on the first-generation projects today and create the foundations for outperformance on future generations.

Regulation can help, but long-term value depends on resilience

Around the world, industrial policy is rapidly evolving to align decarbonization with economic competitiveness. In the EU, the Clean Industrial Deal (CID)[4] aims to bolster regional competitiveness while advancing decarbonization. Measures include improving access to affordable energy to reduce customers' bills, incentivizing electrification and easing industrial investments. The CID will also advance market reforms to encourage clean hydrogen uptake and support public and private investments in renewable energy, providing greater certainty and predictability for companies and investors alike. In the US, the Executive Order Unleashing American Energy[5] underscores a commitment to enhancing energy security and industrial competitiveness by streamlining permitting, prioritizing domestic resource development and reducing regulatory barriers.

In Japan, the GX2040 Strategy,[6] recently approved alongside the state's Seventh Strategic Energy Plan,[7] sets out a long-term framework to accelerate decarbonization and strengthen industrial capacity. In China, meanwhile, the 2024–2025 Action Plan for Energy Conservation and Carbon Reduction[8] mandates measurable improvements across heavy industries, including explicit targets for energy efficiency and carbon reductions in sectors like steel, petrochemicals, non-ferrous metals and building materials.

Yet, while the global regulatory environment is often incentivizing industrial players to take meaningful action on emissions, companies cannot afford to rely on policymakers alone. They must proactively safeguard their future competitiveness by cutting emissions and diversifying their energy supply.

The International Energy Agency (IEA) forecasts that global electricity demand will increase by 80% by 2050. This is nearly twice the growth rate of overall energy consumption and shows how important it is to diversify energy sources not only to enable clean energy adoption, but also to ensure a secure, resilient energy supply.[9]

The onus on companies to act ahead of regulators is reinforced by rising macroeconomic risks. Today's elevated geopolitical volatility and overall policy uncertainty are making industrial decarbonization even more complex. What once felt like isolated crises have become a permanent feature of the business landscape.

Uncertain market conditions are also affecting investment. Our research shows growing negative sentiment around capital projects, applying to both conventional and green investments. While 30–35% of organizations used a predominantly negative tone when discussing their new investments or capital projects in 2024, that percentage has grown to 50% in 2025 (see Figure 6). In this continued fast-moving environment, a multigenerational, repeatable approach helps companies hedge against trade disruptions, safeguard access to capital and sustain momentum amid shifting policy and economic headwinds.

Figure 6

Companies have growing concerns about the viability of capital projects. Negative sentiment is on the rise

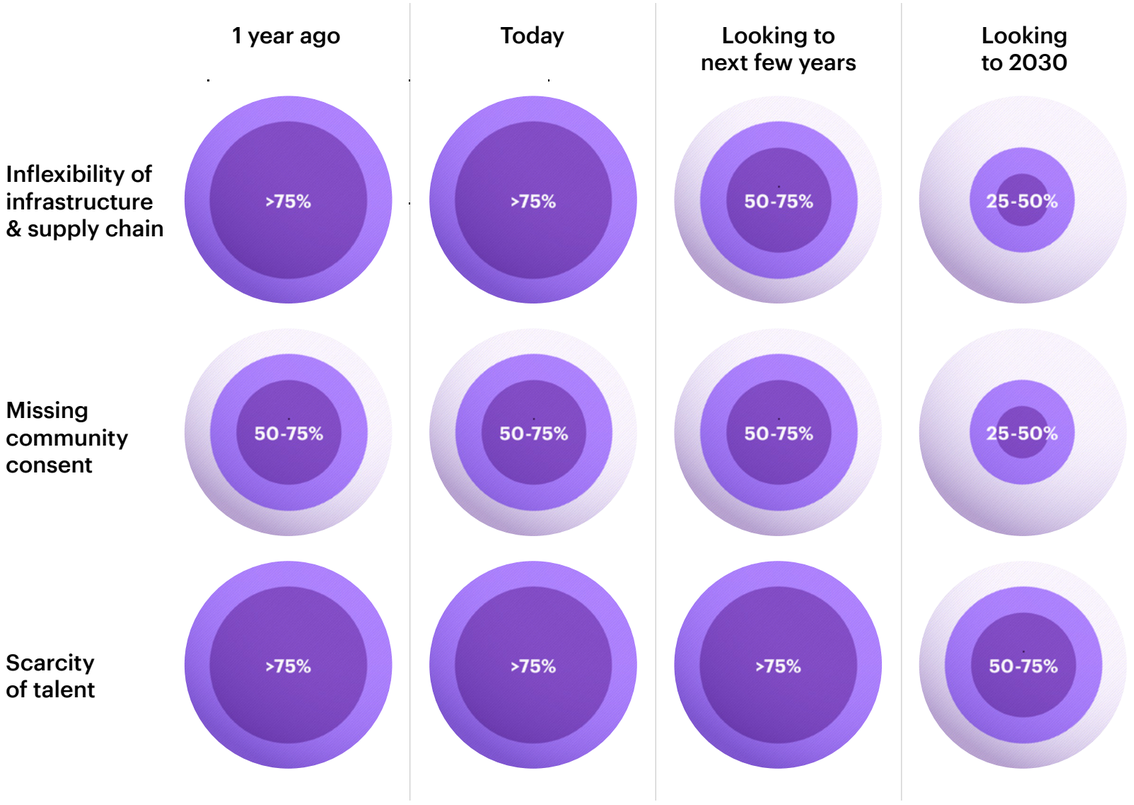
Note: Percentage of companies in utilities, oil and gas, chemicals and mining and metals that mention cancelling capital projects or cutting or delaying capital investments—measured as a share of all companies refering to capital projects or investment plans.

Source: Accenture Research analysis augmented with AI, using data from earnings calls and company publications from January 1, 2024 to April 15, 2025.

However, it's not just about macroeconomic factors. Our research reveals that while heavy industries and energy providers are less concerned about inflation and the cost of green power in the coming years, a high share of these organizations are consistently concerned about infrastructure inflexibility and supply chains, missing community consent and the scarcity of talent (see Figure 7).

Figure 7

Negative sentiment in topics beyond economics is on the rise



Note: Percentage of companies expressing negative sentiment on a topic, calculated as a share of all companies referring to that topic within a given time frame.

Source: Accenture Research analysis augmented with AI, using data from earnings calls and company publications.

Four levers are critical for the success of the multigenerational approach

Our research has identified four levers as essential to enabling the multigenerational approach and unlocking its benefits across complex, capital-intensive portfolios. These levers target persistent challenges—such as cost volatility, supply chain fragility and execution gaps—that continue to hinder large-scale decarbonization.

LEVER 1

Scale efficient, resilient supply chains

Lever 1

Why it matters

A resilient supply chain is the foundation of industrial decarbonization, enabling clean energy infrastructure to scale without supply disruptions, cost spikes or project fragmentation. Siloed, short-term procurement, on the other hand, leads to inefficiencies and curtails large-scale deployment of critical solutions, such as hydrogen, carbon capture and renewables.

> "Without a secured supply chain and guaranteed return on investment, most companies will not venture into new plants to support carbon reduction initiatives."
>
> —Steel executive

The challenge

Accenture's recent research found that, by 2028, 74% of heavy industry executives expect supply chain volatility to negatively impact large capital projects.[10] These disruptions increase costs, delay implementation and prevent companies from scaling beyond pilot projects. Key barriers include:

Long lead times and cost volatility. Critical components like hydrogen electrolyzers and rare earth metals face unpredictable supply fluctuations.

Fragmented supplier ecosystems. Low production volumes and dispersed suppliers increase costs and prevent economies of scale.

Lack of standardization. Without modular designs, every project requires custom engineering.

Regulatory uncertainty. Shifting policies and tariffs discourage long-term procurement strategies.

Furthermore, a study by Accenture and the sustainable procurement ratings organization EcoVadis found that only 50% of companies surveyed have visibility into more than half of their Tier-1 suppliers; the percentage drops to 20% for Tier-2 suppliers and 15% for Tier-3 suppliers.[11] This lack of insight into partner operations severely limits companies' ability to measure and mitigate Scope 3 emissions while increasing exposure to unforeseen risks like regulatory non-compliance and shortages of essential materials.

Companies in the heavy industry and energy sectors are recognizing the urgency of rapidly scaling efficient and resilient supply chains. Our research shows that more than half of companies discussing these actions for industrial decarbonization are prioritizing a time frame of the next one to three years (see Figure 8).

The opportunity

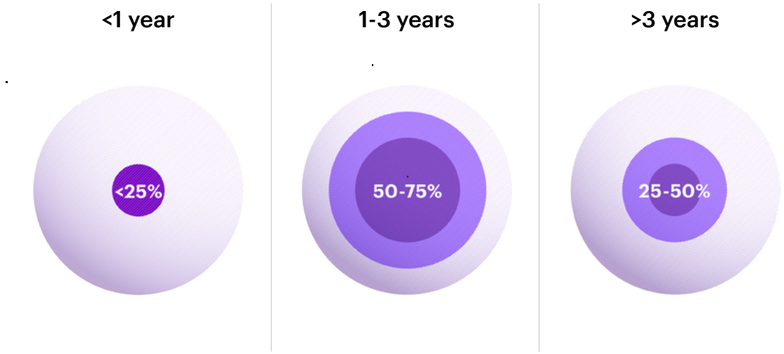
Leaders in oil, gas and power, as well as heavy industry, must now move beyond prioritizing cost-control in procurement and place a premium on cultivating robust, enduring partnerships and strategically diversified supply chains.

By collaborating not just with suppliers and clients but also competitors, companies can accelerate industry-wide standardization, which in turn cuts capital spending and reduces delays by minimizing design changes.

In emerging decarbonization technologies, where pilot projects dominate, sharing knowledge and best practices can help scale viable solutions more than twice as fast. Meanwhile, regionalizing supply chains improves resilience—our research into supply chain resilience shows 3.6% higher growth among companies that prioritize supply-chain localization. With 89% of industry executives planning to manufacture in the region by 2026 (up from 39% in 2023), now is the time to invest in strategic ecosystems that deliver long-term, compounding returns.[12]

Figure 8

Up to 50% of companies have said it will take them more than three years to scale efficient and resilient supply chains



Note: Based on companies discussing actions related to industrial decarbonization—specifically initiatives such as improving and optimizing supply chains to support new decarbonization projects.

Source: Accenture Research analysis, augmented with AI, using data from earnings calls and company publications.

Key actions

1/ Build long-term supply chain partnerships

What to do:
For upstream, think about the origin of the supply chain and getting involved, either directly or through partnerships, with the production of required raw materials through strategic investments. Rework investment and return models, particularly in relation to suppliers of technology innovations, for faster and broader dissemination of improvement opportunities across projects and programs. For downstream, develop multi-year procurement agreements to ensure continuity of relationships, stabilize prices and secure critical materials and energy supply.

Expected outcomes:
- Unit cost reductions of 30–50% over successive projects through economies of scale.
- Shorter lead times enabled by predictable supplier engagement.
- Hedge against price volatility.
- Secured access to critical inputs, including electrolyzers and carbon capture systems.

2/ Drive standardization and modularization

What to do:
Adopt standardized designs and modular components—proven in offshore wind and grid-scale solar—to simplify procurement and accelerate deployment.

Expected outcomes:
- Shorter lead times and reduced capital spending through modular production.
- Better alignment of standards and certification schemes via unified approaches.
- Simplified procurement through consistent, cross-project design approaches.
- Faster deployment by minimizing late-stage design changes.
- Monetization of proven innovations to offset initial investment costs.

3/ Strengthen regional supply chains

What to do:
Advocate for and invest in local manufacturing hubs and industrial clusters to increase supply predictability, limit geopolitical risk and improve cost competitiveness.

Expected outcomes:
- Reduced exposure to trade barriers and geopolitical volatility.
- Regional production advantage through “local-for-local” strategies. Eighty-nine percent of surveyed chemicals, mining and metals executives expect to produce goods in the region within three years, up from 39% in 2023.[13]
- Sustained competitive advantage from localized, efficiency-driven partnerships across project portfolios.[14]
- Scalable, secure access to low-carbon power through aggregated demand in industrial clusters that presents a compelling case for suppliers to scale investment in production and infrastructure.[15]

Case Study

DHL's digital supply chain initiative

DHL Supply Chain partnered with Accenture to digitize, standardize and optimize its global logistics network—enhancing resilience, reducing lead times and enabling real-time visibility.

With over 2,000 warehouses and transport hubs in more than 220 countries, DHL faced the same issues with a fragmented logistics network that industrial decarbonization players struggle with today.

However, by integrating the following capabilities, DHL transformed it into a coordinated, end-to-end supply chain model:

- **AI-powered analytics** to predict bottlenecks
- **Digital twin technology** for real-time supply chain visibility
- **Automation and robotics** to streamline logistics

DHL's ability to scale and integrate complex, multi-market supply chains provides a direct blueprint for industrial players. By adopting similar digital tools and predictive analytics, companies can:

- **Optimize procurement** and reduce lead times
- **Hedge against supply disruptions** in key decarbonization technologies
- **Drive iterative cost reductions** across multi-project decarbonization strategies

LEVER 2

Foster community support and customer demand

Lever 2

Why it matters

Even the most well-funded decarbonization projects can stall without early buy-in from communities, customers and regulators. Industrial players often focus on supply-side readiness—ensuring access to clean energy infrastructure and technologies—while underestimating the critical role of demand-side engagement in accelerating adoption and approvals.

The challenge

Permitting delays, regulatory hurdles and local opposition can push back project timelines by years. This not only weakens cost advantages but also erodes stakeholder confidence, and delays long-term investment flows. Fifty two percent of heavy industry executives expect a lack of stakeholder engagement to negatively impact capital projects by 2028.[16] Key challenges include:

Environmental and aesthetic concerns. Communities often feel excluded from the planning process, which breeds mistrust and opposition.

Perceived lack of local benefit. Communities may not perceive direct advantages from projects if the benefits—like jobs, infrastructure, or environmental improvements—aren't clearly communicated.

Regulatory complexity. The permitting process itself is often complex and fragmented. Communities can exploit these procedural gaps when they feel their concerns haven't been addressed.

> "Local communities may not see how decarbonization efforts translate into tangible benefits, such as job creation or environmental improvements."
>
> —Oil & Gas executive

"Involving communities in renewable energy or recycling projects early is critical. The initial resistance can add three to five years to project timelines, but transparent communication can significantly speed up this process."

—Chemicals executive

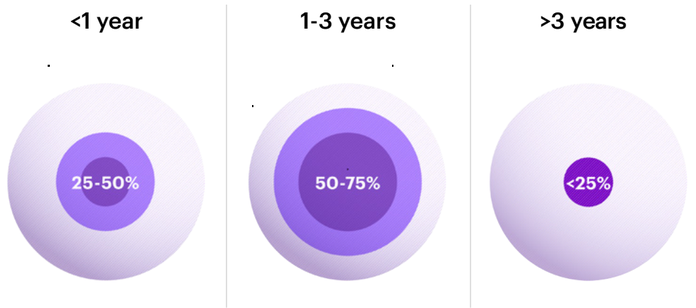
The opportunity

This disconnect between decarbonization efforts and tangible benefits, if unaddressed, can delay projects by three to five years. That's why leading companies must reframe engagement with local community leaders not as a late-stage obligation, but as a strategic enabler of speed, scale and long-term value.

When done well, early communication can significantly reduce permitting delays and unlock faster go-to-market timelines. In fact, 52% of heavy industry executives already expect engagement with local communities, customers and regulators to be a make-or-break factor in major capital projects by 2028—and companies that prioritize early, transparent dialogue can secure smoother permitting and build the demand-side momentum needed to accelerate adoption.[17]

Figure 9

Most companies have said it will take them between 1-3 years to build the required support within communities



Notes: Based on the share of heavy industry and energy companies discussing their actions within the topic, in the context of industrial decarbonization. Capturing actions/initiatives on, for example, improving community and consumer consent for new industrial decarbonization projects.

Source: Accenture Research analysis augmented with AI, using data from earnings calls and company publications.

Key actions

1/ Establish a unified impact framework

What to do:
Create a standardized framework to communicate how decarbonization projects benefit the economy, public health and climate resilience.

Expected outcomes:
- Stronger community trust through alignment with local priorities.
- Lowered resistance via early, transparent communication of project benefits.

2/ Build transparency through targeted communications

What to do:
Use AI-powered, hyper-local communication strategies, such as digital storytelling and interactive tools, to personalize messaging and highlight tangible benefits.

Expected outcomes:
- Enhanced local support through compelling, community-tailored storytelling.
- Reduced stakeholder opposition by addressing misinformation or messaging gaps.

3/ Accelerate approvals through streamlined permitting

What to do:
Adopt digital-first, collaborative permitting models that centralize stakeholder input, automate workflows and increase regulatory transparency.

Expected outcomes:
- Faster project approvals, cutting delays by months or even years.
- Greater stakeholder satisfaction through real-time visibility and accountability.
- Long-term, sustained momentum and engagement with the community.

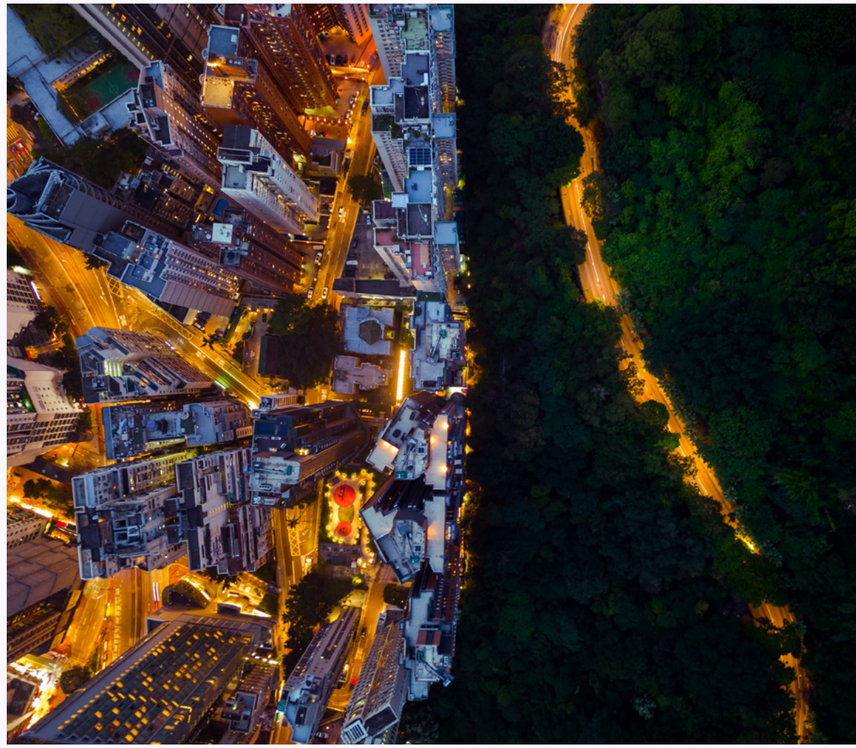
Empowering Americans to support clean nuclear energy

Building community support is one of the hardest challenges in industrial decarbonization, especially around topics like nuclear energy.

In response, Accenture Song partnered with Generation Atomic and Mothers for Nuclear and Constellation Energy on the “Come Clean for Nuclear Energy” campaign to spark conversations and build awareness about nuclear energy’s safety, reliability and environmental benefits.

Using broadcast media, digital channels, influencer content and interactive experiences, the campaign tackled public misconceptions and reluctance to discuss nuclear power. In just nine weeks, it achieved a measurable impact, driving a 50% increase in public support for nuclear energy expansion.

The takeaway? By engaging communities through transparent, relatable and fact-based storytelling, industrial companies can turn skepticism into advocacy, accelerating approvals, strengthening positions and speeding the adoption of critical decarbonization solutions.



LEVER 3

Reinvent talent, skilling and workflows

Lever 3

Why it matters

Industrial decarbonization is not just a technological challenge—it's equally a challenge of people and processes. Transitioning to lower-carbon operations requires new skills, decision-making structures and mechanisms to embed knowledge across projects.

Many companies across oil, gas, power and other heavy industries need to move beyond current ways of working to think about what tasks, processes and workflows can be reimagined to enable the scaling of carbon reduction solutions.

At the same time, AI—including gen AI—is catalyzing workplace transformation on a scale not seen since the industrial revolution. Success now hinges on talent resiliency: the ability to rapidly adapt workforce skills and capabilities to meet evolving business needs, technological advancements and market dynamics.

Our *Making reinvention real with gen AI* research indicates that three times more gen AI-related spending goes to technology than to people.[18] Executives need to balance technology spend with investment in talent and skilling. Organizations can unlock meaningful impact from AI and gen AI investments only when their workforce has the skills and mindset to adapt to evolving technology.

Maximizing gen AI's impact requires a continuous reinvention journey, not a one-off effort. As inferencing capabilities, AI agents and physical AI evolve at pace, the imperative is clear: organizations must build the agility to adapt rapidly and stay ahead of disruption. Yet only 30% of the companies we surveyed expressed confidence in their ability to manage change.[19]

"Talent scarcity is a pressing issue, especially with aging operations and outdated mining methods. It's not just about finding skilled people but convincing them of the value new technology can bring."

—Mining executive

The challenge

Industrial decarbonization is being slowed not by a lack of ambition, but by persistent execution gaps in talent, skills and decision-making. More than 75% of the companies we analyzed are recognizing the urgency of workforce reinvention, focusing on actions related to new ways of working over the next three years or less (see Figure 10). Key barriers include:

Talent shortages and retention challenges. While hiring remains strong in some sectors, retaining skilled workers is a persistent challenge. As one steel executive noted, "Steel doesn't struggle with finding people per se; we struggle with retaining those employees."

Fragmented learning and knowledge silos. Too often, lessons from one project remain isolated, limiting an organization's ability to compound efficiencies across initiatives.

Rigid, outdated processes. Traditional, top-down decision-making structures slow innovation and make it difficult to respond dynamically to evolving decarbonization needs.

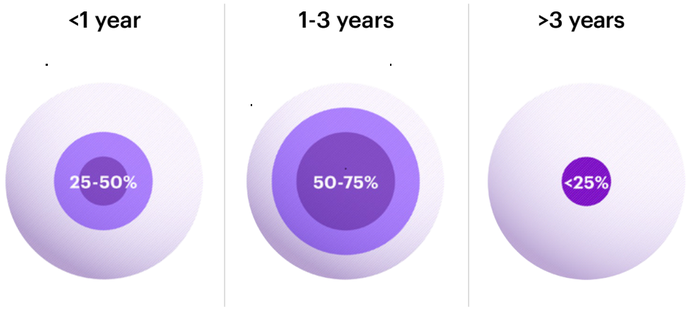
The opportunity

Closing this gap requires building a robust talent engine—data-driven, AI-enabled and grounded in behavioral science. This means first, thinking about what tasks, processes and workflows can be reimagined; and then about how this needs to be supported by reshaping the workforce. The workforce will need an elevated employee experience and a seamless work-learn environment, where employees build fluency in new tools and processes while actively deploying them.[20]

Strategic talent planning and agile teaming are also essential to scale, enabling faster decisions, reducing duplication and ensuring the right skills are available where and when they're needed to accelerate decarbonization.

Figure 10

Less than 50% of companies say it will take them 12 months or shorter to implement new ways of working



Note: Based on the share of heavy industry and energy companies discussing actions related to industrial decarbonization—specifically initiatives such as improving access to talent, reskilling and new ways of working.

Source: Accenture Research analysis, augmented with AI, using data from earnings calls and company publications.

Key actions

1/ Codify and share learnings across projects

What to do:
Lead in new ways, reimagining structure, processes and ways of working to break down traditional silos. Create centralized knowledge hubs, digital playbooks and AI-driven analytics to document and share insights from every project.

Expected outcomes:
- Reduced duplication of effort and accelerated efficiency gains across the project portfolio.
- Fewer errors and rapid iteration across initiatives, as each initiative builds on previous learnings.

2/ Foster interactive training and upskilling for seamless work-learn fusion

What to do:
Build future-ready organizations. Adapt workforce skills and capabilities to meet evolving business needs and use AI to implement cross-functional, simulation-based learning with real-time feedback.

Expected outcomes:
- A learning-focused workplace culture.
- An agile, future-ready workforce and learning paths tailored to individual skill needs.
- Employees equipped with the adaptable skills needed to navigate an evolving technological landscape and the mindset and fluency required to collaborate with AI agents.

3/ Decentralize decision-making and encourage agile collaboration

What to do:
Build disciplines and sustainable capabilities that create clarity of purpose and shift mindsets and behaviors. Shift from top-down decision-making to empowering local teams with real-time, context-specific authority. This can include cross-functional talent rotation.

Expected outcomes:
- Accelerated project timelines as bottlenecks are removed.
- Improved decision quality with AI-driven insights and real-time data.

4/ Embed a talent engine into decarbonization strategies

What to do:
Develop talent roadmaps that anticipate skills gaps, ensure a steady pipeline of expertise and integrate workforce development into broader sustainability initiatives.

Expected outcomes:
- A scalable talent pipeline that prevents talent shortages from becoming a barrier to scaling decarbonization
- A sustainable talent engine that aligns workforce investment with long-term industrial transformation goals.

Fostering a culture of safety at TenneT

TenneT, a European electricity transmission system operator, is at the forefront of modernizing and expanding the German energy grid system.

Following Germany's shift to renewable energy sources, construction projects are underway to expand the grid. TenneT has committed to a zero-harm policy during construction by fostering a culture of safety.

Recognizing that traditional safety training approaches fall short, TenneT and Accenture co-developed an actors-based, immersive, behavior-driven training program to elevate health, safety and environment practices to the next level.

Key features include:

- **Scenario-based, realistic training** that immerses trainees in realistic virtual scenarios aimed at embedding safety behaviors into everyday operations.
- **State-of-the-art training centers** with 360° projection rooms, integrating movies produced by Accenture and physical simulations for experiential learning.
- **A structured evaluation framework** to ensure continuous improvement and iteration.

Every person visiting the construction site for more than three days—including employees, construction workers and engineers—will be required to attend the training. The result is a scalable model for safety excellence. The current "learner satisfaction rate" stands at over 90% after more than 3,000 training sessions. Over five years, the initiative aims to train more than 10,000 people.

By embedding new ways of working, industrial leaders can develop a workforce that is not only prepared for decarbonization but actively drives it. A repeatable approach to reskilling the workforce creates a self-sustaining cycle of learning, efficiency and innovation—ensuring that every project contributes to a broader, scalable net-zero strategy.

LEVER 4

Establish a strong digital core to power AI learnings

Lever 4

Why it matters

Many industrial decarbonization efforts stall due to outdated, fragmented digital systems that fail to capture and apply continuous learning across projects. Without a cohesive digital backbone, companies miss opportunities to automate processes, optimize execution and accelerate decarbonization at scale.

The challenge

Industrial companies face three major digital roadblocks:

Siloed digital tools. Systems used in one project, or for one process step, rarely integrate with others, limiting cross-project learning and slowing replication of best practices. This can be further complicated due to security permissions and integrations.

Lack of real-time insights. There are still multiple processes managed manually and offline. Without a unified digital ecosystem, companies struggle to monitor performance, predict risks and make data-driven decisions at scale.

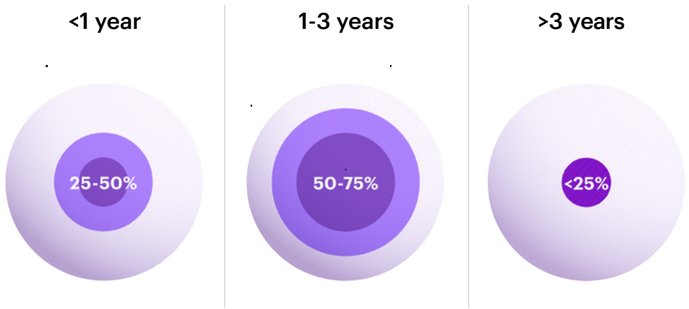
Obsolete digital implementations. Standalone solutions often become outdated before projects are completed, preventing seamless adoption of emerging innovations.

It's no surprise that more than 75% of heavy industry and energy companies discussing digital transformation to support industrial decarbonization programs are prioritizing the next three years in their communications (see Figure 11). Without integrated systems, these programs cannot reach their full potential.

Digital is increasingly amplifying sustainable innovation across heavy industry and energy. Our research shows a steady rise not only in sustainability-focused patents overall, but also in the share of those patents that incorporate digital technology (see Figure 12).

Figure 11

The majority of companies say it will take them between 1-3 years to establish a strong digital core

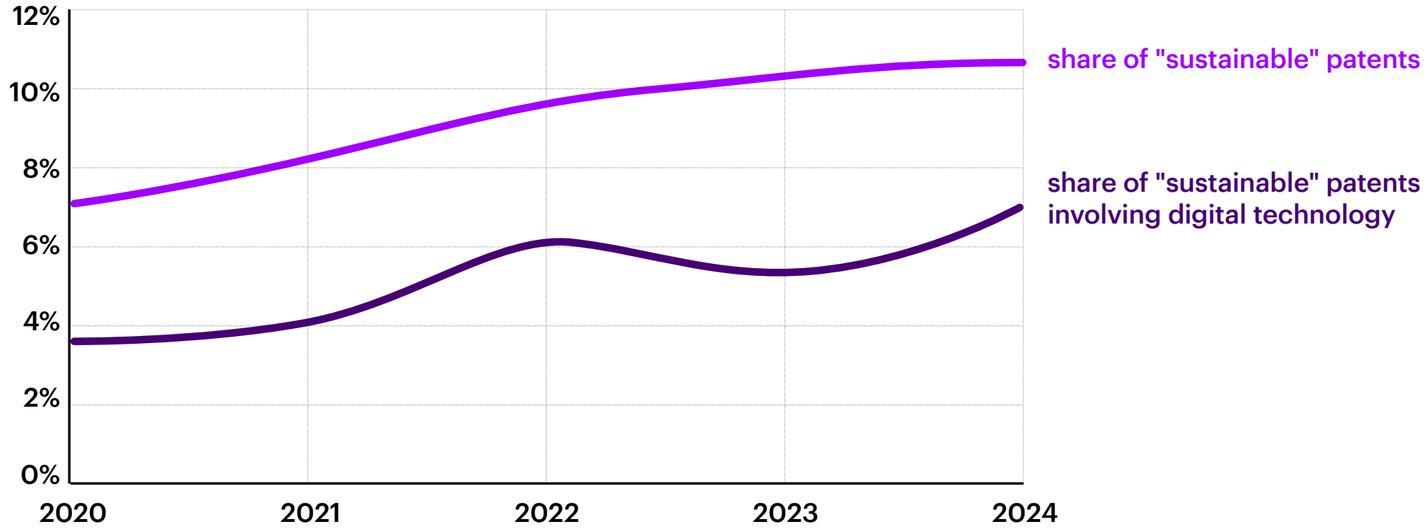


Note: Based on the share of heavy industry and energy companies discussing actions related to industrial decarbonization—specifically initiatives such as creating a strong digital core and a solid data foundation to implement AI.

Source: Accenture Research analysis, augmented with AI, using data from earnings calls and company publications.

Figure 12

Growth of sustainability-focused patents in heavy industries and energy sector, % of patents



Source: Accenture Research based on DerwentInnovation™ (Clarivate 2024), analyzing 180K priority patent filings published between 2020 and 2024/11, excluding simple utility models.

The opportunity

Companies that deploy AI tools as part of a strong, integrated digital core can outperform current decarbonization efforts and future generations of projects. Indeed, organizations that build this foundation—what we call the digital brain—can drive continuous learning, automation and performance gains at scale, as explored in Accenture's Technology Vision 2025 report.[21]

Moreover, in future, agentic approaches applied to complex processes such as capital build or network planning, will connect AI-powered insights and results from across horizontal processes to enable intelligent automation. Agents will compress productivity across processes. And when projects employ the same agents, they will also standardize those productivity gains from one project to the next.

The upside is clear: AI-enabled platforms that unify operations and integrate learnings can reduce delays, forecast risks and boost project success rates A robust digital core also improves compliance, accelerates permitting and captures institutional knowledge—creating compounding benefits that make decarbonization faster, smarter and more repeatable over time.

Key actions

1/ Unify operations with AI-powered data integration

What to do:
Develop a centralized digital platform and deploy AI agents to consolidate real-time project data—from equipment performance and energy consumption to supply chain metrics and ESG indicators.

Expected outcomes:
- Predictive insights and automated decision-making enabled by AI.
- Fewer project delays through pattern detection and forecasting of bottlenecks.
- Capture of institutional knowledge to prevent learning loss from staff turnover.
- Responsible AI use through transparent algorithms and trusted data sources.

2/ Build a collaborative, end-to-end digital ecosystem

What to do:
Create a secure, integrated ecosystem for improved workforce collaboration.

Expected outcomes:
- Up to a 40% increase in project success rates and enhanced regulatory and ESG compliance.[22]
- Validated improvements that become standardized best practices across projects.
- Stronger employee trust through an emphasis on responsible AI use in daily workflows.

3/ Enhance regulatory, permitting and ESG intelligence with AI

What to do:
Implement AI-powered permitting systems and real-time ESG dashboards to automate compliance tracking and streamline approvals.

Expected outcomes:
- Enhanced auditability and transparency by providing real-time visibility into compliance metrics and risk factors.
- Faster project approvals as regulatory friction is reduced.
- Improved data accuracy and reporting efficiency via automation of compliance tracking.

Hinkley Point C’s digital transformation

Hinkley Point C (HPC) is a pioneering nuclear power project in the UK, majority-owned and operated by EDF Energy, a UK subsidiary of the French state-owned company Électricité de France.

It is designed to generate 3,260 MW of low-carbon electricity for 60–80 years. To overcome data fragmentation, regulatory hurdles and execution inefficiencies, EDF Energy partnered with Accenture and Avanade to establish a secure, cloud-based digital ecosystem.

Key innovations include:

- **The nuclear secure cloud**—a centralized platform ensuring real-time data sharing across all project teams.
- **Digital twins for 3D modeling**—reducing engineering errors, enabling predictive maintenance and optimizing asset performance.
- **AI-driven insights from mobile and IoT data**—enhancing project efficiency, safety monitoring and automated compliance tracking.

By integrating AI, cloud computing and digital twins, HPC transformed its execution model—reducing costs, mitigating risks and accelerating project timelines.

HPC’s experience also demonstrates how a strong digital core enables real-time decision-making, risk reduction and seamless integration of emerging technologies. A repeatable, AI-driven digital strategy ensures that every project builds on past insights, creating a self-reinforcing cycle of innovation and efficiency.

Not just ready but powered for change

The industrial sector stands at a crossroads

The last decade has been defined by ambition—an era of commitments, pledges and pilot projects designed to chart a course toward net zero. But ambition alone is no longer enough.

The defining challenge of the next 25 years will be execution—scaling the lessons learned from fragmented initiatives into a self-sustaining, economically viable multigenerational approach.

Crucially, this is not about choosing between short-term gains and long-term impact. Companies that scale solutions iteratively will deliver near-term results, while laying the foundation for long-term advantage. In a world of shifting trade dynamics, rising tariffs and supply chain disruption, the ability to deliver consistently, despite volatility, will separate leaders from the rest.

This transformation is already happening. Leading companies are integrating AI-driven supply chains, standardizing best practices and engaging communities early to foster market demand. Their success proves that industrial decarbonization is not just a climate obligation; it is a source of growth and competitiveness.

A multigenerational approach allows companies to both reduce emissions at scale and adapt, endure and thrive in an increasingly unpredictable world.

Now is the time to turn momentum into impact.

About the research

This report builds on proprietary Accenture research to provide a rigorous and actionable roadmap for accelerating industrial decarbonization. It integrates multiple research methodologies—combining advanced analytics, expert insights and financial modeling.

Our methodology

We leveraged four key methodologies to drive insights:

1. AI-augmented signal analysis
We leveraged Accenture Research's "human + machine" analysis, developed using Accenture's proprietary generative AI tools and methodologies, AlphaSense and ChatGPT Enterprise. We analyzed statements from more than 200 companies' earnings calls, press releases and company reports since the summer of 2023 until April 2025. Current or immediate actions are assessed at less than one year. Further, concretely planned initiatives are assessed in a one to three year time frame, while longer-term strategic actions or initiatives on physical technology with arguably longer time frames are assessed to extend beyond three years.

We created "signals" as curated groups of statements clustered by topic, period and tone. These signals provided real-time sentiment analysis on macroeconomic/structural barriers and enablers of industrial decarbonization, providing comparable insights across industries and regions.

2. Expert interviews and thought exchange
Thirty-five in-depth interviews with executives across key industrial sectors explored decarbonization constraints and opportunities.

A virtual "thought exchange" allowed executives to rate and refine each other's ideas—which were synthesized with the help of AI into key themes and actionable takeaways.

Why this approach is unique

This methodology captures real-time market sentiment, deep executive perspectives and proprietary financial modeling insights. It ensures that our findings are both data-driven and practically relevant, equipping industrial leaders with the insights they need to navigate the complexities of net-zero transformation.

3. S-curve modeling for cost evolution
Accenture's proprietary inverse S-curve modeling was leveraged to capture how costs, including capital expenditures, can decrease across successive projects.

4. Patent analysis on green and digital innovation
We conducted patent analysis using DerwentInnovation™ (Clarivate 2024©), examining 180,000 priority filings by publication date across energy, utilities, chemicals and natural resources.

How Accenture can help

As the world accelerates its push towards sustainability, industrial leaders are faced with the daunting task of decarbonizing their operations—we can help you navigate the complexities of industrial decarbonization with confidence and precision.

We offer a comprehensive framework to guide your organization through every step of the decarbonization process. From formulating a robust net-zero strategy to transforming your infrastructure and operations, we provide the tools and expertise needed to achieve your sustainability goals. It's about creating sustainable value and impact for clients striving to activate industrial decarbonization and achieve net-zero carbon emissions.

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

Net-zero strategy: We help you set and advance your decarbonization strategies, ensuring they are aligned with your business objectives and regulatory requirements. Our framework includes monitoring and measuring performance, and increasing capital efficiency for low-carbon projects.

Infrastructure transformation: Our services focus on enhancing energy efficiency, procuring green energy, and implementing connected energy solutions. These initiatives are crucial for reducing emissions and improving operational sustainability.

Plants and operations: We assist in transforming your plants and operations to be more energy-efficient and environmentally friendly. This includes optimizing processes, integrating renewable energy sources, and leveraging advanced technologies.

Road transportation: We support the transition to green transportation by helping you design and implement sustainable logistics solutions, reducing the carbon footprint of your supply chain.

Products and markets: Our services include designing and launching sustainable products and markets, ensuring that your offerings meet the growing demand for eco-friendly solutions.

Net-Zero finance: We help you align your financial strategies with your decarbonization goals, ensuring that your investments are both profitable and sustainable.

Enterprise carbon intelligence: Building enterprise-wide carbon intelligence is essential for tracking and reporting emissions. Our services provide the data and insights needed to make informed decisions and drive continuous improvement.

Contact us to learn more:
www.accenture.com/us-en/about/contact-us

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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 approximately 791,000 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 and leadership in cloud, data and AI with unmatched industry experience, functional expertise and global delivery capability. Our broad range of services, solutions and assets across Strategy & Consulting, Technology, Operations, Industry X and Song, together with our culture of shared success and commitment to creating 360° value, enable us to help our clients reinvent 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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