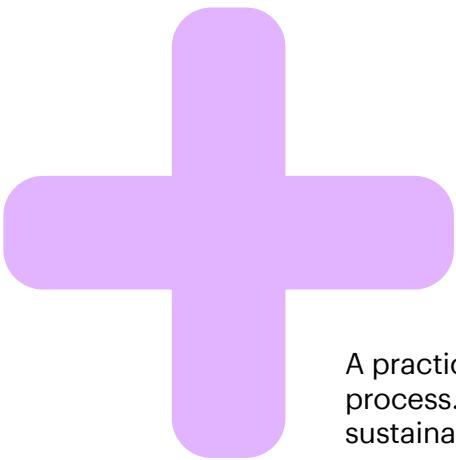


accenture

Decarbonizing Energy: From A to Zero

Overview

Executive summary



A practical guide to navigating the decarbonization process. Make the move towards a more affordable, sustainable and available future.

We call it positive energy.

Preface

The oil and gas industry is in the midst of a transformational change like no other. Unlike previous industry disruptions, the “Decarbonization Transition” will introduce an entirely new set of rules, challenges and opportunities.

Driven largely by consumer demands for a cleaner energy system and investor pressures for reliable financial, as well as environmental, social and governance (ESG) performance, the sprint to decarbonization is on. The industry has set ambitious emissions-related targets to retain its right to operate during and after the transition to a low-carbon/net-zero energy system. As well they should. A number of companies are already taking bold action. Unfortunately, it is highly unlikely that the industry will achieve its 2050 goals.

COVID-19 has given us a glimpse of what the future holds, in terms of cleaner skies and less congested cities. But we should consider it a cautionary tale. The pandemic’s jolt to the energy system was extraordinarily painful. The oil and gas industry

experienced 10 years of transition in just a matter of weeks. Oil demand collapsed and more than 20 percent of coal consumption in some large markets was rapidly displaced by net-zero, marginal-cost renewable power. Aftershocks are still playing out across the industry. The question now is, “How can the industry accelerate and lead an orderly Decarbonization Transition to 2050 and beyond?”

This report, based on deep analyses and insights, represents Accenture’s attempt to answer that question. Our guidance is meant to be pragmatic. It is about more than saving the core business of oil and gas. It’s about orchestrating the transition across sectors and beyond the limits of its value chain. It’s about redefining the role of oil and gas in the future energy system to 2050 and well beyond.

At Accenture, we have the privilege of working with super-majors, national oil companies, integrated oil companies and oilfield and equipment services providers around the world. We know the challenges they face.

And the steps they can take to overcome them. We also know what is realistic. And we have a unique vision of what is possible for oil and gas companies that take bold decisions and make even bolder moves today.

In this report, we’ve attempted to lay out our perspective. In section one, we describe the context of change and present a practical case for what is achievable by the middle of the century. In section two, we explore the impact of the transition on the sectors that rely most on oil and gas. Oil and gas companies will need to not only reimagine their relationships with their customers, but also architect a united response to the seismic change that will affect all. In section three, we outline what we consider to be the only three viable options for oil and gas companies moving forward. We consider them archetypes, rather than cast-in-stone business models. But their general boundaries are set. Companies can choose only one path to follow.

Clearly, aggressive decarbonization actions must be taken. But they must be coupled with a clear understanding of the role each company can play in a new energy system. Action + Ambition will set the next generation of leaders apart.

Accenture's analysis has confirmed the importance of collectively adopting a pragmatic, commercially investable, action-oriented approach to tackling emissions—all with a clear focus on executing the move at scale. Time is of the essence. Companies that act now will not only lead the decarbonization charge toward 2050, but reposition for commercial success for many years after.

In closing, I would like to thank: Jean-Marc Ollagnier, Accenture's Europe CEO, for inspiring us to set the direction for the industry through this flagship report; my colleagues David Rabley, Tom Beswetherick, Sylvain Vaquer, Leanne Rutherford, Simone

Ponticelli, Boris Leshchinskiy, and Anshu Agrawal for leading this effort and without whose commitment, analytical fortitude and passion for the industry they serve this report would not have been possible; and our various industry experts, in particular Vicky Parker, Andrew Smart, David Elizondo and Mauricio Bermudez. I am grateful for their contributions.



A handwritten signature in black ink, appearing to read "Muqsit Ashraf".

Muqsit Ashraf

Senior Managing Director
Global Energy Industry Sector Lead

Storm clouds have been gathering over the oil and gas industry for years. It's now time to heed the warning signs.

The advances in renewable energy technologies that threaten the industry's relevance. The world's growing demand for climate action and a low-carbon future. An abundance of supply that may never be used.

**The tempest is upon us.
And lightning flashes (like
the COVID-19 pandemic)
illuminate in blinding relief
the fragility of an industry
that is at risk of being
washed away.**

Or is it?

For oil and gas companies looking for safe harbors during the Decarbonization Transition, there are few. Investors and customers, alike, are turning their backs on traditional hydrocarbon companies.

As oil and gas companies are realizing, storms can be scary and destructive events, destabilizing the foundations of the most solid structures. But they also bring with them new life. New hope. And a fertile ground upon which to rebuild.

Accenture has identified three distinct roles—or archetypes—that today’s oil and gas companies can assume during the transition and beyond. They can only choose one path forward that they can dominate and that will provide the shelter they seek.



In the eye of the storm



Transforming the fossil fuel-based energy system to one that is sustainable and decarbonized is one of humanity's greatest challenges. It also represents one of the greatest opportunities to make global energy supplies more available and affordable than ever before.

The 2015 Paris Agreement, which set the goal of keeping global average temperature increases less than 2°C (3.6°F) above pre-industrial levels by 2050, has provided a roadmap for countries and industries looking to combat climate change and adapt to its effects. At the heart of the response lie ambitious programs to quickly curtail emissions of greenhouse gases—particularly carbon dioxide (CO₂)—into the atmosphere. To date, more than 800 companies have committed to science-based targets to align strategies with the Paris Agreement.

All eyes are on the global “carbon budget,” or the amount of CO₂ countries can emit before the world is guaranteed to warm at least 2°C (3.6°F). The outlook isn’t encouraging. At the current emissions trajectory, the world will exhaust its remaining carbon budget between 2030 and 2035¹. Based on Accenture’s analyses, we are on course to overshoot our carbon limit by as much as 200 percent by 2050². This would create significant climate effects, including sea level rise, extreme weather, and temperatures routinely exceeding 50°C (122°F) in large, densely populated cities.

A number of stakeholders are placing oil and gas companies at the center of efforts to curb the emissions trajectory and shift it toward net zero by 2050. Environmental activists and concerned consumers alike, have long been pressuring the industry to rein in its emissions. Regulators, also subject to public scrutiny over their handling of environmental issues, are taking more aggressive action. Providers of renewable energy sources have jumped into the fray, adding their voices to criticize the oil and gas industry’s environmental record while also touting their low-carbon—and increasingly flexible—energy alternatives.

Then there are those holding the purse strings. Investors are demanding that industry players not only take bold actions to lessen their reliance on hydrocarbons, but also define and execute long-term strategies to compete in a cleaner energy future. They’re increasingly walking away from companies that don’t have what it takes to manage the transition. Today, a range of greenhouse gas emissions (GHG) are modeled by banks and investors to assess cashflow and risk metrics in investment and credit decisions. Governments are focusing portions of their COVID-19 recovery and stimulus packages on clean energy. Recipient industries, including airlines, are required to meet environmental standards in exchange for funds. And consumers are incentivized to spend their stimulus payments on more energy-efficient solutions.

Some of the loudest calls for oil and gas companies to change course come from the industry itself. Operators recognize their responsibility to deliver energy assets sustainably. Their license to operate depends on the trust that consumers, employees and shareholders place in them. Rebuilding that trust must start today.

About our findings

Accenture is committed to helping oil and gas companies navigate short-term uncertainties and achieve sustainable, long-term growth and relevance. In addition to working directly with clients across the value chain, we continually analyze corporate, trend and climate data and refine scenario models to bring new insights—and new solutions—to the industry. This report and the scenarios we envision are based on our recent analyses and findings.



It won't be easy

Accenture believes that achieving net-zero emissions by 2050 is unlikely, if not impossible. Our stretch scenario outlines a pathway and pragmatic set of actions to get to 80 percent of that goal. Negative emissions will potentially close a portion of the gap that remains and the momentum from concerted action will likely bring about additional gains post-2050. Of course, that's not what the public or industry leaders want to hear. But an honest assessment of the decarbonization trajectory is more valuable than rosier forecasts that will only need to be adjusted down the road.

By knowing what they are up against now, industry leaders can correct course. They can reconsider the trusted role they will play in the global energy future. And they can take the decisive actions that are needed to achieve their net-zero ambitions—even if those ambitions won't be fulfilled until after 2050.

We know what those actions are. We also know the ambitions that are within reach. It is this combination—Action + Ambition—that will set the leaders apart.

Then came COVID-19

As we completed our analysis in mid-2020, COVID-19 was having a deep impact on global emissions. Restricted travel and less industrial and commercial activity have driven a 10 percent reduction in global CO₂ emissions. Importantly, the energy system is responding by reducing higher-cost sources of supply and relying, instead, on lower-cost renewables for a greater share of electricity generation.

Learnings from previous downturns suggest that current reductions in emissions will be short lived. Without deep structural change, the pandemic is expected to affect the emissions trajectory by less than 2 percent through 2050. However, this downturn is different. And so is the response to it. If authorities and industries seize the moment and use stimulus funding and incentives wisely, they can architect and execute holistic structural change in the emissions trajectory.



Action



Ambition

We know what those actions are. We also know the ambitions that are within reach. Combining these two will set leaders apart.

Glimmers of sunlight amid the rain

The good news is that the oil and gas industry has accepted that financial returns are increasingly aligned to environmental, social and governance (ESG) outcomes. There's now a correlation emerging between strong corporate performance on ESG factors and a company's stock performance. Over the past few years, the stocks of companies with high ESG ratings have tended to outperform, and this has also been the case during the COVID-19 crisis³.



The shift to a sustainability mindset is accelerating. In the 2018-19 period, investments in ESG-focused passive funds rose by approximately 12 percent. Equally telling, 99 percent of CEOs of the world's largest corporations now believe sustainability is important to the future success of their business⁴. Consumers are on board too, with 62 percent wanting businesses to take a stand on issues like sustainability⁵.

Like the shift in thinking about environmental stewardship, the transition to decarbonized energy has unstoppable momentum. Several oil and gas companies have already taken a bold stance and have defined their strategic roadmaps (with some reinforcing their commitment during the COVID-19 crisis). The shift is due, in part, to a greater understanding of the role the energy system—and CO₂ emissions, in particular—plays in climate change, as well as evolving consumer demands for lower- or no-carbon energy options. Finally, new innovations in areas such as storage, renewable-grid integration and electricity-based fuels have emerged up to 10 years ahead of their anticipated arrival¹⁵, leveling the cost of renewable generation.

Amid growing interest in decarbonization, oil and gas companies find themselves awash with hydrocarbons. Supply abundance, coupled with the demand slowdown expected in the next 20 years, has made investors skittish and driven the cost of capital up. A lack of discipline among many operators to focus on margins and cash has added fuel to the hydrocarbon fire. It's therefore no surprise that returns from traditional hydrocarbon extraction and processing projects have dipped into single digits from previous highs well above 10 percent¹. The need for oil and gas companies to accelerate their transition to the decarbonized energy future has never been greater.



A break in the clouds

As noted, Accenture estimates that by 2050, an 80 percent reduction of system-wide emissions (and even more thereafter) is achievable if decarbonization actions are complemented with negative emission technologies. Achieving this goal is dependent on the actions oil and gas companies take today, the strategic postures they want to hold tomorrow, and their ability to orchestrate and influence hydrocarbon-burning sectors to join them in the cause along the way.

Forecasting the long-term future of the energy system and the roles different companies play is a complex undertaking. As a first step, it requires an understanding of the themes and influences that will shape the transition to a decarbonized energy system—not only for oil and gas companies, but also the sectors that depend on them most, and the other industries adjacent to them.

To this end, Accenture has envisioned two “states of the world” through to 2050. One state is the by-product of business-as-usual (BAU) practices and mindsets. The other depicts what we’ve termed the “stretch case.” It represents what we believe is possible, realistic and within reach.

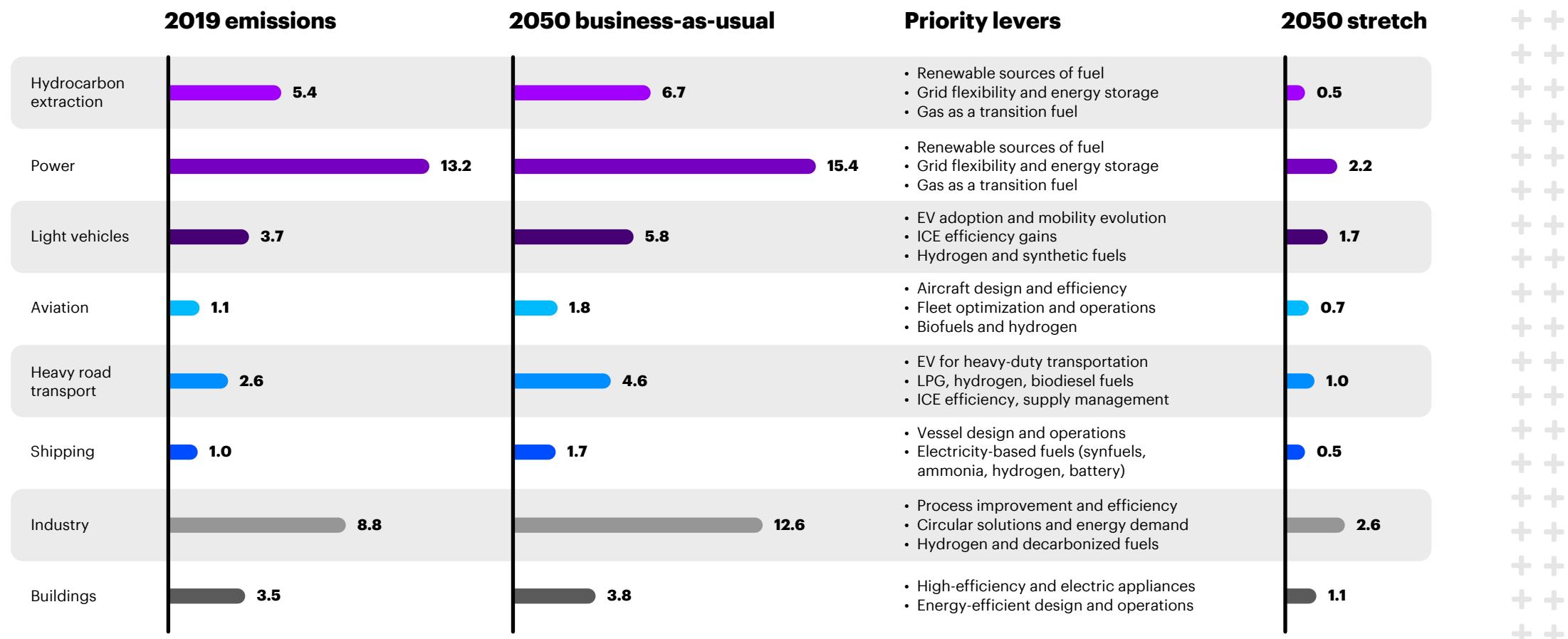
Players across the energy system have three types of action at their disposal along the journey to decarbonization. They can Clean the Core to minimize emissions and maximize efficiency from current operations, infrastructure and value chains. They can Accelerate the Transition to replace existing sources of energy and demand with available and competitive cleaner and zero-emission alternatives. And they can Extend the Frontier to adopt and scale new sources of energy, processes and technologies that are beyond what is commercially and technically possible today. Success requires all three sets of actions to be activated. De-risking the journey depends on getting the balance right over time.

Accenture’s 2050 stretch case assesses the potential impact of over 300 technology and process levers on the energy system. The combined impact of these levers can exceed 40 gigatons of CO₂ emission reduction by 2050.

Figure 1

Source: Accenture Analysis

Global CO₂ emissions by sector (gigaton CO₂ equivalent)



Clean the Core

These actions reduce or eliminate emissions inherent in current assets using existing energy sources, and collectively represent an opportunity to lower global emissions by almost 20 GT.

Currently, processes directly associated with extracting, transporting and processing hydrocarbons emit over 5 GT of CO₂ each year. That could rise to close to 7 GT by 2050². Reducing direct emissions of CO₂ and also methane (which is smaller in absolute volumes, but 30 times as polluting as CO₂)⁶ will determine whether the industry retains the right to operate in the future. The technology and processes required to achieve near net-zero emissions exist and have been proven.

To achieve this, oil and gas companies have a number of options. They can maximize the efficiency of existing assets across the energy system. They can capture vented, flared and fugitive gas emissions. And they can deploy circular solutions that reduce energy intensity and waste from operations. Together, such actions can reduce an oil and gas company's direct emissions by 80 percent².

Natural gas plays a critical role. Heralded as a "transition fuel" due to the fact that it burns cleaner than other fossil

fuels, natural gas has the potential to be more than a source of feedstock for power generation and chemicals. It can, for example, support the hydrogen economy and enable cleaning of industrial processes in sectors like heavy-duty transportation. But gas will only reach its potential as a transition fuel (and more) if its emissions liability can be materially lowered. If it can't, we can expect to see an accelerated pull back from the commodity and a far more disruptive transition as a result.

Sectors adjacent to or dependent on oil and gas, such as power and heavy industries, can similarly reduce emissions by improving energy and materials efficiency and capturing greenhouse gases to clean their core operations. Their actions will not only help to achieve their own decarbonization targets, but also have a direct bearing on the oil and gas industry's Scope 3 emissions, which occur at the point of combustion and within their customers' supply chains.

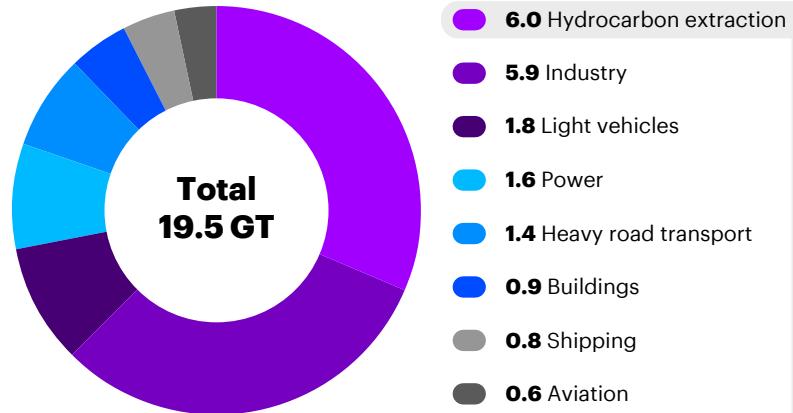


The full oil and gas value chain emits an additional 20 GT once Scope 3 emissions are factored in. The remainder of emissions derived from the energy system lies with coal, which adds close to 15 GT². Effectively addressing the Scope 3 emissions requires new models of partnership, innovation and collaboration across the energy system. Oil and gas companies will not succeed without putting skin in the game and actively working with the companies that consume their products to actively lower emissions in their downstream operations, processes and activities.

Figure 2

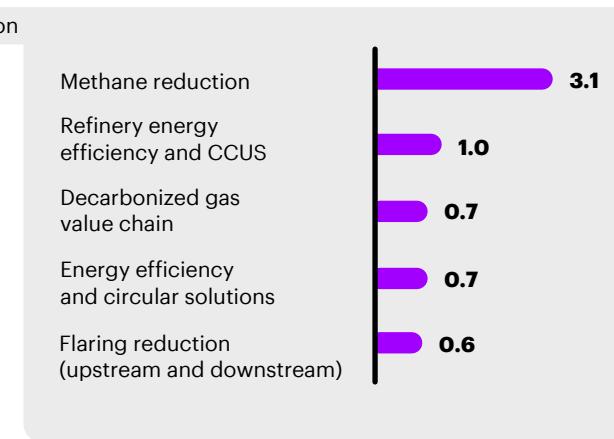
Clean the Core GT CO₂ reduction

Sector opportunity to reduce emissions from 2050 business-as-usual to 2050 stretch



Oil and Gas Clean The Core GT CO₂ opportunity types

Theme opportunity to reduce emissions from 2050 business-as-usual to 2050 stretch



*Total might not equal sum of individual rows owing to rounding

Source: Accenture Analysis

Accelerate the Transition

These actions reduce or eliminate emissions by shifting to commercially and technically scalable, lower emission-intensity energy supply sources, and collectively represent an opportunity to lower global emissions by 21 GT.

While transitioning toward lower- or zero-emitting fuels, oil and gas companies must also look beyond the impact of the transition within their own operations. They need to consider how their scope of engagement across the energy sector and actions might influence or support their customers and help to architect changes in adjacent sectors. This broader thinking is a must for oil and gas companies that are committed to tackling Scope 3 emissions—or the emissions associated with consumption of their products.

Helping to mitigate Scope 3 emissions is notoriously challenging, given that they

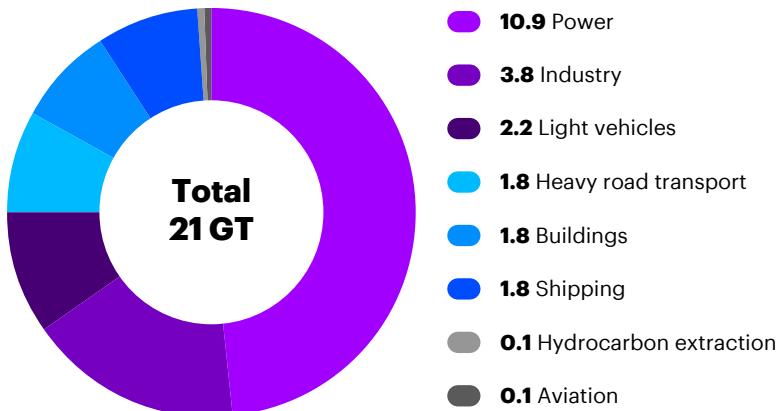
occur after the point of sale for oil and gas companies. Oil and gas companies, therefore, need to position themselves as partners to their customers, jointly committed to supporting their emissions-reduction strategies and harmonizing emissions reporting. Offering new fuel blends or energy sources, demand management expertise or even infrastructure services will be critical since the inclusion of Scope 3 multiplies the oil and gas industry's CO₂ emissions targets by up to 500 percent. The good news is that as energy shifts from being a pure commodity to a source of tangible customer value, new partnership models will take shape to drive the transition.



Figure 3

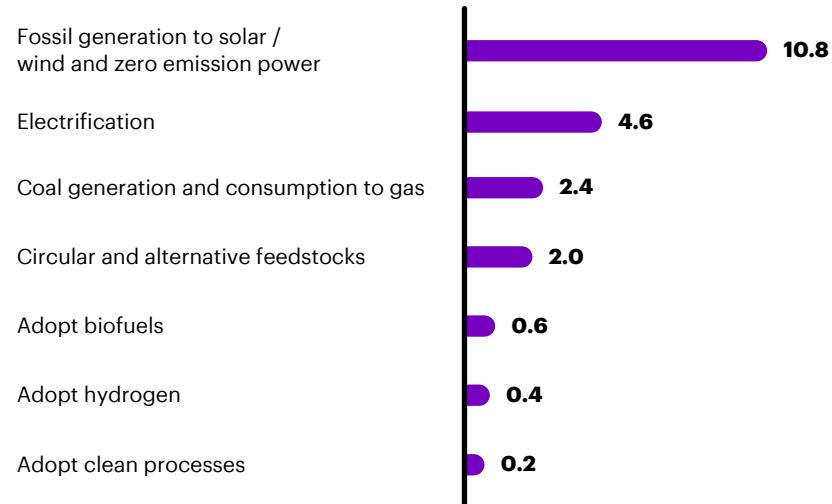
Accelerate the Transition GT CO₂ reduction

Sector opportunity to reduce emissions
from 2050 business-as-usual to 2050 stretch



Accelerate the Transition opportunity types

Theme opportunity to reduce emissions
from 2050 business-as-usual to 2050 stretch



Source: Accenture Analysis

Extend the Frontier

These actions reduce or eliminate emissions by deploying processes and energy supply sources that are not yet currently commercially and technically scalable, but will be by 2050. Extend the Frontier actions collectively represent an opportunity to reduce stretch case emissions by an additional 17 percent in 2050, or over 2 GT.

Examples include blue hydrogen that oil and gas companies can derive from steam-methane reforming at an increasingly competitive cost. This opens up new possibilities in transportation and energy storage, where it can enable a greater share of intermittent renewables, as well as in hard-to-abate industries such as metals and mining. Biofuels offer a potential alternative to jet fuel, which oil and gas companies can process in repurposed refineries. Oil and gas companies can also further leverage the current supply infrastructure and customer relationships that have enabled their industry to date. Advanced industrial processes that avoid emissions from the process itself will further extend the frontier as technology and economics overcome the existing challenges in scale and cost. A case in point is Portland cement manufacturing, where more than 50 percent of emissions arise from the current requirement to super-heat ground limestone to produce calcium oxide; future advanced processes using alkali-activated cements can replace this step with a low-emission alternative.

In addition, negative emissions actions, including direct air capture (atmospheric carbon dioxide reduction) and bioenergy with carbon capture and sequestration (BECCS) are worth pursuing—even though they may not yet be proven at scale or at the required level of economic viability. Truly “breakthrough” solutions such as nuclear fusion, which could transform energy permanently, are also advancing. Yet their contribution within the upcoming 30 years is still uncertain.

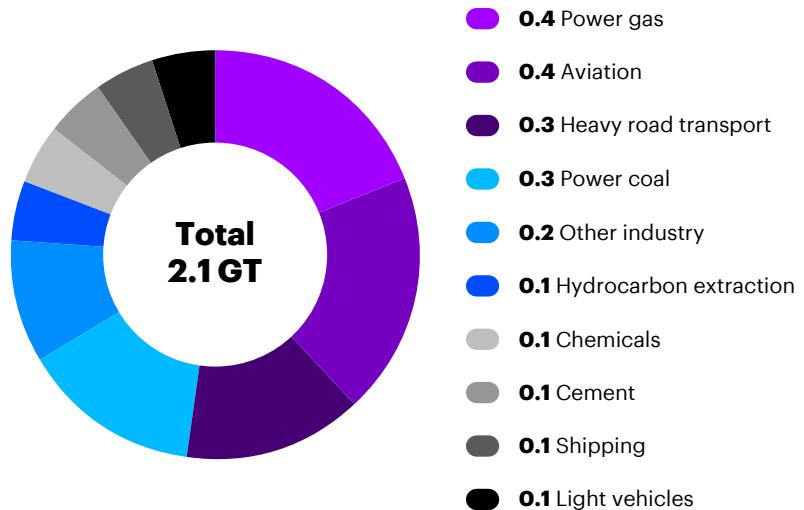
It is our view that technology leaders with deep R&D and energy sector experience will be in a position to emerge at the forefront of this expanded energy system. Few should bet against oil and gas playing a key role. With clear leadership capabilities and unparalleled record in maturing complex energy solutions, the oil and gas industry might have found its next growth frontier.



Figure 4

Extend the Frontier GT CO₂ reduction

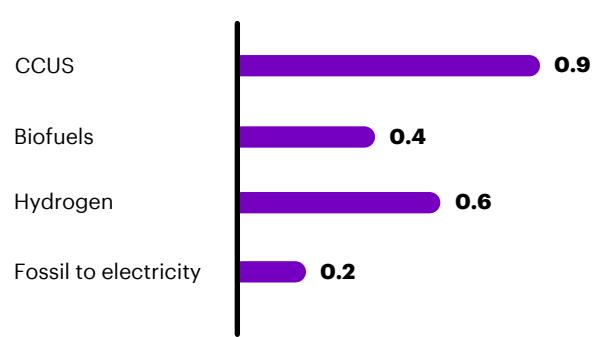
Sector opportunity to reduce emissions
from 2050 business-as-usual to 2050 stretch



Source: Accenture Analysis

Extend the Frontier opportunity types

Theme opportunity to reduce emissions
from 2050 business-as-usual to 2050 stretch





Forecast: Partly cloudy

The 2050 end game is not an energy system without fossil fuels. Rather, the objective for oil and gas companies is to play a central role in the decarbonization of the energy system. A new focus on process efficiency and demand management, together with an expansion into decarbonized and electricity-based energy solutions, can extend the license of oil and gas to create value for years to come.

There are compelling opportunities for oil and gas companies during the transition to a decarbonized energy system. However, balancing shareholder returns, emissions mitigation, consumer needs, and new business value will challenge the industry to reinvent itself.

Through the 2020s, value and investment are poised to migrate away from oil and gas companies' core business, toward

electricity-linked energy. Near-term priorities will be focused on transforming today's core portfolio, while also creating optionality to win in adjacent sectors. The Decarbonization Transition won't be as effective—or may not happen at all—if oil and gas companies don't play an active role in developing solutions for their customers in those sectors.

That means more than investing. It means innovating and collaborating with partners to make the transition to a low- or no-emission future a reality. Cross-sector R&D teams can, for example, work together to identify potential uses for hydrogen with biofuels in the aviation industry. Or oil and gas companies might join up with utilities to extend the traditional value chain to cross-sector offerings like mobility-as-a-service solutions. In these and countless other ways, oil and gas companies will be actively architecting and creating the low-carbon opportunities in which they can invest—and through which they can grow.

Importantly, they will also be actively creating something else: stronger customer relationships. To take optimal advantage of these new opportunities, oil and gas companies need to appreciate that the end-customer journey and demand patterns will continue to change. The target end consumers for oil and gas companies (and other sectors where they play an important role) are shifting from primarily large businesses to also include small businesses, B2B2C

operators, and even individual consumers such as households or neighborhoods (for power services, for example). Reaching and engaging these customers during and after the Decarbonization Transition will be key.

Furthermore, digital technologies that promote collaboration and transparency, sustainable supply chains, new customer touchpoints, integrated carbon and emissions visibility and tracking, and compelling, differentiated customer experiences all have a big part to play in the direct-to-consumer world, and are a core element of the sector's digital transformation.

Technology and existing infrastructures play to the oil and gas industry's strengths, both as it pursues new opportunities and in the delivery of electricity-based fuels, biofuels, geothermal, offshore wind and carbon capture, utilization and storage (CCUS) solutions. However, the competitiveness, returns and cash profile of these businesses (with the exception of offshore wind and large-scale solar photovoltaics)

are challenged in the near term. To date, they have been reliant on subsidies or capital structures that are inaccessible to oil and gas companies. What's more, oil and gas operating models are not yet aligned to manage portfolios that have one foot in today and one in tomorrow.

But this is all set to change. After several false starts, there's an unstoppable momentum toward a low-cost, available, reliable, decarbonized energy system that drives growth and enhances living standards. While it's certainly too early to claim victory, the emergence of clear pathways for success across most of the largest energy system sectors is cause for new optimism. And positive support, inputs and incentives from many quarters—policy, innovation, society and business—will accelerate that momentum. Especially for oil and gas.

Extended forecast: Sunny at times

In many markets, the power utility sector has added intermittent renewables to the generation mix at a pace few forecasters anticipated. The oil and gas industry must now embark on a similar journey across the energy system and within its core assets. How will oil and gas players thrive and lead during the period of transition and beyond? Nothing short of a comprehensive rebuild will cut it, transforming today's oil and gas leaders into energy-solution-focused, customer-

centric, low-carbon companies that drive new value in new ways. The ultimate destination for oil and gas companies could take several forms. Through our analysis, we have identified three archetypal choices for tomorrow's oil and gas leaders: the Decarbonization Specialist; the Energy Major; and the Low-Carbon Solutions Leader. Each is distinct in its requirements, sources of value, and the extent of shift that will be required to move beyond today's business.



Archetype 1: Decarbonization Specialist

Some will rightly select to be the Decarbonization Specialists in the traditional oil and gas value chain. These companies will double down on operating the cleanest, highest-margin portfolio of oil and gas assets upstream, midstream and/or downstream. With the most efficient production and emissions management capabilities, they will create value through a low-emissions operating model and high-performing ecosystem that other players can't readily emulate. Circularity—characterized in this instance by the reduction, reuse and recycling of equipment and waste—will feature prominently in their business models. So will cleaner energy sources to power operations and assets. But today's oil and gas businesses will not automatically become Decarbonization Specialists. It is a role that only the highest-performing asset and infrastructure operators can seek to play.

Archetype 2: Energy Major

Integrated oil companies and selected national oil companies have the potential to extend their business and operating models into the wider energy system. These Energy Majors of the future will carve out a role in both oil and gas and an electricity-dominated energy system. In that capacity, they may build or add a winning and scaled clean electricity business to their integrated portfolio of assets, using their advantaged supply position, brand and retail networks, and trading and project-development capabilities, to build out competitive positions in power and other energy sources.

Expansion into the wider energy space will create optionality that enables them to reduce their emissions intensity. While continuing to hold strong positions in the oil and gas value chain, they will likely branch out into other areas such as storage, mobility or infrastructure. They will be well placed, for example, to lower the carbon intensity or help boost the proportion of intermittent renewables in the energy mix. Or they may stake their claims in alternative sources of energy that can be scaled. Biofuels and hydrogen hold great potential. Regardless of the specific moves they make, tomorrow's Energy Majors will need to become customer-centric organizations. That will likely require them to build enhanced retail capabilities or new service-oriented business models. As with Decarbonization Specialists, the pathway for becoming an Energy Major is not open to all. Those that succeed will place significant investments in their new area of focus, be it electricity, alternative fuels, or energy-related services.

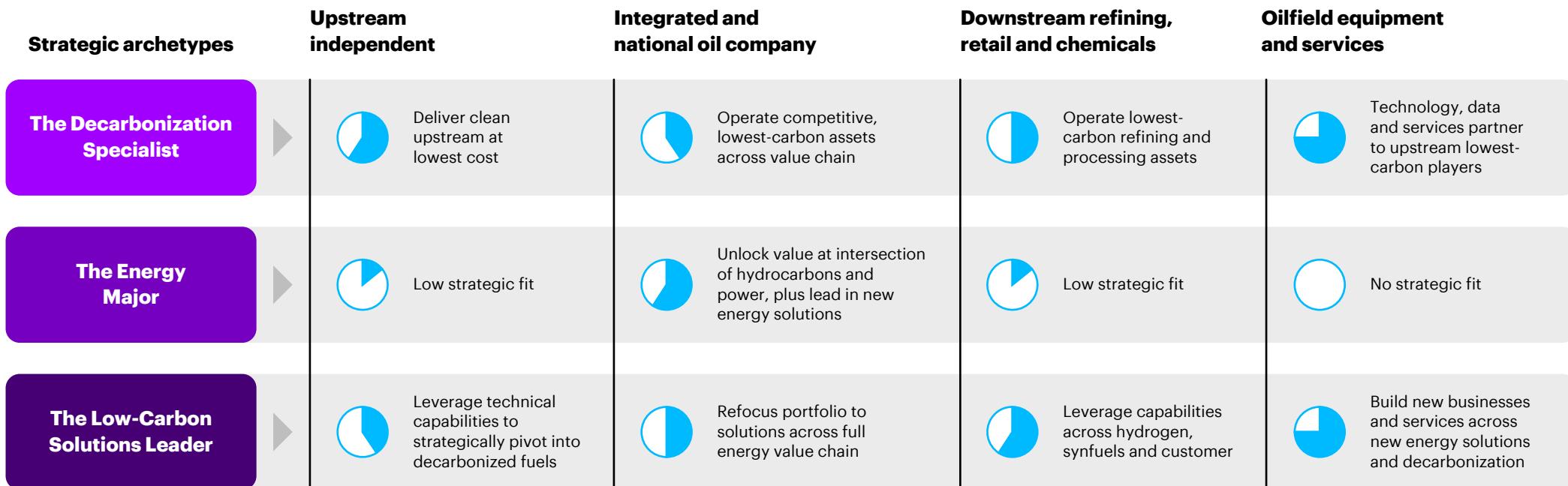
Archetype 3: Low-Carbon Solutions Leader

The Low-Carbon Solutions Leader will undertake a profound strategic departure from its current business model. Companies choosing this path will exit their current roles, monetize their core assets, and leverage their capabilities and expertise to win in new areas of the emerging clean energy sector such as offshore wind, biofuels or hydrogen. They will build a new portfolio of solutions supplying clean power, developing biofuels or green hydrogen solutions, storing energy or even providing technical and technological solutions to other players. This strategy can enable oil and gas companies to reinvent as clean energy companies relatively quickly—and without the burden of existing assets, portfolios and constraints. But success on this path requires more than cash. It requires developing or acquiring a unique set of capabilities and a vision to re-emerge as a very different type of energy company to the one that they were.

Figure 5

Source: Accenture Analysis

Strategic archetypes of the future



○ Low opportunity to win, little fit with capabilities and assets

● High opportunity to win, strong fit with capabilities and assets



Oil and gas company leaders are already assessing their alternatives. The strategic archetypes outlined above define the general boundaries and stark alternatives over the coming decades.

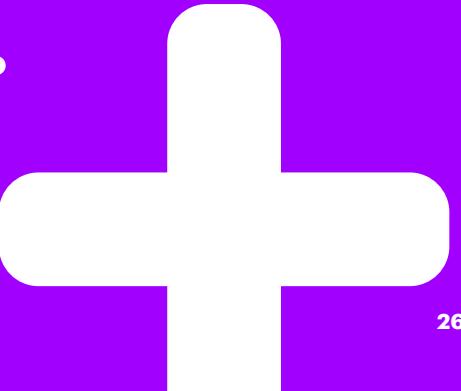
There are, of course, some in the industry that will not survive during the transition to decarbonization. And few, if any, will emerge with the same models they have today. The vast majority will have to transform. While the specifics of any transformation will differ from company to company, there are certain things all companies must get right. They need, for example, to move forward with three sets of actions to

Clean the Core, Accelerate the Transition and Extend the Frontier of possibilities. They also need to identify opportunities to partner with customers to accelerate new and valuable solutions. And they need to set an intentional course to enter and win in new business areas with revamped operating models, technologies and ecosystem partners across the energy value chain.



With the right ambition, the right preparation, a commitment to purposeful change, and an approach that balances opportunity and risk, oil and gas companies can take the lead in creating a net-zero future.

The path to achieving their future ambitions is open now. It's time for the industry leaders to make their moves.



Accenture Decarbonization Scenarios

The Accenture global decarbonization model was constructed using a four-step approach.

- 1.** We first established the emissions base case (emissions today) for each demand sector using accredited governmental and NGO sources.
- 2.** We then projected BAU emissions to 2050 by combining the expected increase in sector demand with the expected emissions abatement on current trajectories.
- 3.** As a next step, we identified, by demand sector, the emissions reduction levers and their potential if fully implemented.
- 4.** Finally we projected a percentage reduction achieved by lever according to the remaining business-as-usual emissions it would impact (near-term levers will have a larger percentage impact than those that come later and have a reduced base to impact) and the extent to which we will be successful in fully implementing each lever by 2050.

Glossary

Term	Definition
2DC guideline	One of the key guidelines formulated during the Paris Agreement, which called for an assessment of the impact on a company's portfolio and business strategy of policies and restrictions consistent with achieving the globally agreed upon target to limit global average temperature rise to no more than 2°C above preindustrial levels.
5G	Refers to the 5th generation mobile network. It is a new global wireless standard that is designed to connect everyone and everything, including machines, objects and devices. Advantages of 5G include higher peak data speeds, ultra low latency, massive network capacity and increased availability.
Asset-light business model	A business model where the company owns relatively fewer capital assets than is required to run its operations. This is achieved by outsourcing the capital requirements by way of operating leases or other pay-per-use service models.
BAU	Business-as-usual
Bio-energy with carbon capture & sequestration (BECCS)	A carbon removal technique that includes two technologies. First, biomass is converted into heat, electricity or liquid / gas fuel and, subsequently, the carbon emissions from this conversion are captured and stored or utilized in other long-lasting products. BECCS can thus serve to reduce the overall CO ₂ concentration in the atmosphere.

Term	Definition
Biodiesel	Biodiesel is a form of diesel fuel derived from plants or animals and consists of long-chain fatty acid esters. It is a renewable, biodegradable fuel produced from vegetable oils, animal fats, etc.
Biofuel	A type of renewable energy source derived from microbial, plant or animal materials. Examples include ethanol (derived from corn or sugarcane), biodiesel (derived from vegetable oils, animal fats, etc.), green diesel (derived from algae, etc.) and biogas (methane derived from animal excretions, etc.).
Biomethane	Also known as "renewable natural gas," it refers to methane produced either by "upgrading" biogas (a process that removes any CO ₂ and other contaminants present in the biogas) or through the gasification of solid biomass followed by methanation.
Biomethanol	Biomethanol is typically generated through a thermochemical reaction. The feedstocks for the process can be any type of concentrated carbonaceous materials (i.e. biomass, solid waste, coal, etc.). The process entails converting feedstock into biogas through gasification and the synthesis of methanol.
Black start service applications	Black start is the procedure used to restore power in the event of a total or partial shutdown of the electricity transmission system without relying on any external electric power source.
Blue hydrogen	Hydrogen produced by steam methane reformation, where the emissions are curtailed using carbon capture and storage.
Carbon budget	The overall quantity of CO ₂ and other greenhouse gases that the world, country or company can emit without risking an average global temperature increase beyond 2°C. It can also refer to the quantity of CO ₂ or greenhouse gases that a country, company or organization has agreed is the maximum it will produce in a given time period.

Term	Definition
Carbon net neutrality	Carbon neutrality means every ton of CO ₂ that is emitted is compensated with an equivalent amount of CO ₂ which is removed.
Carbon offsets	A reduction in emissions of CO ₂ or other greenhouse gases made in order to compensate for emissions made elsewhere.
CCUS	Carbon capture, utilization and storage (or CCUS) is a critical emissions reduction technology that can be applied across the value chain. CCUS systems capture CO ₂ from power plants or industrial processes and either use it as a raw material in the production of other fuels or permanently store it in deep underground geological formations.
Circular economy	An industrial system that hinges on a shift towards renewable energy, eliminates the usage of toxic chemicals, and eliminates waste through enhanced design of materials, products, systems and processes.
CNG	Compressed natural gas (or CNG) is gas compressed to a pressure of 200+ bars. It is used in cars and other light commercial vehicles as a fuel and produces lower emissions compared to diesel- or petrol-fired internal combustion engines.
Connected Autonomous Shared Electric (CASE)	CASE refers to new areas of "connected" cars, "autonomous / automated" driving, "shared" and "electric." Technological advances in these areas are disrupting the automotive industry.
Crowd shipping	A novel shipping concept where logistics operations are carried out by crowd sourcing and existing resources such as vehicle capacity and drivers, thereby offering potential for economic, social and environmental benefits.

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