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The 2030 decarbonization challenge

The path to the future of energy

Chemicals

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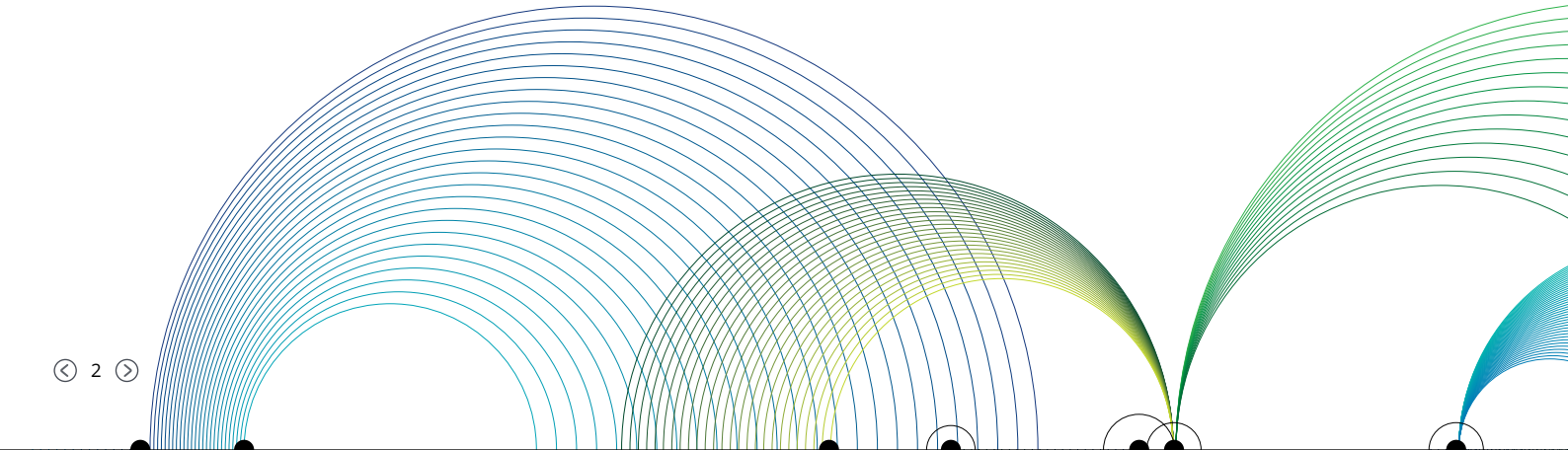
Forward

The global energy mix is shifting from fossil fuels to renewables. There are abundant examples of both public and private organizations working hard to decarbonize the economy. As this energy transformation or "Green Deal" gains momentum, new ecosystems are forming and new technologies are emerging. These developments are helping to grow renewables, develop new energy carriers, improve energy efficiency, reduce emissions and create new markets for carbon and other by-products as part of an increasingly circular economy. At the same time many of these commonly pursued steps to decarbonization, such as increased electrification, wide-scale use of renewable energy and intensifying energy efficiency measures pose unique challenges.

Many participants in the Energy & Resources (E&R) industry have publicly declared their intention to become carbon neutral by 2050. While their long-term vision is clear, the more perplexing challenge for E&R companies lies in the immediate future. Many companies are struggling to understand the material impacts that their stated goals are going to have on their valuations, operations, employees and markets over the next few years.

This report explores how companies in certain sectors of the E&R industry—chemicals, oil and gas, mining and metals, and power, utilities and renewables—can accelerate decarbonization over the next decade and achieve meaningful interim targets by 2030.



Introduction

The transition toward a clean energy future is underway and it will change almost every aspect of E&R companies' assets and operations. Taking a global view across sectors, the top drivers of decarbonization include:

- Customer, employee and community demands.
- Investor pressure.
- Policy and government targets.
- Technology and operational cost reduction—a more efficient frontier.

A closer examination of each driver suggests that the energy transition is anchored in long-term trends, which is likely to make it capable of withstanding the current economic downturn.

Customer, employee and community demands

A groundswell of support for climate action has arisen across the globe. 2019 saw the biggest climate protests ever as millions took to the streets to demand immediate action to tackle climate change and reduce pollution.[1] In the estimated 185 countries where demonstrations took place, protesters put pressure on governments and businesses to address urgent sustainability issues, such as rising sea levels in the Solomon Islands, toxic waste in South Africa, air pollution and plastic waste in India, and expansion of coal extraction in Australia.[2] The economic shutdowns in 2020 in response to the coronavirus pandemic have further highlighted the environmental damage and pollution that have become the norm for much of the world's population. In China and India, for example, the skies cleared over industrial centers for the first time in years.[3,4]

The change in consumer attitudes, activism and the positive impact of reduced mobility and industry on the environment is apparently getting through to companies and industries. More and more are acknowledging that they need to embrace a low-carbon future not only for the sake of the planet, but to improve customer loyalty and assure their long-term viability. A growing body of evidence reflects this shift in sentiment. For instance, nearly three-quarters of United States business respondents in the 2020 Deloitte Resources Study said their customers are demanding that they procure a certain percentage of electricity from renewable resources, and a rising portion (77%) actively publicize sourcing of renewables.[5] From sustainable building materials to green minerals, demand is also increasing for other carbon-neutral products beyond energy. Meanwhile, a shift in generational values has occurred. Younger employees increasingly want to work for companies that benefit society in addition to producing a profit.[6] The recent rise in employee activism suggests that employees are increasingly monitoring company responses to issues, ranging from gun control to climate change to the coronavirus pandemic.

Policy and government targets

Where the public leads, policymakers eventually follow. Climate strikes and marches around the globe have illustrated that both employees and customers mean business when it comes to emission reductions. With large swathes of the public demanding action on climate change, many governments now have a mandate to set carbon-reduction targets and enact green legislation.

The European Union (EU), for instance, aims to be climate-neutral by 2050. Pursuing an economy with net-zero greenhouse gas (GHG) emissions is at the heart of the European Green Deal and aligned with the EU's commitment to global climate action under the Paris Agreement.[7]

China has also announced ambitious carbon-reduction goals, having set 2030 as a target for peak emissions as part of the Paris Agreement.[8] China's near-term goal is to reduce emissions intensity: energy use and carbon emissions for every unit of gross domestic product.[9] It is currently on track to reach its goals after reducing emissions per GDP by 5.1% and 4% in 2017 and 2018, respectively.[10] More recently, China's decarbonization progress received an unexpected boost: an analysis by Carbon Brief, a UK-based website specializing in climate change, estimated that the coronavirus shutdown from December 2019 through February 2020 had temporarily cut China's carbon emissions by 25%.[11]

Beyond setting reduction targets, some governments are using carbon pricing schemes to accelerate progress toward their goals. More than 40 governments worldwide have now adopted a price on carbon, either through direct taxes on fossil fuels or through cap-and-trade programs.[12] These programs have so far produced mixed results. Some are perceived to be wildly successful while others are viewed as ineffective and expensive at a time when energy customers cannot bear the added costs. That may be why some governments are choosing to tax carbon indirectly through subtler methods such as renewable portfolio standards, energy efficiency mandates, emissions regulations, and carbon-offset pricing.

Investor pressure

In response to policy shifts and customer needs, investors too are taking decarbonization seriously. BlackRock, the world's largest fund manager, with about US$7 trillion of assets under management, is an example[13]. In 2020 Larry Fink, BlackRock's chief executive, declared that "climate risk is investment risk," and published two letters, one to clients and one to CEOs, stating that the group would begin to "place sustainability at the center of its investment approach."[14] He also predicted that "in the near future—and sooner than most anticipate—there will be a significant reallocation of capital to address the climate threat."[15]

Key aspects of BlackRock's sustainability strategy include:

- Selling direct investment in companies that derive more than 25% of their revenues from thermal coal.
- Pledging to vote against management teams that do not publish reports in line with the recommendations of the Task Force on Climate-Related Financial Disclosures and the Sustainability Accounting Standards Board.
- Using economic, social and governance (ESG) criteria more rigorously in active investment strategies.
- Offering more sustainable investment funds.[16]

While BlackRock's strategy made headlines due to the fund's size and influence, other investors have also been pressuring companies to take more action on climate change. For instance, Climate Action 100+, which BlackRock has joined, targets high-emission companies and has grown into one of the largest investor-led engagement initiatives, with over 450 investor signatories and representing over US$40 trillion in assets under management across dozens of markets.[17] Although short-term financial returns generally remain at the forefront, investor efforts such as these could have profound long-term implications for global business and finance, particularly for the E&R industry.

Technology cost reduction

Steep reductions in technology costs are helping E&R companies enable their decarbonization strategies.

Energy storage, which is key to large-scale adoption of renewable energy, is a case in point. Average market prices for battery packs have plunged from US$1,100/kilowatt hour (kWh) in 2010 to US$156/kWh in 2019, an 86% fall in real terms, according to a report released by Bloomberg New Energy Finance (BNEF).[18] Battery-pack prices are projected to fall even further to around US$100/kWh by 2023, driving electrification across the global economy, according to BNEF's forecast.[19]

In addition, advancements in digital technology, such as the Internet of Things (IoT), blockchain, digital twins, and AI-enabled energy-management and trading platforms, also promise to boost efficiency and drive costs down across both conventional and renewable energy value chains.

An opportunity to transform

As these drivers intensify and converge, many leading E&R companies are publicly announcing goals related to reducing emissions, utilizing renewable energy, and addressing climate-related risks. In Deloitte's recent energy transitions survey entitled Navigating the energy transition from disruption to growth, 89% of E&R executives reported that they either already had a plan in place or were developing a strategy to reduce reliance on fossil fuels.[20] 30% of those executives already had a fully developed plan in place. While some E&R companies are mainly responding to government mandates, others see the energy transition as an opportunity to transform themselves via long-term scenario planning over the next 10 to 30 years.

The future of energy

Scenario modeling traditionally arrives at a potential future by examining trends and considering the effects of variables that could be encountered along the way. But what if researchers took a fundamentally different approach based on the idea that the future is not determined by trends but by what will shape their trajectory? To find out, the Deloitte Energy, Resources & Industrials industry team identified 19 uncertainties that will likely influence the speed and scope of the macro trends that are underway today. Working backward along their trajectories, the team arrived at four plausible and divergent scenarios for what the future of energy might look like in 2035 from a global perspective. For more information on Deloitte's Future of Energy Scenarios visit our website

Thus far, the transition to a low-carbon economy has largely been led by the power and utilities (including renewables) sector. Emissions from leading power and utilities companies around the globe have fallen dramatically since 2015, according to an analysis commissioned by the World Economic Forum.[22] Point380, a specialist data analytics firm, performed the analysis using company data reported to the CDP, a not-for-profit organization that monitors global emissions.[23] The reductions are likely due to a combination of factors, including:

- Green policies, such as carbon pricing schemes and renewable portfolio standards, which are driving power generators away from coal-fired thermal generation.
- An abundance of low-cost, cleaner-burning natural gas, which is being used as a bridge fuel in transitioning away from coal.
- Supportive incentives to invest in renewables and bring down the price of technology.
- Commitments from large commercial and industrial customers such as those in the RE100 initiative to source 100% of their power from renewable sources[24].

Building on the progress made, some power and utilities companies are raising the bar on their own, without further prompting from regulators. For instance, the Italian multinational energy corporation, Enel, set a carbon-neutral ambition for 2030, well before the 2050 goal of many companies.[25] To attain this goal, the company is pursuing an ambitious global investment plan to expand its renewables generation portfolio.[26]

Mining and metals organizations came under public pressure early to reduce GHG emissions as part of preserving a social license to operate. Consequently, some are already working toward electrifying their operations and are collaborating with industry associations and other groups to develop innovative solutions for decarbonizing energy-intensive processes, such as smelting and calcining. For instance, in July 2019 BHP announcement their intention to invest US$400 million over five years on low emissions technologies and natural climate solutions and support partnerships to address Scope 3 emissions.[27] Since then, they have identified approximately US$350 million of investment opportunities and are now beginning to allocate funding. The initial investments will focus on reducing operational emissions initially through the purchase of renewable energy and on Scope 3 emissions in the steelmaking sector, with a particular focus on emerging technologies that have the potential to be scaled for widespread use[28]. Similarly, Rio Tinto plans to spend US$1 billion over the next five years on climate-related projects.[29] It has also exited coal production, agreed to an asset-by-asset review of its emission reduction targets, and joined the Energy Transitions Commission to accelerate progress on hard-to-abate sectors.[30] Meanwhile, CEMEX has announced an ambitious strategy to reduce its carbon dioxide (CO_2) emissions by 35% by 2030.[31]

Companies in the oil, gas and chemicals sectors, whose core business models are based on producing and processing hydrocarbons, have generally been slower to change. Nonetheless, several companies are now seizing upon the transition to a low-carbon economy as a means to transform not only how they operate, but also what they offer. Shell, Repsol, Equinor, Total, and bp have developed initial investment plans to diversify their businesses and have set long term energy intensity targets to reduce emissions.[32] Their plans include investing in renewable energy sources, such as solar, wind, hydrogen and biofuels, as well as expanding into ancillary low-carbon businesses such as battery packs and grid-balancing technologies.[33]

With cross-sector intentions, the scale of Oil Majors' commitments could be a game-changer for the E&R industry. For instance, within 10 years bp anticipates having increased its annual low-carbon investment 10-fold to

around US$5 billion per year.[34] This investment is expected to encompass a variety of low-carbon technologies, including renewables, bioenergy and early positions in hydrogen and carbon capture, usage and sequestration (CCUS).[35] Likewise, Total has announced its intention to become a leading international player in renewable energies and has allocated significant funds toward achieving this goal.[36] The company currently allocates more than 10% of its capex to low-carbon electricity, and it plans to increase this allocation to 20% by 2030 or sooner.[37]

Similarly, several multinational chemical companies have launched transformational initiatives centered upon sustainability. DuPont, for instance, has committed to: integrating circular economy principles into its business models; designing 100% of its products and processes using sustainability criteria including the principles of green chemistry; and reducing GHG emissions by 30% by 2030, including sourcing 60% of its electricity from renewable energy.[38]

The desire to refashion themselves is not limited to the world's largest companies. For example, Occidental, an integrated energy company with oil, gas, and chemicals operations and low-carbon ventures, recently announced its bold aspiration to become completely carbon-neutral by using CCUS and by developing other economic applications for CO2.[39]

Navigating the future of energy

Although the transition to a low-carbon economy is gaining momentum, there is still much work to be done. In a 2019, Monitor Deloitte Australia conducted a market study of 112 companies around the world, 69% of them in the Energy, Resources & Industrials industry. Data came from publicly available disclosures and sustainability reporting from 2017 to mid-2019. During this period, these 112 companies collectively emitted 4.53 billion tonnes of carbon dioxide, of which 96% was attributable to E&R—oil and gas, chemicals, mining and metals, and power and utilities. Though these figures can only be approximate given variations in reporting standards, they still illustrate the magnitude of the challenge that lies ahead.

Decarbonization involves heavy lifting. For companies pursuing these goals, it requires a transformational shift in the way they operate: how they source, use, consume and think about energy and feedstocks and how they engage with multiple stakeholders. It also requires a significant financial commitment from investors and governments. The energy transition also has sector-wide implications for how E&R companies interact with each other as well as for how the sectors themselves may combine and converge.

To help companies navigate their way to the future of energy, the following sections examine the current state of decarbonization across four E&R sectors: chemicals; oil and gas; mining and metals; and power, utilities, and renewables.

Each analysis examines the current state of decarbonization in the sector; distinct or outsized macro drivers; which emissions are within a company's control; and potential decarbonization pathways and practical considerations that may influence a company's decarbonization strategies and tactics. For the purposes of this paper we will use the emissions taxonomy put forth by the Greenhouse Gas Protocol: Scope 1 emissions are direct emissions from owned or controlled sources; Scope 2 emissions are indirect emissions from the generation of purchased energy; and Scope 3 emissions are all indirect emissions (not included in Scope 2) that occur in the value chain of the reporting company, including both upstream and downstream emissions.[40]

Chemicals

Today's chemical industry is built on hydrocarbons, which are used both as a feedstock and as a source of energy. This is largely why the sector is often classified as "hard to abate"—its emissions cannot easily be reduced. However, advances in decarbonizing chemical production could have a profound impact globally. The benefits are likely to spread beyond the sector itself since chemistry provides the building blocks for many value chains.

Distinct or outsized drivers

In addition to the previously mentioned drivers, the sector is being pushed to decarbonize by regulatory and scientific pressures. The impacts of climate change, subtle in the past, are now apparent. Some scientists already believe that climate change will make health crises, like the current coronavirus pandemic, more frequent and severe.[41] The sector is also coming under scrutiny from another angle, as the public becomes increasingly sensitive to plastic waste and the improper disposal of end products.

Today, social pressure is far more powerful than regulation, since it comes from both inside and outside a company. Increasingly, shareholder value is all about brand and reputation. An irresponsible company will lose investors and customers. Meanwhile, within the organization, employees are becoming more conscious of corporate behavior vis-à-vis societal values. Rather than being the driving force, regulation is a manifestation of this changing consciousness. Accordingly, bans on single-use, non-biodegradable plastics are mounting.

The chemicals sector's approach to social responsibility is now very much in the spotlight. The scope extends beyond the more traditional forms of chemical industry emissions to carbon, drills down into by-products, and holds operators accountable for post-consumer waste. For instance, China, one of the world's biggest users and makers of plastic, has unveiled a detailed plan to reduce single-use plastics across the country. The plan includes banning non-biodegradable bags in major cities by the end of 2020 and in all cities and towns by the end of 2022.[42]

The chemicals sector is responding to a greater or lesser degree throughout the world, with its own commitments to decarbonization as well as to recycling and resource recovery. For instance, as part of the EU Green Deal, the European chemical sector has committed to carbon neutrality by 2050 as a part of its contribution to achieving the COP 21 climate resolve.[43] Large-scale waste-to-fuels projects, often undertaken in partnership with others in the value chain, are also becoming commonplace. For instance, Dow Chemical recently partnered with Fuenix Ecogy Group in The Netherlands to supply pyrolysis oil feedstock made from recycled plastic waste, while Nouryon joined Air Liquide, Port of Rotterdam and Shell to develop a waste-to-chemicals plant to produce advanced bio-methanol.[44]

Which emissions are under a chemical company's control?

All Scope 1 and Scope 2 emissions are at least theoretically controllable. Chemical companies are no strangers to carefully engineered, closed-loop systems that capture virtually every emission and by-product from the production of dangerous gases such as chlorine or phosgene. Typically the limiting factor in these instances is not technology, but cost. However, Scope 3 emissions, or those emitted by customers and third-party suppliers, pose a more perplexing technical challenge.

With this in mind, some companies are pursuing a number of decarbonization pathways. These include:

- **Improving resource and energy efficiency to produce chemicals and materials.** This is something the industry has always been good at but, might potentially be further improved by the use of digital tools, such as predictive analytics, advanced visualization, and energy management applications powered by artificial intelligence (AI).
- **Using sustainable waste or bio-based feedstocks, such as plant or animal fats, sugar, lignin, hemi-cellulose, starch, corn or algae.** These types of sustainable feedstocks naturally lend themselves to the production of bio-based chemicals, like alcohols, organic acids and polyesters. However, their use is also limited, due to competition with food, biofuels and bioenergy applications and by physical limitations caused by soil erosion, water shortage, land use, reduced biodiversity and the usage of agrochemicals. Sustainable feedstocks tend to have low resource and logistics efficiency. It takes, for instance, 2.5 tons of lignocellulose or eight tons of sugar and long transportation distances of the raw materials to produce one ton of methanol.[45]
- **Avoiding production of virgin materials, like polymers, rubbers, batteries, packaging materials, solvents, heat transfer fluids, lubricants, etc.** This could be accomplished by closing material loops, whether through re-use, mechanical or chemical recycling, or alternative uses in other applications. An additional positive effect is reduced littering as single-use, non-biodegradable plastics and other virgin materials become more valuable. If circularity is feasible across logistics, material separation, and recovery, then not producing virgin materials is often the best climate neutral solution. But circularity does not necessarily mean producing the same product for the same application again. Often it is more effective and efficient to make other products or use them in other applications, such as using recycled wind-turbine blades as an additive for construction materials or giving lithium-ion batteries from mobile applications a second life as stationary power sources. Despite the potential of circularity, those materials make up only about 20% of the chemical industry and thus the impact is limited to that order of magnitude, even if almost all the materials are recirculated.[46]

Overall, about 40% of the chemical industry's long-term emission targets could at least theoretically be achieved by maximizing energy and resource efficiency, using sustainable bio- or waste-based feedstocks and running materials in circles to prevent them from leaking into the environment.[47] What about the remaining 60% of the emissions reduction target?

Practical considerations

Abundant and cheap renewable energy is a prerequisite to achieve the remaining 60% CO2 reduction. In order to become climate neutral, electrification of the transport system and the chemical processes is needed, with full substitution of fossil hydrocarbons by renewable energy sources, such as solar (photovoltaic or concentrated), wind power, bioenergy, waste-to-energy, heat pumps, energy storage, hydropower (tidal or wave), geothermal, or green hydrogen. It will also require substituting climate-neutral feedstocks, beyond those sourced from waste, biomass or circularity, for fossil hydrocarbon-based feedstocks.

Particularly problematic is the need for green hydrogen. It takes six to eight times as much energy to make hydrogen from water than from natural gas or oil.[48] At present, if the European chemical industry ran on green hydrogen, it would require all of the energy consumed in Europe today.[49] Climate-neutral hydrogen is key to decarbonization because it enables the production of syngas/methanol and ammonia, and ultimately the nine key chemical building blocks (chlorine, ammonia/urea, methanol, ethylene/propylene, benzene/toluene/xylenes) that make up more than half of the chemical industry's CO2-emissions (power-to-products).[50]

Given the practical considerations around green hydrogen, the question becomes whether it is sensible to make plastics and chemicals while consuming so much renewable energy. Perhaps this energy should be used for other things. One solution may be carbon capture and sequestration (CCS). Another may be carbon capture and usage (CCU), whereby new technologies make it possible to use carbon as a feedstock for new products and processes.

There is also the overarching issue of whether demand for many conventional plastics and chemicals will wane as the public becomes more educated about the environmental impacts of end products and more willing to accept eco-friendly substitutes. The market is starting to show that people are readily accepting more environmentally capable substitutes, even if they cost slightly more or function a little less effectively. Both start-ups and established companies around the world are gaining traction with diverse products, such as biodegradable seaweed-based packaging, plastic-free diapers that use a film made out of corn, tires made with synthetic spider webs and dandelion rubber, and toothpaste pellets that do not require a disposable tube.

Cross-sector solutions

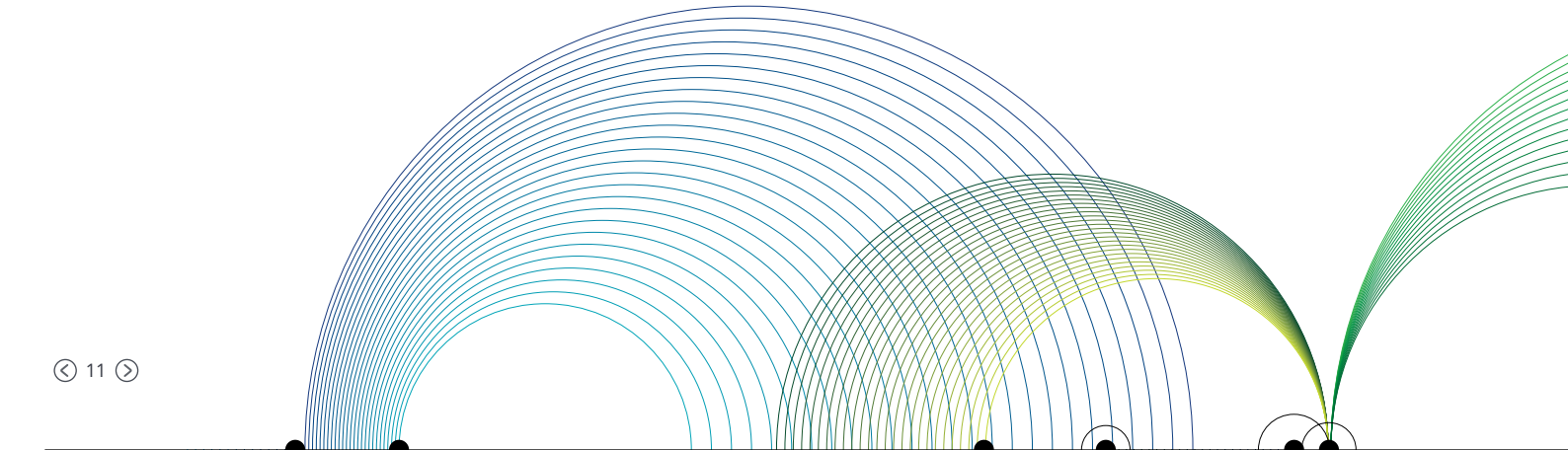
Understanding the financial impact of climate-related risks and opportunities on their businesses is imperative for companies across all sectors. In time, greater scrutiny will be placed on organizations to not just disclose but respond to the transition and physical risks that lie on the path to the future of energy.

Transition risks include depressed asset values, stranded assets and changing market demand. For example, midstream companies that own gas pipelines may someday encounter decreased utilization or disuse, the odds of which increase with time. An unintended consequence of the transition could be that the big companies will exit the space. This has happened with coal mining and coal-fired power plants in the United States and Europe to some extent, raising the question of who ends up owning high-emissions assets as they wind down. It might be a race to the bottom, with the least socially responsible companies the only ones willing to take these assets on, potentially creating new risks. Another question is at what stage do asset valuations start to take into account the eventual phase out of fossil fuels.

Physical risks include direct and indirect impacts of severe weather on infrastructure, worker safety and productivity. The industry has already seen far too many real-life examples. The E&R industry in Australia offers a case in point; stronger typhoons in Northern Australia have repeatedly caused shutdowns because some mine sites and all LNG facilities are close to the coast. There have also been many days of extreme heat, above 40°C (104°F), where workers need more breaks, reducing productivity[51]. Fires, too, have come close to critical infrastructure, triggering shutdowns and pre-emptive power outages.

In this environment, markets are beginning to scrutinize the methodologies companies use to prepare for the energy transition to ensure they are adhering to science-based targets and developing effective strategies for risk mitigation and carbon abatement. Robust, science-based analytical tools and frameworks are likely to become essential. Such tools can help companies to identify decarbonization pathways and prioritize abatement projects by analyzing their costs and linking them directly to science-based targets.

As executives figure out how to manage the decarbonization challenges within their company and sector, they should not forget that vertical integration and cross-sector consolidation may be part of the solution. This could begin with bilateral partnerships but evolve into partnerships or acquisitions throughout the value chain. For instance, a mining company could merge with a cement-maker, or an oil and gas company could acquire a battery manufacturer or enter into a joint venture with an EV automaker. In a world where the traditional lines between sectors are blurring, these types of non-traditional amalgamations may become routine.



Conclusion

Towards the new circular economy

For companies that emit and/or produce hydrocarbons, the pressure to change is building on all sides. But as the problems become more urgent, they are also becoming more feasible to solve. The emergence of a low-carbon, circular economy is now possible and many governments and regulators are starting to show their support. They now stand to gain, rather than lose, political capital by enacting policies that spur climate action and establish a circular economy.

While the economic shock of the coronavirus pandemic may slow progress in the short term, it is also shining a spotlight on the human impacts of pollution and climate change, thus advancing the decarbonization agenda in the long run. What emissions or waste products are attractive to acquire is an interesting question that arises.

New technologies make it possible to use CO2 as a feedstock for chemicals and plastics. Waste-to-hydrogen plants are being built. Renewable electricity is rapidly descending the cost curve. This suggests the E&R industry is on the cusp of a paradigm shift that could transform waste from a problem to a solution.

Instead of pondering how to dispose of CO2 and other waste, many companies may by 2030 view everything they produce, including emissions, by-products and end-products, as a resource that can be traded to create economic value. New partnerships and markets are likely to form. Substances long emitted or discarded as costly nuisances can become products that companies want to buy. And a new, cleaner, more circular economy can emerge.

About Deloitte's Decarbonization Solutions

The Decarbonization Solutions package provided by Deloitte member firms, includes modules relating to abatement portfolio management, decarbonization scenarios, abatement pathways, and impact analysis as well as modules to help consider physical climate risk. The modules leverage scientific information from leading bodies and methodologies including Represented Concentration Pathways from the Intergovernmental Panel on Climate Change, shared socio-economic scenarios from the International Institute for Applied Systems Analysis, and methodologies from the Science-based Targets Initiative, among others. The modules compare forecast emissions reductions from selected abatement projects with short, medium and longer-term aspirations and pathways as well as identify physical climate risks.

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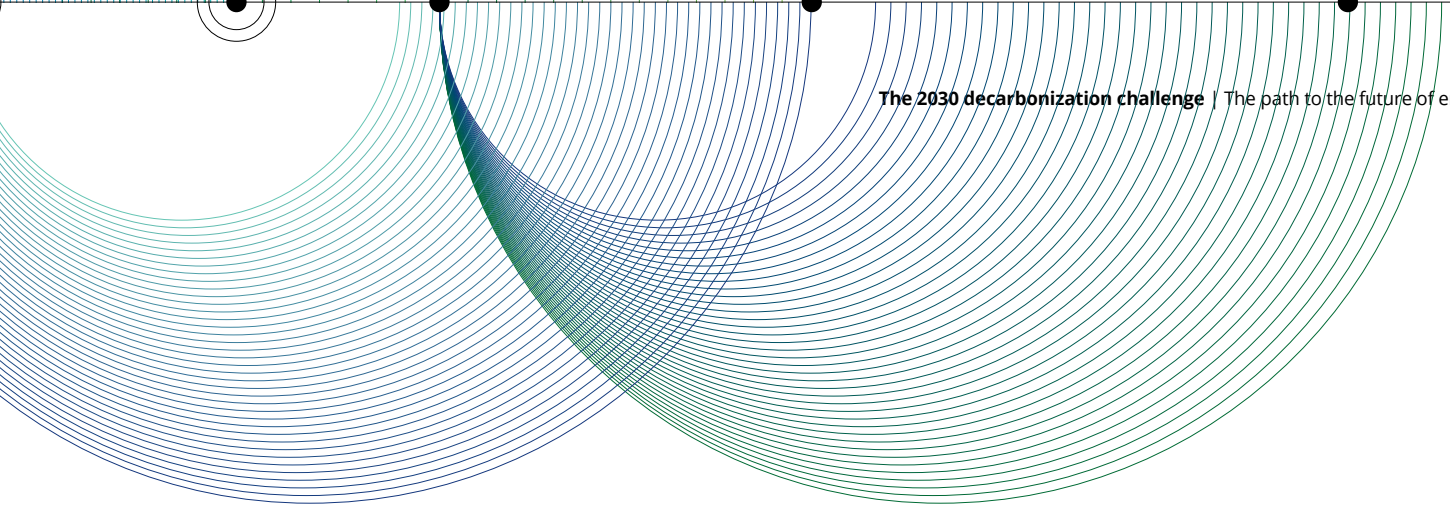

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