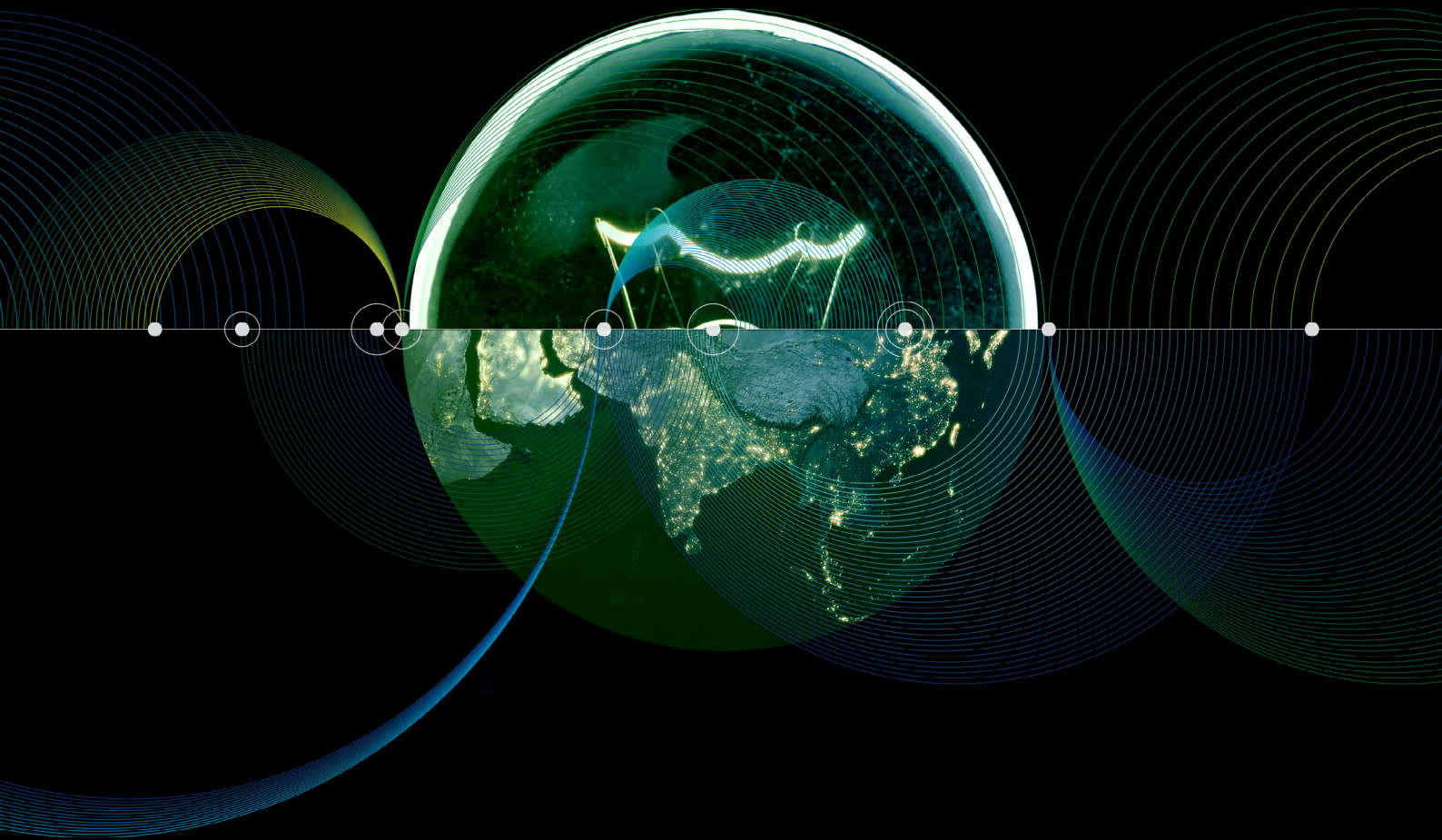


Deloitte.



The 2030 decarbonization challenge

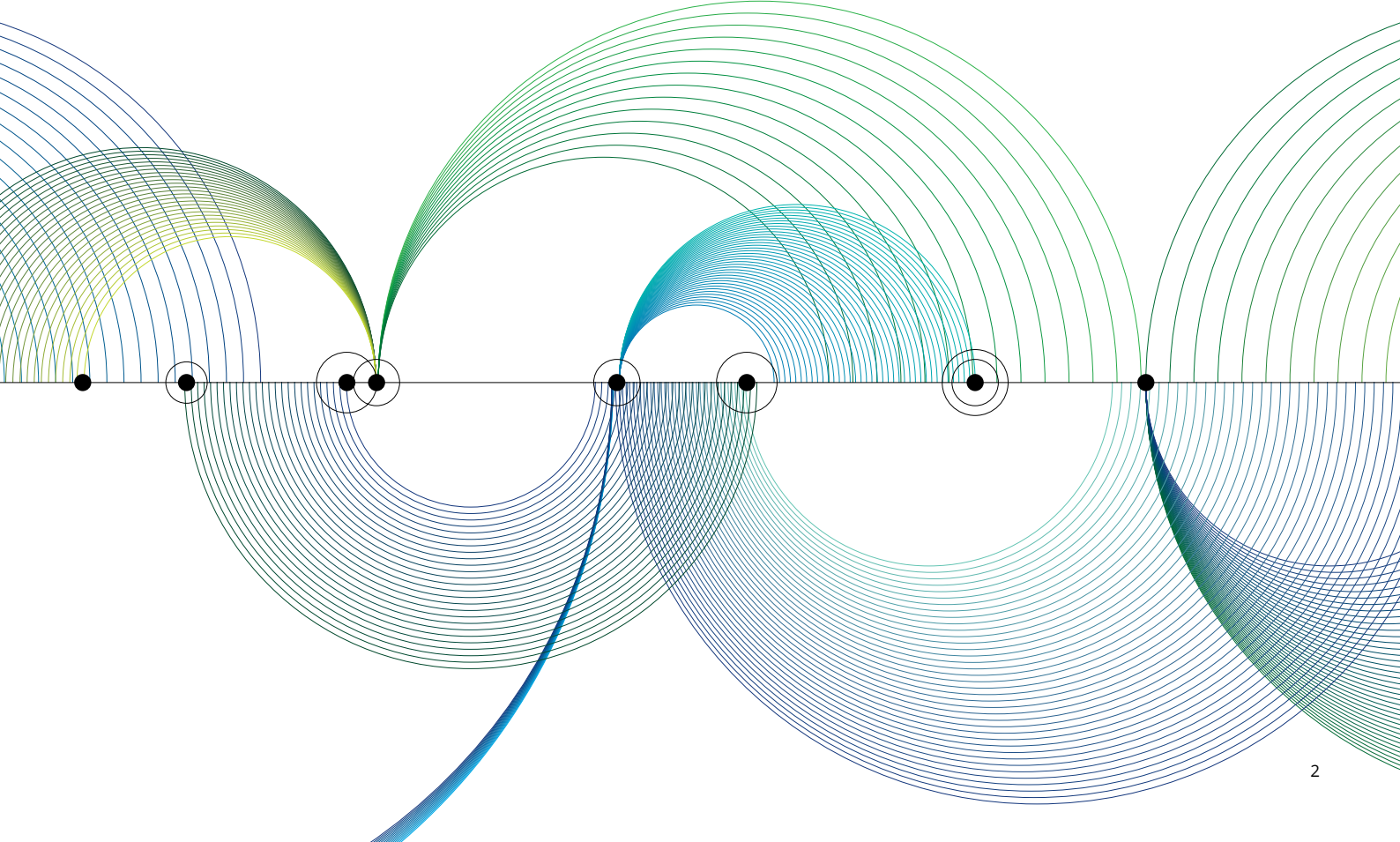
The path to the future of energy



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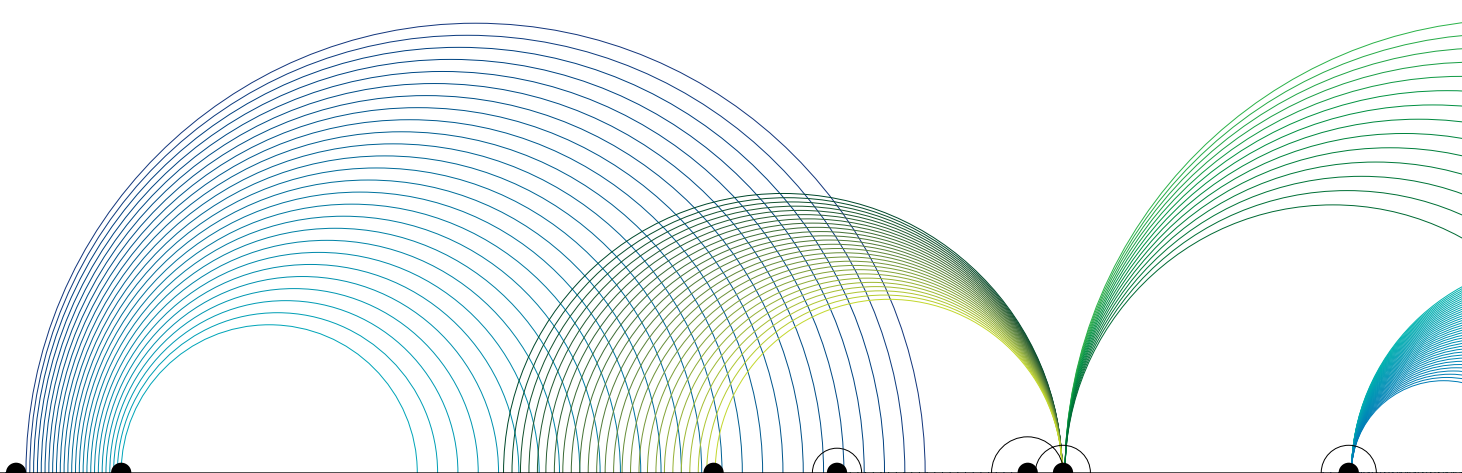


Forward

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.

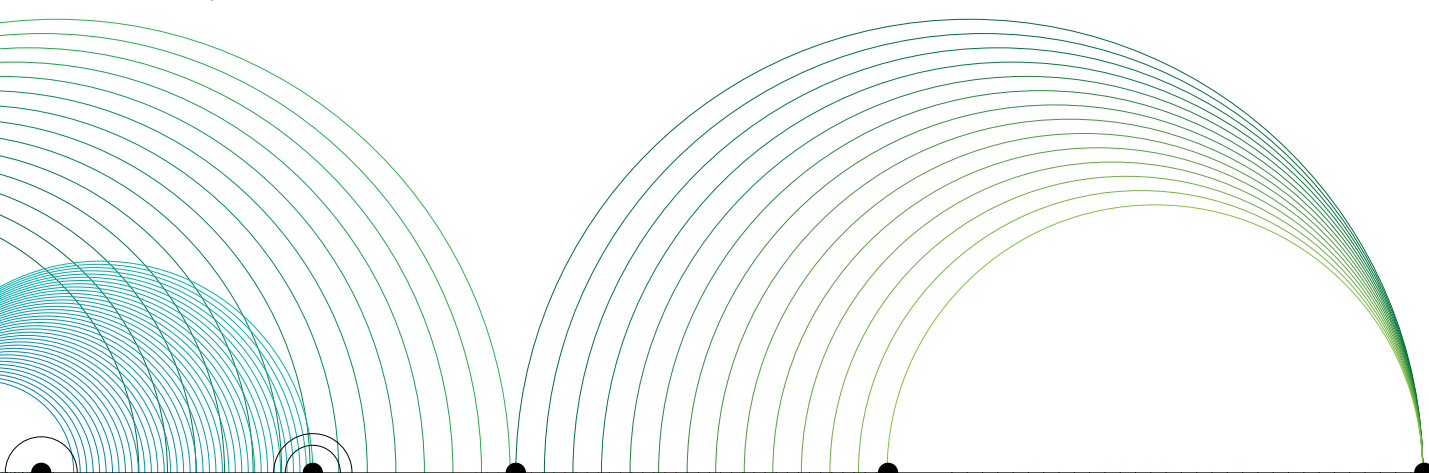
Customer, employee and community demands

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 example¹³. 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 sources²⁴.

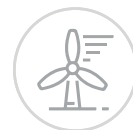
Building on the progress made, some power and utilities companies are raising the bar on their own, without further prompting from regulators. For instance, the Italian multinational energy corporation, Enel, set a carbon-neutral ambition for 2030, well before the 2050 goal of many companies.²⁵ To attain 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 announced 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 use²⁸. 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 (CO₂) 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



Oil and gas



Power, utilities
and renewables



Mining and
metals



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 Ecology 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, hemicellulose, 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.





Oil and gas

Global oil and gas markets have been upended. The contraction in global demand caused by the coronavirus pandemic and excess supply from the oil price war between OPEC and other major producers have hit upstream and downstream operations hard. Cutting carbon emissions may be a priority for some companies in the short-term, but the difficult market conditions are likely to encourage those who survive the current crisis to articulate decarbonization pathways, examine different business models and demonstrate a disciplined approach to capital expenditures.

Distinct or outsized drivers

Like the other sectors, oil and gas companies are feeling pressure from all sides to reduce emissions. However, investor pressure has been particularly intense and direct. On March 6, 2020, UBS announced that it would no longer fund offshore drilling in the Arctic.⁵¹ Multiple United States banks, including Wells Fargo & Company and Goldman Sachs, had previously announced similar policy shifts⁵². Investors want to understand the long term investment strategies of oil and gas companies in a world seeking to limit the increase in global temperatures to well below 2°C.

Which emissions are under an oil and gas company's control?

Scope 1 and 2 emissions, those that are produced during operations, are largely under an oil and gas company's control. Accordingly, common mitigation strategies focus on lowering the carbon intensity of the value chain by:

- Electrifying operations and incorporating renewables to fulfill power needs.
- Enhancing energy efficiency and reducing energy intensity.
- Adopting low or no emission fuels such as hydrogen, efuels/synthetic fuels, biofuels and ammonia.
- Improving logistics to reduce fuel consumption. For instance, invoking the principles of a sharing economy, some operators coordinate logistics, including trucks, marine vessels and helicopters, to optimize transport times and volumes.
- Establishing common standards and leading practices for improved energy efficiency and decreased emissions.

- Reducing routine flaring.
- Employing methane capture.
- Optimizing production and reservoir management through the use of digital tools such as IoT sensors, digital twins, and virtual reality to model scenarios, monitor operations, track emissions and energy usage and proactively maintain equipment.
- Producing lower-emission products—moving from one hydrocarbon to another (for example, from coal to natural gas) or creating another product (such as biofuels or syngas).
- Increasing reuse or employing additive manufacturing to decrease waste and increase supply-chain flexibility.

Practical considerations

To satisfy investors and remain viable during the transition, oil and gas companies essentially have two primary avenues for transforming their business models.

- **Diversifying into other forms of energy and enabling technologies:** Some companies have decided to build up competencies in renewables, often focusing on biofuels such as wind and solar power, smart technologies to help balance the electrical grid as more intermittent renewables come online, or energy-efficient methods for producing green hydrogen. Others are acquiring companies in ancillary sectors, such as solar installers or electric vehicle (EV) charging stations, to expand their portfolio of low- to no-emissions offerings. Regardless of the strategy, an overarching trend is emerging. Many oil and gas companies are shifting their business models so that more value is created through downstream customers, rather than upstream assets. For instance, an oil and gas company might purchase a retail power provider to offer biofuels bundled with renewable electricity.

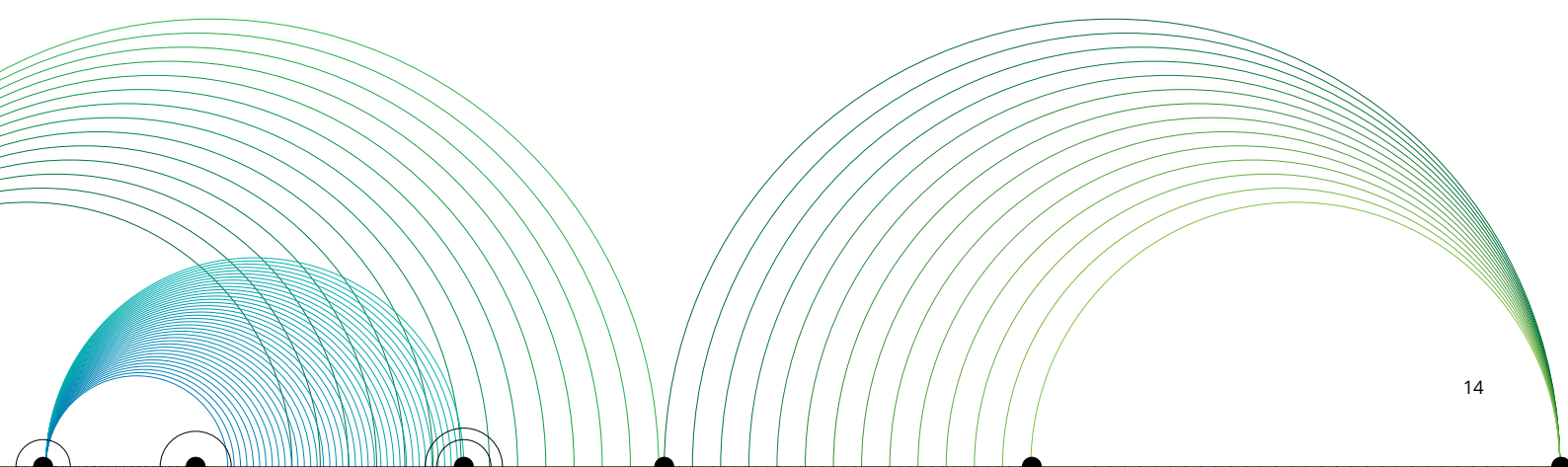
• Turning Scope 3 emissions into a business

opportunity: Another path is to turn CO₂ into a valuable raw material, not just a waste product that must be controlled. Trillion dollar markets have been predicted for the use of CO₂ as a feedstock for a variety of building materials, chemicals and fuels. The value of CO₂ has already been demonstrated in enhanced oil recovery processes. Some uses for CO₂ sound more like science fiction than fact. For instance, C2CNT, a Canadian company, is using “molten electrolysis” to transform CO₂ directly into carbon nanotubes, which are stronger than steel and highly conductive.⁵³

Carbon capture technologies have been rapidly evolving on a parallel track. Engineers at the Massachusetts Institute of Technology recently developed a new way to remove carbon dioxide from the air.⁵⁴ Unlike traditional carbon capture technologies, this system can remove any concentration of CO₂, from the high levels in power-plant emissions to the relatively low ones in open air.⁵⁵ Although they may not yet be commercially viable, breakthroughs of this kind could gain traction. If they do, there could be a race to capture carbon emissions and sell them as a valuable commodity.

As they transform their business models, many oil and gas companies are simultaneously considering decarbonization pathways for their existing upstream and downstream businesses, often proactively working with ecosystem partners to accelerate that process.

For instance, bp recently announced its ambition to become net zero by 2050 if not sooner, along with a new strategy for pivoting from “an international oil company focused on producing resources to an integrated energy company focused on delivering solutions for customers.”⁵⁶



As part of this transformation, bp intends to develop approximately 50 gigawatts (GW) of net renewable generating capacity, partner with 10-15 cities and three core industries in decarbonization efforts, and double its customer interactions to 20 million per day—all by 2030.⁵⁷

Meanwhile, Repsol states that it was the first energy company to make the commitment to achieve net zero emissions by 2050 in alignment with the climate objectives set out by the Paris Agreement.⁵⁸ The company has established intermediate decarbonization goals for 2025, 2030, and 2040, and it has outlined a decarbonization strategy that addresses emissions from both its operations and its products.⁵⁹ This strategy includes collaborating with auto manufacturers to develop sustainable mobility markets.⁶⁰ For example, Repsol has partnered with Kia Motors Corporation to create WiBLE, a car-sharing service that uses fully electric, hybrid, and plug-in hybrid vehicles.

Shell has outlined a net carbon footprint ambition that includes diversification and ecosystem involvement. It recently announced a short-term target of reducing its net carbon footprint by 3% to 4% by the end of 2022, along with its intention to set targets annually, with each year's target covering either a three or five-year period.⁶¹ The company has also partially linked executive pay, and that of around 16,500 employees, to its carbon-reduction targets.⁶²

In addition, Shell aims to address value-chain emissions by helping other sectors decarbonize.⁶³ To this end, the company has published a joint report with Deloitte that outlines industry perspectives on how to reduce emissions in the shipping sector.⁶⁴ [Decarbonising Shipping: All Hands on Deck](#) presents the views of 80 senior shipping executives, representing 22 countries and almost all segments of

the industry, and it presents 12 potential solutions or recommendations for action.⁶⁵

Despite ambitions like these, obstacles exist. For some, differences in finance models are a barrier. On the one hand, upstream businesses have historically generated higher margins than renewables, although the recent oil price reductions have helped to close that gap. On the other hand, developing a portfolio of renewable generation assets generally carries much less risk than drilling offshore or in other challenging geographies.

There are many questions as to how these shifting risk and financial factors could play out for traditional oil and gas investors since they will probably need to adjust to having a portfolio of different businesses within the same corporation. Also, oil and gas companies will likely need to review their dividend policies to make sure they are consistent with the risk profiles and returns of their existing businesses as well as those they are trying to develop. However, the supply and demand imbalance may have permanently altered the dividend context.

Amid difficult market conditions almost all oil and gas companies are looking more rigorously at their capital allocations. Some are choosing to invest only in known geographies. Others are limiting capital expenditures to projects that are likely to be viable in a lower demand environment. This includes developing new technologies to support a circular economy, such as CCUS, waste-to-fuel and waste-to-feedstock conversion, and smart grids to support the two-way flow of power and information. With capital allocations coming under greater scrutiny, new large-scale exploration and development projects may be constrained for some time.





Collaboration on the Norwegian continental shelf

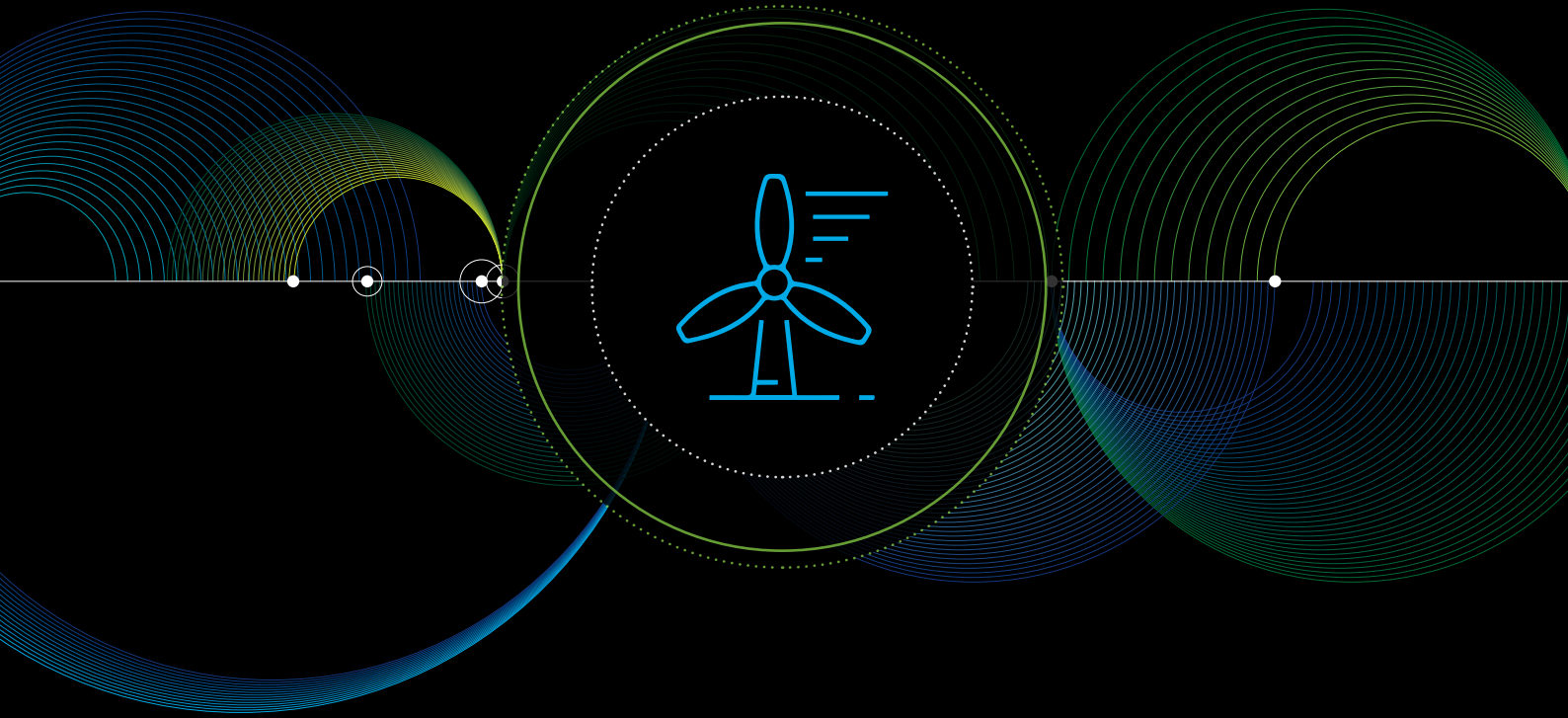
The oil and gas industry in Norway set the goal of cutting emissions by 40% by 2030 compared to 2005 levels. To accomplish this goal, the sector has begun to exploit synergies between the petroleum sector and offshore floating and fixed wind power. These efforts include Equinor's commitment to floating wind power in the Tampen area of the North Sea. Norway also has a carbon tax, which has prompted companies to focus on reducing their power needs throughout the lifecycle of a field. For instance, Equinor has developed the technological capability to simulate the entire drainage strategy for a field, optimizing it not just from an economic point of view but also in terms of the power that will be needed throughout its life cycle.

Norway's national approach to meeting the Paris Agreement's goals demonstrates the power of cross-industry collaboration. Interrelated sectors come together to develop leading practices and decarbonization strategies through KonKraft, a collaboration arena for the Norwegian Oil and Gas Association, the Federation of Norwegian Industries, the Norwegian Shipowners

Association, the Norwegian Confederation of Trade Unions (LO), and LO members of the United Federation of Trade Unions, and the Norwegian Union of Industry and Energy Workers (Industry Energy).

Low- and zero-emission fuels are a current area of focus for the group since they are essential to achieving large emission reductions in the maritime sector, where only energy-dense products such as biogas, hydrogen and ammonia can deliver the power a ship requires. Hydrogen-powered offshore supply ships are already under development. The oil and gas sector in Norway is also engaged in various projects to produce hydrogen from water and renewable electricity as well as from natural gas with CCS. Also, Equinor has entered into an agreement with the shipping company Eidesvik Offshore to enable the Viking Energy supply ship to run for long distances on pure ammonia without GHG emissions.

Source: KonKraft Report 2020, "The energy industry of tomorrow on the Norwegian Continental Shelf: Climate strategy towards 2030 and 2050," <https://konkraft.no/wp-content/uploads/2020/02/The-energy-industry-on-the-NCS.-climate-strategy-towards-2030-and-2050.pdf>. Accessed August 20, 2020



Power, utilities and renewables

Organizations in the power and utilities space are moving faster to decarbonize than many other sectors. This is due partially to policy but principally to economics. Low-cost natural gas has displaced coal, reducing sector emissions significantly, wind and solar are among the cheapest resources available in most areas, and battery storage costs have plummeted. Technological advances have also improved energy efficiency across generation, transmission and distribution, and paved the way for new models of distributed generation such as microgrids, community solar, and peer-to-peer energy trading. The power sector is also benefiting from the movement to electrify transportation and certain industrial processes. Additionally, social pressure from customers is driving the sector to develop a “green” portfolio of services and products. This pressure has given rise to new offerings in the following areas: energy efficiency, distributed generation and storage, smart energy management, energy system flexibility services, green origin of energy certificates, smart cities, net-zero and LEED-certified⁶⁶ buildings, electric vehicles, and more. For the power, utilities and renewables sector, promoting decarbonization has become a key attribute of customer engagement.

Distinct or outsized drivers

The power and utilities sector shares the same drivers as the other sectors. However, since electricity production is the single greatest contributor to global greenhouse gas emissions at 31% of total emissions, and many renewables technologies are already mature, the power and utilities sector has generally felt these pressures earlier than other sectors. Consequently, companies have been decarbonizing for more than a decade.

Although coal-fired generation still accounts for a large portion of electricity generation capacity in certain regions, producers around the world are largely working to expand their renewable energy portfolios, repurpose, decommission or increase the efficiency of their thermal power plants, and improve energy efficiency in buildings. Natural gas is expected to continue to play a major role in electricity generation for at least the next decade since it is widely seen as essential to handling peak loads and offsetting the intermittency of renewables. Some power producers are also extending the lives of their nuclear plants, which are valued for their baseload capacity and low-emissions profile. However, public sentiment about nuclear power and its waste disposal issues remains negative.

The power and utilities sector also encompasses natural gas utilities, which are facing their own breed of challenges. Natural gas is still a valuable home-heating source and commercial and industrial energy source and is likely to remain so for some time. However, the long-term future of the sector is in question as the energy transition gains momentum and new technologies come to the fore. For instance, in the United States a nascent movement has begun to encourage or require all-electric new construction. Several cities have recently enacted new zoning codes prohibiting installation of gas lines in major new construction and so-called gut renovations.⁶⁷ Meanwhile, in the United Kingdom the possibility of substitution has appeared: as part of a government-commissioned study, a group of leading engineers recently determined that it is technically feasible to replace natural gas with hydrogen in the country's gas grid.⁶⁸

In light of these developments, power and utilities companies—ranging from small, local co-ops to large, investor-owned utilities—generally understand that they must develop renewables as well as products and services that help customers reduce their carbon footprints, or they may not survive.

Which emissions are under a power and utility company's control?

Scope 1 and 2 emissions are under a power and utility company's control and have been under scrutiny for some time. This includes improving the efficiency of customers and helping them become "prosumers" through distributed generation (i.e., installing solar panels) and electrifying all home energy usages (i.e., electric vehicles, thermal hot water heaters, heat pumps, batteries, etc.). On the supplier/provider side, this includes reducing or offsetting the emissions generated by fuel producers, equipment manufacturers, and third-party logistics and service providers.

Practical considerations

With no historical precedent, decarbonization of the power and utilities sector will require a robust ability to manage and derive insights from data. Although disruption and displacement pose significant threats, some see abundant opportunities to create new business models and revenue streams by applying advanced analytics and scenario modeling across the three main segments of the value chain: retail power, grid transmission and distribution, and generation.

In the retail power segment, companies will need to gain a deep understanding of residential, commercial and industrial customers so they can develop attractive offerings and insert them at the right point in the customer lifecycle. As outlined in the Deloitte publication, [Widening the Lens: Big-picture thinking on disruptive innovation in the retail power sector](#), retail power companies should consider broadening innovation programs to survive amid a multitude of new market entrants and new business models from existing competitors.⁶⁹ A renewed focus on innovation is essential to developing a broad catalog of products and services. Companies should also consider building ecosystems with third parties to accelerate customer adoption of new products and services and facilitate new channels of communication. Moving ahead, service delivery excellence, including digital channels to manage customer relationships, will likely be a key differentiator. Greater digitalization can also help to reduce operational costs.

In grid transmission and distribution, companies will need to assess how to deploy smart technologies, along with having proactive discussions with regulators about incentives and how they can recoup their investments. As distributed generation expands and more renewables enter the system, companies will increasingly need to develop and be compensated for solutions that balance the grid and facilitate the two-way flow of electricity.



Smart platforms lighten the load on the grid and consumers

As more distributed resources come online, more technological solutions are needed to lighten the load on the electricity grid. eMotorWerks, an Enel X subsidiary, and LO3 Energy, which facilitates local energy marketplaces through advanced digital services, have joined forces to test an AI-powered, grid-balancing solution that aims to put money back into the pockets of EV owners while reducing the environmental impact of charging. The project connects eMotorWerks' JuiceNet EV charging platform to one of LO3's energy marketplaces to allow local renewable energy to be traded between the microgrid and EV owners. LO3's Exergy™ platform underpins the data exchange that enables price signals and peer-to-peer transactions, while the eMotorWorks JuiceNet platform enables local demand from electric vehicles and households to be matched with the local supply of affordable green energy in real time. The idea behind this project and others underway at Enel X is to give consumers choice in how they consume energy, including when and what type of resources they use to charge their EVs as well as when and how EVs can be leveraged as energy resources for local grid-balancing through demand response.

Source: Enel X company website, "A smart platform to enable EV charging with clean, local energy," December 10, 2018, <https://www.enelx.com/en/news-and-media/news/2018/12/project-efficient-charging-micro-grid-electric-vehicles>, accessed August 31, 2020.

In addition to deploying distributed resource management (DRM) technologies, the pace of decarbonization largely hinges upon the evolution of energy storage technology. Currently, lithium ion batteries are the default option for grid-scale storage, but they only provide power for a few hours in an efficient and economic way. Fortunately, promising longer-duration storage technologies are in development, including flow batteries, compressed air systems, liquid air systems, flywheels, thermal storage (e.g., molten salt), stacked blocks, and hydrogen.

In generation, companies will need to find cost-effective ways to expand renewable portfolios by choosing appropriate technologies and suitable locations, while determining whether to transform or decommission thermal plants. These plans will vary greatly across countries.

Across all segments of the value chain, companies will be challenged to:

- **Compete with a host of new competitors.** Developing renewable generation has lower barriers to entry than building centralized fossil-fuel-fired plants. Changing regulations and the application of new digital technologies (e.g., the cloud, AI, robotic process automation, etc.) are inviting new entrants into the retail sector. This has opened the door to a number of smaller players as well as to larger technology and telecommunications companies which aim to become the main provider of home services. In addition, oil and gas majors are entering the field to diversify energy portfolios. These competitors have deep pockets and, despite the transition away from fossil fuels, are likely to have profitable businesses for decades to come that can be used to fund investments in other areas.



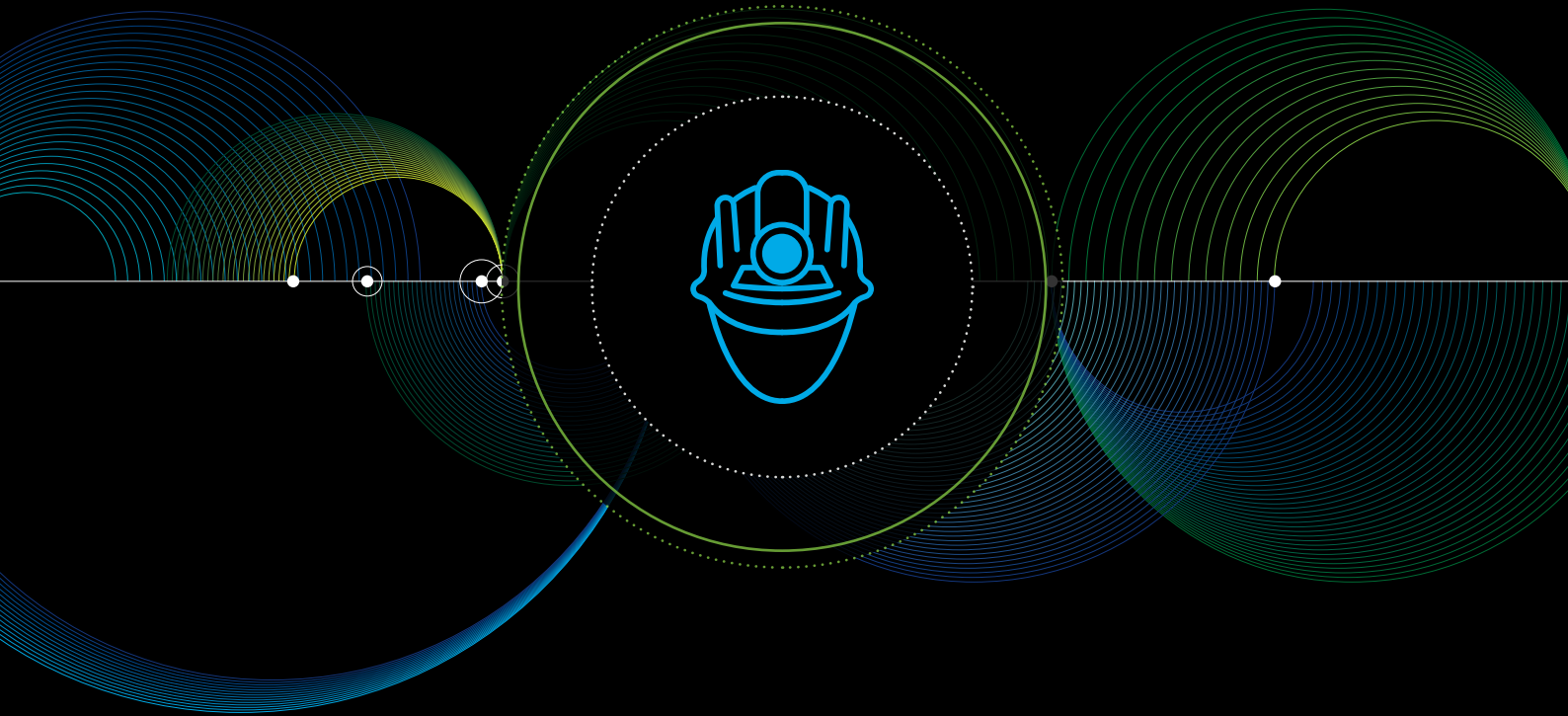


• **Anticipate and influence the regulatory environment.** Investments in the system and the grid are even more necessary during this energy transition because management of the system will be much more complex. But in many areas of the world, regulatory authorities have yet to align financial incentives with the investments that need to be made. For instance, a generation company may need to build a gas-fired thermal plant to maintain reliability, but it will only operate for about 1,000 hours per year due to increased renewables in the system, as opposed to the 5,000 or more hours necessary for it to be economical. Or, a power grid company may need to make upgrades to handle more connections with distributed generation. There is also the issue of how to compensate energy storage providers for the value they add to the grid. Without the right regulatory frameworks in place to build markets and ensure adequate returns, power and utilities companies will be forced to make some difficult choices about which projects to pursue and how to fund them.

In their interactions with regulators, companies may wish to consider tying their investments to customer value and satisfaction, resiliency, and better performance in terms of uptime and reliability. Examples include developing back-up microgrids that will turn on during outages or utility-grade solar projects that customers can opt in on. Companies will also need to manage the issue of equity. Some argue that many residential solar programs are inherently unfair to low-income customers: not everyone can afford to install solar panels, while those who can often don't pay their fair share to maintain the grid. Similarly, there are concerns about grid fragmentation. For instance, microgrids may become concentrated in wealthier areas, presenting the risk that whole communities could be left behind.

- **Transition to digital tools and lean organizations.** A big part of keeping costs down involves digitalization and improved workforce management. Cloud-based customer service and billing systems will likely be a part of this transition. So will cloud-based human capital management systems that improve the employee experience, enable more-efficient scheduling of personnel, and facilitate talent management and retention. Some regulators in the United States are starting to respond to these needs by allowing cloud investments to be classified as capital expenses. This change in perspective opens up new avenues for funding digitalization programs and promoting adequate returns on investment.
- **Determine new growth strategies.** Internationalization could be a growth option for some power and utilities companies in developed countries where energy demand is flat. Companies may also get an unexpected boost from coronavirus pandemic stimulus funds. The likely responses to the crisis are not fully known but some governments are expected to incentivize clean energy programs and infrastructure projects as a mechanism to jumpstart flagging economies and get people back to work.

Despite the coronavirus crisis, many power and utilities companies remain focused on their decarbonization pathways. Companies have generally paused their large capitalization programs during the crisis but are expected to resume them in the long term. In the near term, companies will likely concentrate on building resilient organizations, digitizing workforce management, and improving their supply chains.



Mining and metals

Decarbonization in mining largely relies upon electrification and renewables. In some ways, it is easier to envision how mining could become carbon-free than other sectors. That does not mean it will be easy.

Distinct or outsized drivers

Investors are applying intense pressure on large multinational players in the mining sector, particularly regarding operational emissions. The rapidly declining cost of renewables has made it easier for them to respond. For example, BHP has signed a deal to develop new solar and wind farms in Australia's Queensland state which will enable them to run their coal operation in the region on solar. They expect this will help them cut their indirect emissions in the country by 20% over five years⁷⁰. BHP is also moving toward green copper by signing renewable energy contracts that will allow its Escondida and Spence copper mines in Chile to shift to 100% renewables, replacing imported LNG.⁷¹ It has also committed itself to eliminating ground water usage in Chile by 2030 by investing in desalination plants.⁷²

With a patchwork of different national and local policies to navigate, many mining companies are designing their decarbonization strategies based on the most stringent common denominator and then applying those tactics globally across their organizations. Although mining and metals companies expect carbon pricing and increasing regulation, these are not the primary drivers at present. Instead, investors and the markets are ahead of where governments stand, as evidenced by the increasing number of companies that are signaling their decarbonization ambitions.

Supply chain pull is also generally stronger in mining than in other sectors. For instance, battery manufacturers are starting to look for carbon-neutral lithium and nickel, while automakers are starting to ask for green steel and aluminum. Market demands such as these may become the biggest driver of all. If customers start demanding green products, mining companies must offer them in order to stay in the game.

Which emissions are in a mining company's control?

Operational emissions (i.e., Scope 1 and 2) are largely within a mining company's control. Although execution is always tricky, it is generally easy to see how it can be done. One exception is fugitive emissions from coal mining, where there are still no widely available economically viable solutions for controlling methane leakage. Another exception is emissions from construction base materials, especially cement, where CO₂ is produced as a byproduct of the calcination process.

Value chain emissions (i.e., Scope 3) are where it becomes harder. This includes upstream suppliers, which provide copper, steel, and vast amounts of concrete to construct the mine site as well as downstream customers who use base materials and metals to construct virtually every heavy-duty product in modern society, ranging from ships to bridges, cars to buildings, and much in between. In mining, value chain emissions can be several times greater than operational emissions. With few easy answers available, many believe a more complex solution may be necessary to manage Scope 3 emissions in mining and beyond: principally the creation of a circular economy, whereby carbon-neutral ore is used to make carbon-neutral materials.

Practical considerations

The thorny part of decarbonization in mining, which involves tackling value chain emissions, requires partnerships and an ecosystem mindset. Forcing customers to use raw materials in ways that reduce emissions is counterproductive. Partnerships of customers and suppliers who have the same goal is generally more effective. However, forging such alliances would oblige mining companies to collaborate with each other and with other players in the supply chain.

Instead of imposing carbon-reduction targets upon the downstream value chain, companies will increasingly need to function as an ecosystem, setting goals in terms of the

partnerships they have, the trials they are conducting and the solutions they are developing. They will also need visibility on who buys and sells their ores, including traders and end customers, and how the minerals they mine are ultimately being used. New blockchain-enabled tracing methods are already being deployed to track ethical sourcing of materials and they should readily be extendable into low-emissions mining. An effort overseen by the multinational responsible sourcing group, RCS Global, offers an example. Led by Ford, a cross-industry, collaborative effort is underway to help ensure that cobalt supplies in high demand for use in lithium ion batteries are not linked to human rights abuses.⁷³ For the pilot project, Ford has teamed up with IBM, South Korean battery maker LG Chem, and China's largest cobalt producer Huayou Cobalt to test the first blockchain solution for tracing supplies of the metal from the Democratic Republic of Congo.⁷⁴

From an ecosystem perspective, mining companies will also need to make sure their positions on carbon-reduction align with industry association standards. This is important to avoid "green-washing," where companies profess to be committed to carbon reduction for branding purposes but do not back up their claims with measurable action. This alignment is also important in order to arrive at standardized ways of reporting.

Maintaining a social license to operate is a significant practical consideration for many mining companies. Rightly or wrongly mining is often perceived as a low-tech, heavily polluting industry. This affects the attraction and retention of employees, particularly younger ones. Accordingly, large multinationals increasingly want to be out in front on sustainability issues in order to attract the best talent. Being a leader in carbon abatement also delivers practical social benefits, such as improving air quality by reducing particulate emissions from diesel-powered trucks and heavy equipment, and creating sustainable power sources, which can be transferred to the community after the closure of the mine.



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.

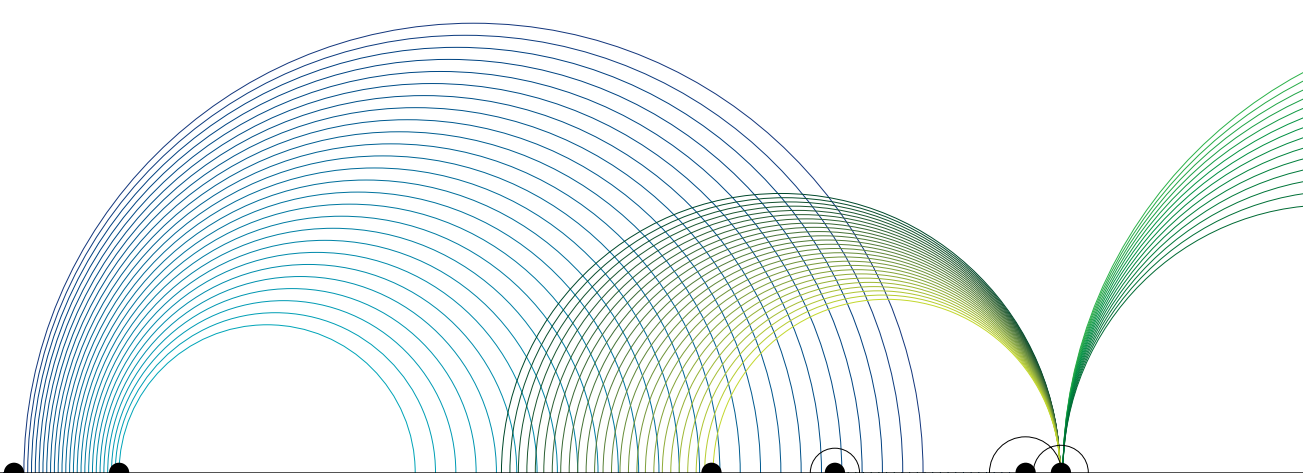
Transition risks include depressed asset values, stranded assets and changing market demand. For example, midstream companies that own gas pipelines may someday encounter decreased utilization or disuse, the odds of which increase with time. An unintended consequence of the transition could be that the 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 productivity⁷⁵. 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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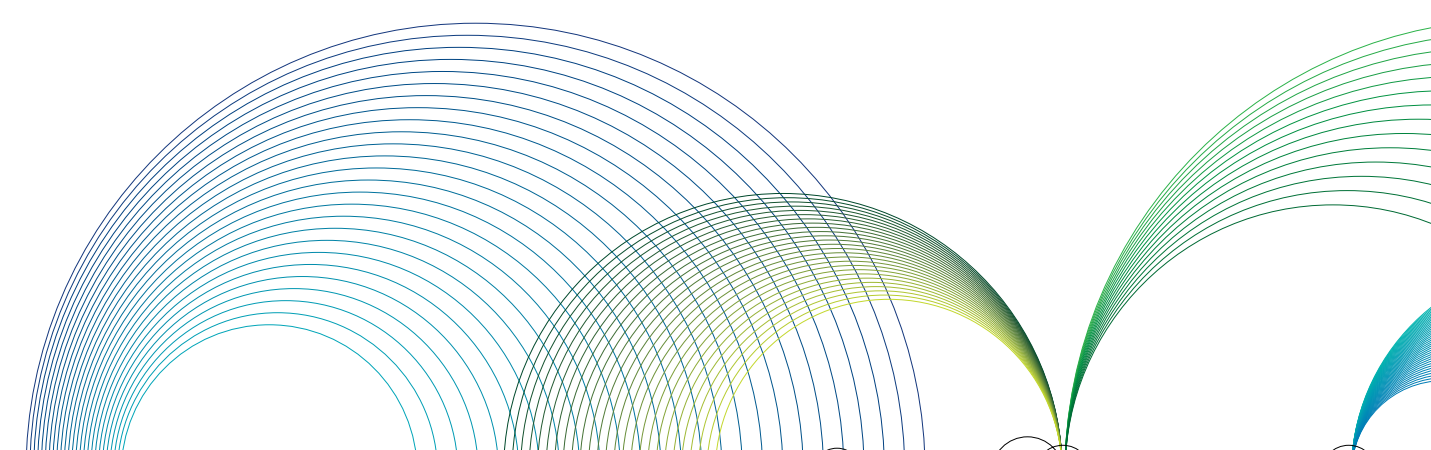
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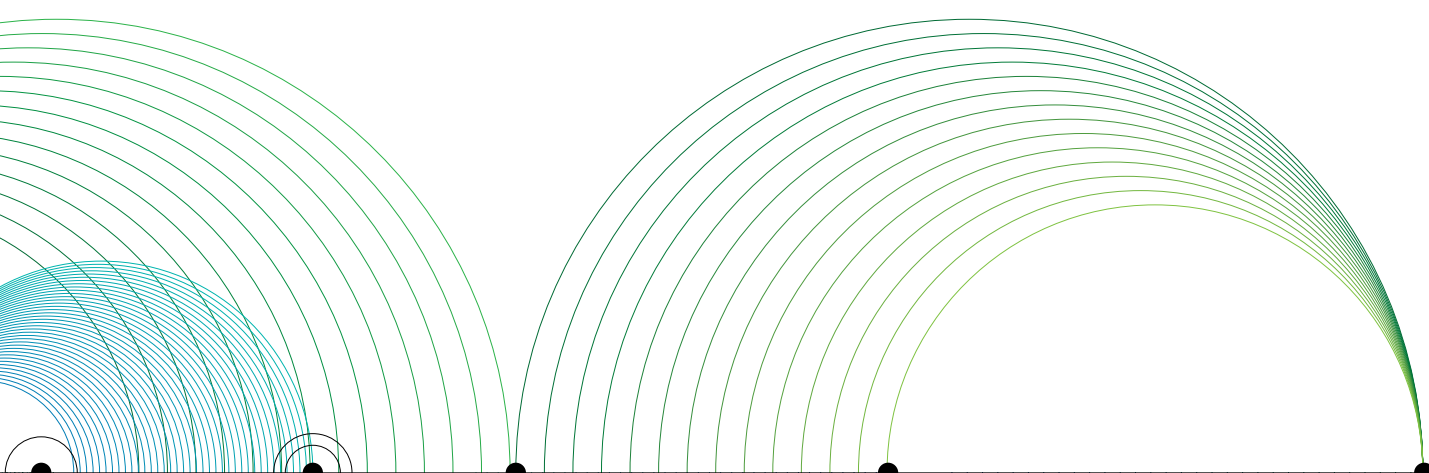
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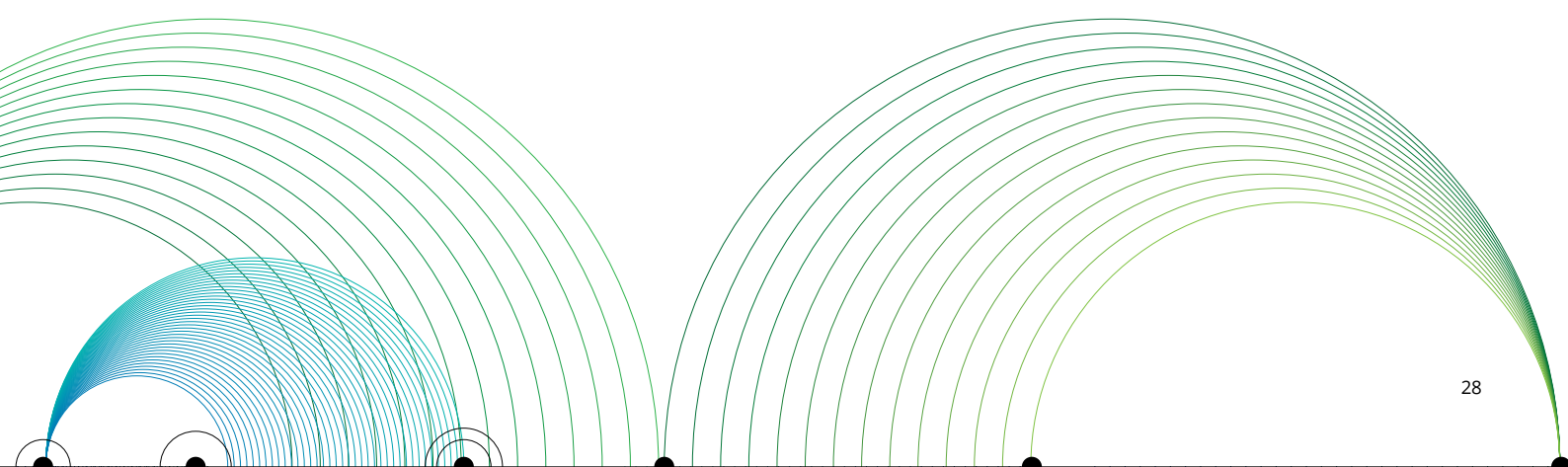
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