The green, electric future of oil and gas

Five avenues to allow the traditional oil and gas industry to play a more pivotal role in a net-zero world

February 2021

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Introduction

The COVID-19 outbreak has not dampened the worldwide push for greener energy, despite some predictions to the contrary. Customer demand, government action, and other market forces continue to shift primary energy consumption away from fossil fuels toward renewable and decarbonized alternatives. Although the following developments present challenges for traditional oil and gas companies, they also present an opportunity to adopt new, clean-energy business models that can support their recovery and generate growth in a net-zero future.

Demand signals and operating environment

Even as oil and gas demand begins to rise again after COVID-19 brought the world to a grinding halt, fundamental changes to the structure of how and where we live, work, travel, and use technology will likely remain, with implications for the traditional oil and gas business model.

Although global energy demand stands to grow as much as 50 percent by 2050,[1] it is unclear how much of that energy will be supplied by the oil and gas industry in its current form. The industry may have to wait until the end of 2021 before global oil demand returns to 100 million barrels per day (b/d),[2] while others don't expect demand to ever return to pre-COVID-19 levels.[3]

Meanwhile, excess production capacity, a collapse in commodity prices, and equity market volatility have led to the loss of billions of dollars in energy company stock value and bond depreciation. Many companies face large debts.[4] Banks are seeking to cut their exposure to oil and gas companies during the current demand crisis, so loan redeterminations may trigger earlier-than-anticipated repayments.[5]

All of these developments have cascading ramifications for an industry that only recently trimmed back costs to adjust to the 2014 price collapse..

A motivated industry

Corporate leaders are increasingly focused on addressing risks to their organizations from climate change. Oil and gas executives are no exception:

93% say that decarbonization is a key to succeeding in a net-zero global economy, the highest response of any sector.

97% agree that their ability to manage climate-related risk is important for keeping their jobs over the next five years.

Source: Survey by KPMG and Eversheds Sutherland of more than 500 global business executives, August 2020. For more information, read the report

"Climate change and corporate value: What companies really think."

Government commitments

Oil and gas demand in developing economies is still expected to increase until 2035, and perhaps beyond.[6] By contrast, developed nations around the world are largely pushing for decarbonization.

For example, the energy development plan from the largest global economy, China, stipulates that non-fossil energy must amount to 15 percent of total energy consumption by 2020 and 20 percent by 2030. Additionally, Beijing has become the global leader in electric vehicle (EV) manufacturing and sales with an ambitious push to electrify mobility.[7]

In recent months we also have seen many COVID-19 stimulus packages that include sustainable infrastructure and clean energy initiatives, e.g., the European Green Deal. Countries are even stipulating in their liquefied natural gas (LNG) contracts that they will buy only from operators that provide a lower-carbon intensity product.

In the United States, state and local governments are launching proactive measures, such as California's ban on gas-powered cars and passenger trucks by 2035.[8]

Corporate initiatives

In the absence of government regulations, companies throughout the world—most notably in the United States—are voluntarily working toward carbon reduction and renewable energy goals. Approximately half of the Fortune 500 has set goals to reduce their overall carbon emissions,[9] and 23 percent have made commitments to be carbon neutral by procuring 100 percent renewable energy and/or meeting science-based emission-reduction targets by 2030 (or sooner).[10]

Capital markets

As energy consumption shifts more toward green electricity, many investors are increasing their focus on impact and environmental, social, and governance (ESG) investing while exiting fossil-fuel investment and financing. Investors have seen the outperformance of ESG-linked stocks relative to benchmark averages over certain periods, including during the COVID-19 crisis.[11] In turn, investors are rewarding fund managers with ESG-informed strategies with record-setting inflows.[12]

Historically, oil and gas companies faced significant shareholder risk when they moved away from core competencies toward ESG-related businesses. Investors buy into markets and companies for exposure to those very markets; they don't generally take positions in oil and gas companies for electricity and renewables exposure. However, shareholder sentiment is shifting, and investors see that an ESG focus can help shield investments from negative share price performance. In short, in the current environment, diversification into activities that enhance ESG ratings and perceived market value may be better tolerated—and even embraced—by investors.

Finally, there is significant pressure on banks, insurance companies, asset managers, and other capital market participants to transact with businesses that meet predefined criteria on the ESG agenda. Global initiatives such as the EU Action Plan on Sustainable Finance aim to reorient capital to more sustainable businesses. Oil and gas companies that embrace ESG can protect and even enhance their access to debt and equity finance.

Far from constraining oil and gas companies, these developments can be harnessed by the industry to open all-new opportunities for future business.

The new reality for oil and gas

Changes in customer behavior, technology, mobility, and other trends impacting the demand for oil and gas were accelerated by the fight against COVID-19. With plenty of experience recovering from downturns and overcoming barriers to building their businesses, oil and gas companies are in fighting shape to take on the latest challenges.

One important step that organizations can take is incorporating ESG principles directly into their operating models. Whether they invest in renewable energy businesses, develop products and services to help other sectors decarbonize, or pursue other strategies around the "E" in ESG, oil and gas companies stand to reap a host of benefits ranging from improved access to capital and talent, to stronger community and regulatory relationships.

For more about ESG in the operating model and four other key themes that serve as a foundation for navigating the new reality, see our paper *"Revival of the fittest."*

Five avenues for oil and gas companies to lead in green innovation

As oil and gas companies consider how best to weather the current storm and prepare for any lasting impacts from COVID-19, a pivot from a pure *oil and gas* focus to an *energy services* focus—especially energy from renewable or sustainable sources—is an effective overarching solution to the challenges they face.

Over the last several years, a number of the supermajors began quietly moving into electricity-related positions by acquiring both generation capacity and retail providers, as well as fortifying trading desks to capture exposure to financial markets tied to electricity.[13] Originally, these were long-term plays to diversify energy portfolios and gain exposure to renewable electricity production. However, these moves may prove fortuitous as the industry tries to move forward after COVID-19.

Additionally, decarbonization-aligned business models such as alternative fuel production leverage the core competencies of the oil and gas industry: engineering prowess, the ability to operate in adverse conditions, and provision of energy products and services.

Each of the five growth avenues discussed below can enable individual oil and gas companies to leverage their strengths, capabilities, adjacencies, and investments to date. While there are competitors from other sectors entering each of these markets, we strongly believe that the oil and gas industry has natural advantages that can help companies to take a leading role.

1 Renewables: Solar- and wind-based power generation are gaining worldwide momentum

Market potential

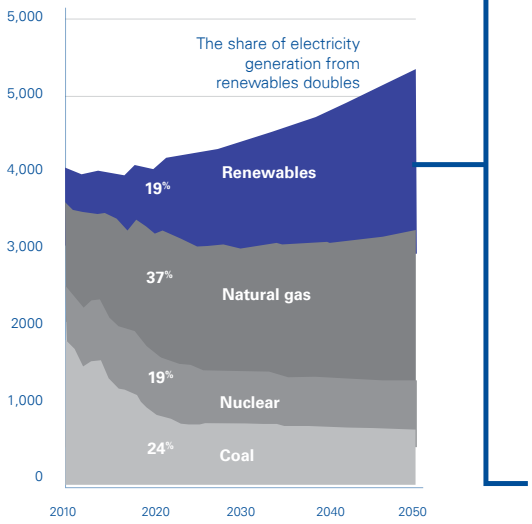
U.S. renewable electricity generation has more than doubled since 2008[14] and could account for nearly 21 percent of electric power in the United States in 2020, according to some analysts.[15]

Production volumes for renewable energy, particularly wind and solar, have grown rapidly; U.S.-installed wind assets now exceed 100,000 MW and solar assets exceed 66,600 MW. These facilities are expected to bring more new generating capacity online than natural gas over the next three years, according to a recent report by The Federal Energy Regulatory Commission (FERC).[16]

All renewables, including biomass, geothermal, hydropower, solar, and wind, will add nearly 51 GW of new generating capacity to the U.S. total by February 2023, while volumes of natural gas, coal, oil, and nuclear power combined will actually decrease by almost 2 GW over the same period.

Electricity generation from selected fuels

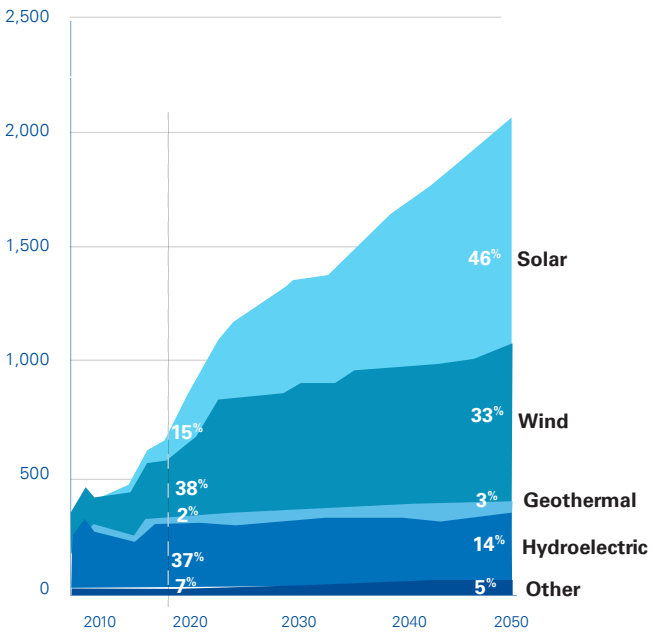
billion kilowatthours



U.S. renewable electricity generation is the fastest-growing electricity resource throughout the projection periods.

Renewable electricity generation, including end use

billion kilowatthours



Promising developments

Barriers to the uptake of renewables are beginning to dissipate.

— Forecasting challenges can be overcome with advanced data analytics and other newer technology tools that allow more accurate predictions around when, where, and how much renewable electricity is available. The most developed models can now predict wind-energy production volumes three to five days in advance with sufficient accuracy to enter the capacity markets.

— The ongoing need to direct electricity from where it's generated to where it's needed can be addressed by ramping up transmission-line projects that link generation assets to load centers. With the help of private developers, utilities will be able to use this tactic to increase renewables penetration.

— Complaints about renewable intermittency have been a consistent refrain. Now, grid-level storage goes a long way toward mitigating these issues and allowing shifts in production that align with load conditions. More durable and inexpensive energy storage solutions are among the recent innovations that will help spur the development of renewable energy projects.

— To help improve the economics of grid-storage projects, utilities can consider integrated solutions with renewable energy facilities and stand-alone facilities. This is especially true when investment tax credits (ITCs) and similar tax incentives are captured.

It is worth calling out that offshore wind is finally gaining traction. While this mode of renewable energy has been slow to take hold in the United States as a result of regulatory constraints and real or conflated environmental concerns, its potential as an energy source is tremendous. Compared to onshore wind, offshore-wind technologies are more consistent; boast higher average wind speeds; and utilize larger, taller, and more efficient turbines that maximize the amount of energy collected by individual turbines and farms.

Several years ago, offshore wind production already exceeded 2,000 GW or 7,200 TWh even though production was limited to sites with higher wind speeds, in waters no deeper than 100 meters, that were located outside of economic and environmental exclusionary zones, according to a U.S. Department of Energy study. That was more than double the current annual consumption of energy in the U.S.[17] Since that time, technological advances have helped floating offshore wind become a viable alternative much sooner than expected. Farms can now be constructed further offshore and in deeper waters, allowing the wind energy industry to scale up even faster.

The oil and gas opportunity

Oil and gas companies and the constellation of companies that support them are keenly aware of how to build and operate in an offshore environment. Wind energy provides an excellent opportunity to develop new energy service markets and even activate idled onshore and offshore infrastructures, equipment, and personnel.

Measured by levelized cost of energy (LCoE), wind and solar technologies are at least as competitive—and, in many markets, more competitive—than energy generated from fossil fuels.* In fact, recent analyses suggest that solar and onshore wind are now the least-expensive sources of new-build generation for at least two-thirds of the global population and will make up almost 50 percent of world electricity generation by 2050.[18]

* For oil and gas companies considering a renewable energy push, LCoE is a useful benchmark to evaluate competition in a particular market. As measured by LCoE, the average cost of electricity generation for an asset over its lifetime has decreased steadily since 2010 and is expected to decrease even further by 2030. However, it is important to keep in mind that this measure doesn't fully reflect factors like developer returns and risk profiles when quantifying the price of purchasing renewable electricity.

2 Hydrogen: The most ubiquitous energy source is finally having its moment

Market potential

Achieving corporate- and country-level decarbonization and emissions goals is becoming increasingly challenging as targets become more aggressive and existing tools are exhausted.

Enter hydrogen—the most abundant atom in the universe. Hydrogen boasts the densest fuel per unit mass, more than 2.5 times that of gasoline,[19] and it is one of the cleanest sources of energy given that it produces little more than water vapor when burned.

Low-cost production and storage of green hydrogen create a wide range of energy-delivery use cases. For example:

— A strategic approach to energy storage can help companies mitigate the seasonal variability of renewable energy production.[20] During periods of excess electricity production, bonus electricity can be used to produce and store hydrogen. Then, during periods of intermittent variability and reduced output, stored hydrogen can be used as a large-scale "battery" to ensure continued production of low-carbon energy to meet demand.

— Hydrogen can also facilitate decarbonization in long-haul trucking and transoceanic shipping. Both forms of transportation require significant volumes of stored energy in the form of diesel and bunker fuel. The current generation of battery technologies doesn't offer enough storage to meet operational requirements without compromising on freight load and/or adding significant costs. However, renewably produced hydrogen converted and stored as methanol and/or ammonium can serve as a transition fuel, enabling these critical commercial activities to continue while better energy storage and delivery technologies are developed and matured.

Promising developments

Hydrogen is an increasingly attractive option for decarbonizing electricity, heating, transport, and industrial processes, among other scenarios.

While utilizing electrolysis to produce hydrogen from water requires considerable electricity, the price of solar and wind to power electrolysis continues to rapidly decline.

Together with increasing demand for differentiated energy products, the economics for hydrogen are becoming more advantageous. When produced with renewable energy-powered electrolysis, the process and resulting "green-hydrogen" fuel comprise a carbon-neutral decarbonization solution.

As companies invest in solar, wind, and other cost-effective processes, hydrogen production volumes can begin to scale to meet growing demand across a range of energy consumption modalities. A recent study by the Hydrogen Council noted that the broad development and adoption of the *hydrogen economy* could meet 18 percent of the world's total energy requirements by 2050.[21]

The oil and gas opportunity

As interest and investment in hydrogen grows, the oil and gas industry can support and even drive development.

Oil and gas companies have decades of experience with petrochemicals, carry the in-house expertise to support the development of hydrogen-related innovations, and know how to build energy production facilities at scale. This practical experience enhances the industry's credibility with both capital markets and regulators, which opens doors for investment, eases the processes of piloting and permitting innovative technologies, and creates opportunities to capture advantageous tax structures associated with research and development.

Additionally, with a little processing, oil and gas companies can use their existing transmission and distribution pipeline infrastructure network to transport hydrogen. By leveraging the network, the oil and gas industry can play a critical role in accelerating the adoption of hydrogen across a wide range of industrial, commercial, and retail domains while reducing associated energy costs and carbon emissions.

3 Biofuels: Gaining increasing government support

Market potential

Next-generation or advanced biofuels overcome the limitations of fossil fuels and earlier-generation biofuels. Biofuel producers can utilize existing infrastructures in lieu of building new, specialized equipment. They can also reduce associated processing and refining emissions, while encouraging responsible land use, including the use of non-food crops as feedstocks. These fuels, when coupled with low-carbon fuel certifications, are economically attractive to produce and are increasingly viewed as an environmentally responsible alternative to traditional fossil fuels by both customers and government agencies.

Promising developments

Next-generation biofuels are receiving a significant boost by government agencies and research universities that are exploring a wide array of next-generation biofuel pathways: biodiesel; hydro-isomerized fats and oils; biomass pyrolysis-derived diesel; cellulose-derived oxygenates; ethanol, butanol, and similar long-chain alcohols; biomass pyrolysis-derived gasoline; and cellulose-derived oxygenates. The research continues to explore fuels and fuel combinations that can help optimize cost, performance, and energy density for both compression and spark-driven engines.[22]

Low-carbon fuel markets are developing rapidly across many geographies where oil and gas companies operate. Markets such as California's Low Carbon Fuel Standard (LCFS) and the EU's Fuel Quality Directive are proving to be profitable for suppliers as they have preexisting production infrastructures equipped to deliver qualifying fuels.

The oil and gas opportunity

Unlike established oil and gas companies, the low-carbon fuel producers responding to these local mandates may not be the most robust or experienced liquid fuel players in the petroleum and petrochemical sector. As a result, they may be missing out on opportunities to enhance their market share, improve operational performance, or achieve economic efficiencies to improve production margins.

Oil and gas companies could open or transition existing facilities for low-carbon fuel manufacturing in or adjacent to jurisdictions with applicable markets and potentially operate more efficiently and effectively than these less-experienced producers. Larger companies are also better equipped to scale production than many niche or boutique entities, which may have capital constraints and/or lack of experience operating large-scale industrial refineries.

4 Commercial transportation: The first phase of a broader transition to electric vehicles

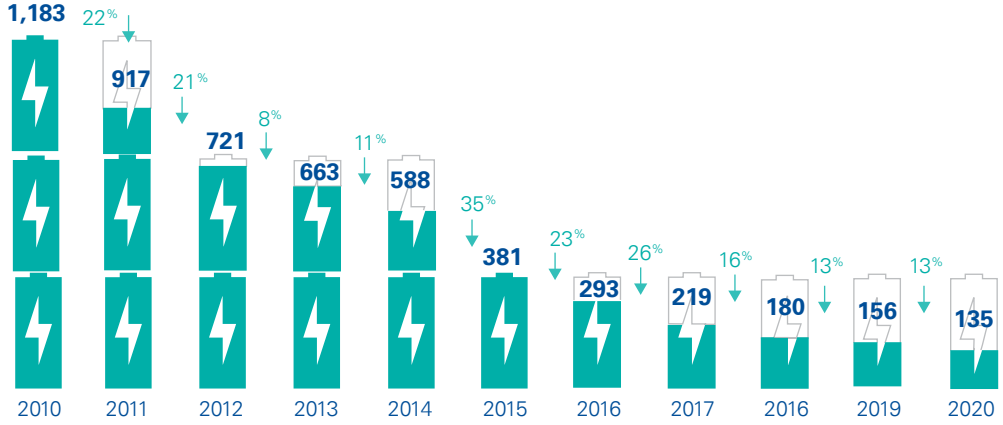
Market potential

Beyond renewable energy, transportation represents the single most significant opportunity to kick-start large-scale acceptance of low-carbon energy. In the U.S., electrification of the trucking industry—the largest purchaser of finished petroleum products in the country—will have a far greater impact on the oil and gas industry than consumer EV growth.[23]

For a blueprint on how electrification of transportation can play out, American oil and gas companies can look to China. The Chinese government is driving the global market for electric buses by prohibiting cities from acquiring traditional diesel buses. At one point, Chinese city governments were bringing more electric buses online every week than the total number of commercial EVs operating in the world. More than 400,000 electric buses on Chinese roads,[24] has reduced worldwide petroleum demand growth by almost 3 percent.[25]

Lithium-ion battery price survey results: Volume-weighted average

Battery pack price (real 2019 $/k/Wh)



Source: BloombergNEF

In the U.S., having fleets of electric commercial trucking vehicles with long-haul capabilities and rapid recharging capabilities will result in a massive reduction in fuel demand. And the innovation most likely to shift the transportation landscape is less expensive battery technology.

Promising developments

Battery manufacturing costs have declined an average of 18 percent annually over the last decade. As prices continue to fall, the business case for battery-powered trucking becomes more favorable.

Initial applications are likely to be local and regional, i.e., routes of less than 200 kilometers a day primarily between and within cities. Based on their load factors and travel distances, trucks assigned to these routes require less than half the battery storage of long-haul-trucking platforms.[26] A smaller battery size in turn reduces associated purchase premiums to less than $25,000,[27] which based on recent analyses can be recouped in less than two years as a result of reduced fuel and maintenance.[28]

The oil and gas opportunity

COVID-19 has reshaped consumer buying behavior for the near future, if not forever. Customers who increased their online purchases during shutdowns and enjoyed the convenience and value of shopping from home are likely to continue to do so. This activity will multiply the number of deliveries—from manufacturers to warehouses to distribution centers to individual homes.

Electric commercial trucking is one-way companies can improve efficiencies and meet carbon emissions targets. While the utility industry has made greater inroads in establishing charging stations than oil and gas, companies with a downstream footprint to leverage on the highways can consider building charging stations at warehouses and manufacturing facilities.

5 Carbon capture, utilization, and storage: Making decarbonization possible across all sectors

Market potential

Removing carbon from industrial sources and the atmosphere is a critical component of the transition to a "net-zero energy system."29 Carbon capture, utilization, and storage (CCUS) solutions include a wide range of promising technologies to capture and repurpose carbon dioxide (CO2) to enable industrial processes like enhanced oil recovery, or to sequester it underground.

There are two approaches to capturing carbon:

- Direct air, which captures carbon directly from the ambient air
- Indirect air, which includes nature-based support (reforestation, restoration of habitats, etc.), naturally occurring carbon-capture processes (land management techniques), and technology-based processes (bio-based fuels incorporating CCUS components, etc.).

Promising developments

While the earliest CCUS projects were technically viable, achieving large-scale development and deployment was hampered by complexity and cost. The next generation of CCUS has quietly emerged and appears primed to deliver on its promise in both power generation and industrial applications where the oil and gas industry can participate.

Oil and gas companies have a great deal of experience developing large, highly complex industrial facilities. This puts the industry in a strong position to build and operate carbon-capture and sequestration facilities not only for themselves, but also for those customers who lack the ability or desire to directly operate their own.

The oil and gas opportunity

Oil and gas companies could be knowledgeable and experienced partners to large, nontechnical emitters such as airlines and commercial real estate owners looking to build and operate CCUS equipment, including direct air capture solutions. This would involve either a technology-based approach using liquid catalysts to capture CO_2 from air passed over chemical solutions, allowing the balance of the air to return to the environment; or a dry chemical/solid catalyst approach, in which air chemically bonds to a filter or other media and is locked in place.[30]

In regard to forestry-based solutions, a handful of oil and gas companies, particularly the European IOCs like ENI,[31] Shell,[32] and Total,[33] are making significant investments, such as the multicountry REDD+ effort.

These solutions are designed to generate carbon offsets for direct consumption and resale. In some instances, the offsets are used to create differentiated products for sale to the market whereby end-users can directly manage emissions while continuing to use existing equipment and infrastructures.

As noted, the industry may use captured carbon to offset emissions associated with retail and commercial products, or to develop novel carbon-based products. For example, hydrogen can be combined with carbon monoxide produced during the carbon-capture process to create synthetic versions of such commonly used fuels as gasoline, diesel, and jet fuel. When these fuels are produced using renewable energy, their use is considered carbon neutral.[34]

Oil and gas majors are starting to make their moves

At present, European majors are well ahead of U.S. companies in the push toward renewables and related utilities.[35] The U.S. oil and gas industry's average investment in noncore areas, including green energy, has been around one percent of total capital expenditure to date.[36] It's no surprise that U.S. companies have been more conservative, given investor expectations and other challenges for even the very largest players in oil and gas. However, their efforts are expanding. Examples across the globe include:

- ***BP*** announced a $1 billion investment in offshore wind projects through a deal with Equinor in September 2020 and is looking to expand even further in North America. The move was part of the company's stated target of net zero by 2050, including increasing renewable power capacity to 50 GW over 10 years. The company already has a sizeable onshore wind business.[37] BP has also partnered in CCUS and hydrogen projects, among others.[38]
- ***Chevron*** has a modest renewables portfolio of around 65 MW, designed to serve its core oil- and gas-producing operations.[39] The company recently entered a global power purchase agreement (PPA) designed to "green" its power supply, which represents a significant advance. The company has also invested $1 billion in CCUS projects in Australia and Canada, and, in 2018, launched a US$100 million Future Energy Fund to invest in innovative technology.[40] The venture capital fund has targeted EV charging, battery technology, and direct-CO_2 capture from the air.
- ***ExxonMobil*** is investing more than $1 billion per year into R&D-related to reducing carbon emissions, and the company has a biofuels output goal of 10,000 b/d by 2025. The company has also invested heavily in carbon capture and storage (CCS) and discloses it has a working interest in approximately one-fifth of the word's total carbon-capture capacity.
- ***Royal Dutch Shell's*** low-carbon business plans include investing between $2 billion and $3 billion annually in wind and solar power generation alone, with additional investment dedicated to EV charging, hydrogen and biofuels, and other clean energy innovation. The company's incubator, Shell Ventures, invests in and partners with small and medium enterprises (SMEs) to develop new technologies and business models.[41]
- ***Total*** now has a gross low-carbon power-generation capacity of almost 9 gigawatts worldwide, including 5 gigawatts from renewable energies and a target of 25 GW of renewable generation by 2025.[42] At the beginning of 2020, the company won Europe's largest EV charge-point contract in the Netherlands, partnered with Groupe PSA in a pilot EV battery facility, and took a 2 GW Spanish solar position.[43]

Next steps

With the right strategies in place, oil and gas company leaders can capitalize on this moment in the industry's history. The journey starts with the following:

Match opportunities with strengths

Explore each of the five ways to lead in green innovation we present in this paper and determine which of the ideas align best with the organization's assets and experience. For example, many supermajors have the cash reserves and assets to ride out current challenges, as well as the ability to scale electricity and related energy services. At the same time, many mid-tier and smaller companies are nimble enough to readily develop and integrate innovative solutions, carving out niche markets where larger players may be unwilling or unable to compete economically.

Establish financial resilience.

Go beyond taking short-term actions, such as restructuring debt and preserving liquidity. Ensure the organization is as efficient as possible, is properly managing financial risk, and has the resources and access to low-cost capital to take advantage of opportunities as they arise.

Leverage natural advantages.

Tap into the vast pool of knowledge, skills, and industry expertise gained over more than 150 years. With a celebrated history of innovation and years investing in and navigating complex physical and geopolitical environments, oil and gas can play a key role in expanding global electricity to approximately 800 million people worldwide, while still meeting net-zero goals.

By embracing emerging opportunities that allow them to meet demands for cleaner electricity and energy solutions from consumers, businesses, and the industrial sector, oil and gas companies can remain competitive and play a leading role in the worldwide energy transition.

How KPMG can help

KPMG firms provide professional services to:

100 percent

of the oil and gas companies in the **EuroStoxx 50**

81 percent

of the 43 oil and gas companies in the **FORTUNE Global 500**

81 percent

of the 59 oil and gas companies in the **Forbes Global 1000**

78 percent

of the 91 oil and gas companies in the **Platts Energy Top 250**

The business world today is more complex, volatile, and fast-moving than ever before. Business leaders across the world must respond to a range of economic, environmental, and social considerations including energy and fuel use, climate impact, operational decarbonization, water use, and resource scarcity. The journey to a sustainable, low-impact business model that is responsive, adaptive, and resilient to these changes can be challenging.

KPMG energy and sustainability professionals can support companies on the journey along the continuum or at specific points where they need help the most. KPMG firms are among the pioneers of sustainability consulting, which gives us a level of experience few can match.

Local knowledge, global experience

KPMG's global organization means KPMG firms have in-depth understanding of the economic, political, environmental, and social landscapes wherever companies operate. Whatever challenges clients face, we have the professionals with the necessary international experience to assist.

Multidisciplinary teams of professionals

Our energy and sustainability teams works side by side with other KPMG professionals from audit, tax, and advisory, including sector specialists, management consultants, tax accountants, and experts in climate impact, decarbonization, supply chain, infrastructure, international development, and more.

Industry focus and insights

Our sector-focused groups offer tailored advice from experienced professionals, many of whom come from the industry and have an intimate knowledge of specific business issues.

An important first step in the move to NetZero is the accurate capture and reporting of emissions, renewable energy consumption, and carbon offsets.

Learn how KPMG Climate Accounting Infrastructure can help you get to the next level of trust with consumers, investors, and regulators.

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We would like to thank the following contributors: Robert Cuff, Lyndie Dragomir, Kara Fitzsimmons and Theresa Lee.

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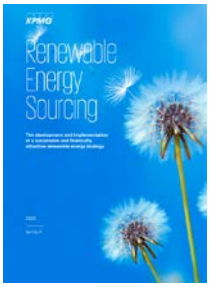

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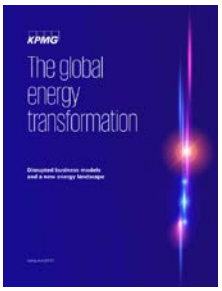

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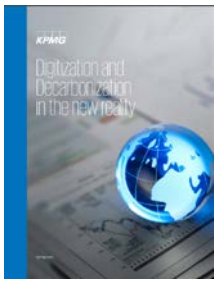

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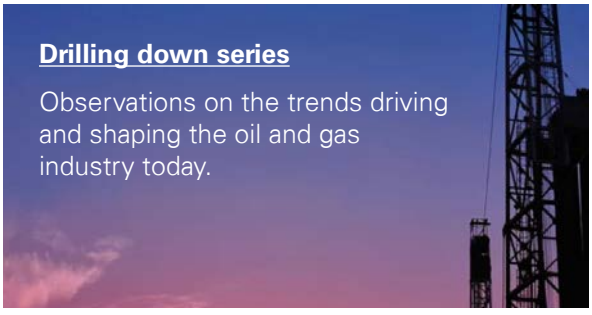

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