IBM Industries

Energizing a global carbon-neutral future across multiple converging industries

Deploying strategies that decarbonize and digitalize businesses for the energy transition

Contents

Executive summary

The energy transition has reached its tipping point. Climate impacts, technological advances, public discussion and regulatory interventions are coalescing to offer unprecedented challenges and opportunities to old and new players in the energy industry. The oil and gas, energy and utilities, automotive, and information and communications technology industries are positioning themselves to compete in the shifting energy market. As a result of the energy transition, the shape and mission of these increasingly connected industries might fundamentally change, and new energy industry leaders might arise. The following scenarios can occur:

- Oil and gas company executives are redirecting up to 10 percent of their capital investments to a diverse portfolio of renewables including wind and solar. These organizations are exploring new technologies for reduction of methane emissions, carbon-capture utilization and storage (CCUS), biofuels, hydrogen fuels, geothermal energy and energy storage. Leaders of oil and gas companies are preparing to capture their market share and mind share in the post-carbon energy market.
- Executives within the energy and utilities industry have typically invested in classic renewables such as wind and solar. But, these leaders are refocusing on the customer relationship customers to create intimacy in a digitalized market where competitors can sell other energy options into the home. They are also preparing to face external threats to their traditionally heavy regulated and localized industry.
- Automotive manufacturers are experimenting with Mobility as a Service. This process aims to transform the end-to-end transportation experience against a backdrop of technology confusion about electric, hydrogen, hybrid, autonomous and cognitive vehicle options. With car sales down overall in the ride-sharing economy, the right choice of business model is key.

Faced with these possible futures—and often contradictory models about the actual speed and scale of the energy transition—energy industry executives must make a decision. Energy leaders need to deploy market strategies that decarbonize and digital capabilities to create new energy ecosystems that make the best use of technological advances and break down traditional industry boundaries. The asset and capital-intensive nature of the energy sector, the complexities in running a network-based business, and the impact of energy choices on consumers, business and governments provides leaders who move first a potential competitive advantage. The initial adapters can thrive in the energy transition and actually help accelerate the process with a sustainable competitive business model.

The energy transition has reached its tipping point

Throughout history, people have always impacted their environment. Climate change is one of the largest impacts human beings have ever had on their environment. A broad consensus is building among a wide variety ofstakeholders—from governments to citizens to businesses—that effective actions must occur globally to mitigate the negative impacts of the use of fossil fuels, including wood, coal, oil and gas. These actions and their endpoints are often referred to as the energy transition. Leaders of the oil and gas, energy and utilities, and automotive businesses are devising strategies to survive and thrive during and after this fundamental transition, which is somewhat steered by changing policies and regulations.

The following diagram shows how many different forces have coalesced to fuel the speed of change.

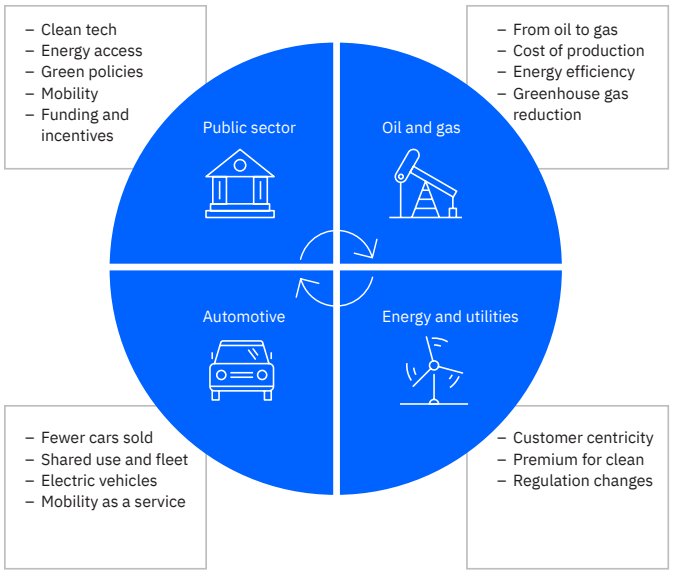

Figure 1: Many sectors of industry influence are impacted by the effects of the energy transition.

The energy transition from carbon-based to carbon-neutral economies is taking place with different degrees of intensity and speeds across the geopolitical landscape. In each region of the world, a complex set of factors influence the transition, such as the energy balance, economic makeup, regulatory environment and political circumstance. Despite geographical differences in energy availability, access and use, businesses worldwide are trying many initiatives to mitigate the effects of climate change and shape the energy landscape of the future.

The flow of energy is about to change

The majority of the world's energy currently comes from fossil sources, primarily produced by the oil and gas industry. Approximately 60 percent of that energy is used directly to generate heat or motion and 40 percent is converted into electricity. The approximate breakdown for use of energy from fossil fuels is 20 percent for mobility and transportation, 30 percent for industrial and agricultural processes, and 50 percent for heating, cooling and lighting of buildings.

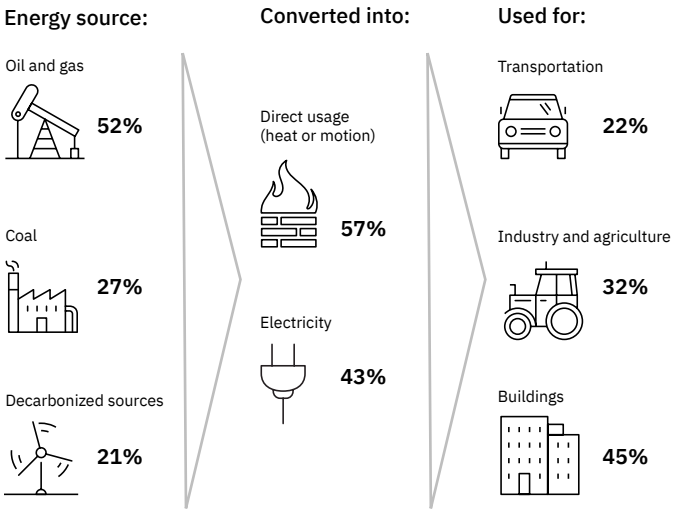

Figure 2: Global flow of energy (left) to usage (right), simplified from Cullen and Allen.[1]

Considering the industrial landscape with Figure 2 in mind helps understand where the oil and gas, electric utilities and automotive industries are currently active. As the world continues to decarbonize, these industries might have to redefine their positions in the energy ecosystem on production, consumption, or both.

Decarbonization meets digital: New energy

Renewable energy sources depend on uncontrollable factors such as the weather and are therefore mostly generated intermittently. Their production is also decentralized. In contrast, the fossil energy system uses a limited number of capital-intensive production companies that guarantee a steady flow of supply. When renewable energy sources replace fossil fuels, a delicate balance of supply, storage and demand needs to be managed to help ensure energy availability and, in the case of electricity, keep the electrical grid stable.

Digital technologies are essential to keeping this delicate balance. The technologies are also necessary to service increasingly fickle end consumers, who have mobile devices to buy their energy and monitor its usage. In many parts of the world, these same consumers own solar panels to produce energy, and car and home batteries to store energy. This setup is sometimes called the democratization of the energy system, whereby consumers also play the role of energy producer due to the digital revolution. To win in this complex new energy world, energy producers need to excel in a combination of decarbonization strategies and digital capabilities.

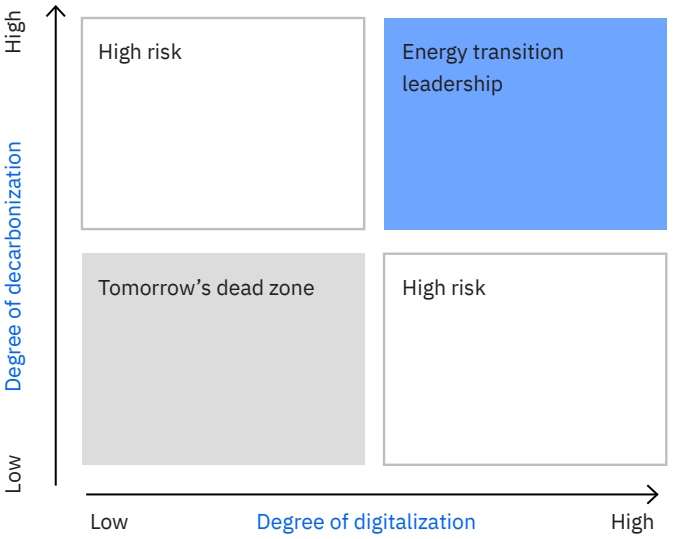

Figure 3: Future energy industry leaders can safeguard future revenues and their license to operate through decarbonization strategies, while improving operational margin and enhancing customer intimacy with digital capabilities.

Energy company executives which only pursue a decarbonization strategy without operating digitally are at risk of becoming tomorrow's commodities. Leaders of these companies can be left out of the conversation and dependent on the intelligence of others to understand and meet customer demand. These executives are also likely to have inefficiencies built into their physical operation.

On the other hand, energy company leaders who build digital capabilities without changing their fossil fuel production portfolio risk being left with uncompetitively priced and unwanted fossil assets. With no decarbonization strategies, these executives might eventually even lose their licenses to operate.

Forward-looking energy companies should therefore combine decarbonization and digital technologies, approaches and strategies to assume a leadership position in a carbon-neutral digitalized world. This is the world of new energy.

Equally unequal: Facing the energy trilemma

The energy transition is well underway, but not in the same way in all places. Perspectives on the causes of climate change, its impact and the appropriate responses vary geopolitically by ambition, direction and speed. Remediation actions that are taken occur unequally as well.

This uneven situation is the result of the "trilemma," a difficult choice between three alternatives. The World Energy Council (WEC) considers energy sustainability a trilemma defined by the following three core dimensions:

- Energy security
- Energy equity
- Environmental sustainability

The WEC claims that "achieving high performance on all three dimensions entails complex interwoven links between public and private actors, governments and regulators, economic and social factors, national resources, environmental concerns, and individual consumer behaviors."[2] These factors cause different transition speeds and pathways for energy transition throughout the world.

The moment of price parity between a fossil and a renewable energy source is a great indicator of how the energy transition might progress. When renewables are available at the same price point as fossil fuels, consumer preferences and economic momentum—supported by policymakers—can conspire to propel the energy transition forward. According to an analysis by the International Renewable Energy Agency (IRENA), price parity for electricity generation has already occurred in some regions of the world. These changes notably are for onshore wind, hydropower, solar, geothermal and biomass generation, given the right environmental conditions.[3]

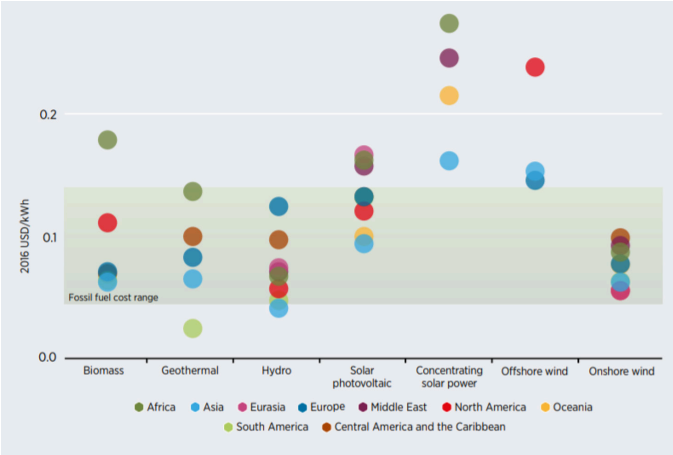

Figure 4: The diagram from IRENA depicts the weighted average levelized cost of electricity by renewable power technology, 2016 and 2017.[4]

The moment of price parity between electrical and traditional vehicles is expected to occur around 2025, with some regional variation.[5] For heat, the moment of price parity is more difficult to assess. Several technological barriers still prevent renewable heat from scaling in the same way as renewable electricity.[6]

Therefore, the energy transition might be highly differentiated across sectors, regions and nations, and depend on the ability to scale technological advances. This process raises complications but provides an opportunity for a combination of diverse approaches and solutions. Recognizing and using these opportunities can give rise to the future multi-sector energy leaders who can convert the energy industry transition into their competitive advantage.

New names, new energies, new ecosystems

A tipping point in the energy transition occurred March 15, 2018, when the Norwegian oil company Statoil became Equinor. The press announcement explained the reason why in the following statement: "The name change supports the company's strategy and development as a broad energy company … 'The world is changing, and so is Statoil. The biggest transition our modern-day energy systems have ever seen is underway, and we aim to be at the forefront of this development. Our strategy remains firm. The name Equinor reflects ongoing changes and supports the always safe, high value and low carbon strategy we outlined last year,' says chair of the board in Statoil, Jon Erik Reinhardsen."[7]

Two months later, tasked with supporting innovative energy companies, leaders of Shell Ventures invested USD 60 million in German battery storage manufacturer Sonnen to develop scalable domestic batteries. This initial investment was just one in a portfolio of a USD 2 billion annual investment into what Shell executives call "new energies" and followed the March 2018 acquisition of UK-based First Utility. Shell leaders then rebranded First Utility to Shell Energy Retail and acquired the European electrical vehicle (EV) charging company New Motion and the US-based EV charging and management software company Greenlots. Executives at Shell also took full ownership of Sonnen, thereby acquiring the third largest manufacturer of home batteries.[8]

Leaders at BP have their own alternative energy program, investing in biofuels, biopower, solar and wind, with a long list of interests.[9] For instance, BP executives acquired Chargemaster for EV charging, similar to leaders at Total who acquired G2mobility.

In March 2018, executives at ExxonMobil and Synthetic Genomics Inc. announced a new phase in their joint algae biofuel research program designed to produce 10,000 barrels of algae biofuel per day by 2025. "Our work with Synthetic Genomics on algae biofuels continues to be an important part of our broader research into lower-emission technologies to help reduce the risk of climate change," said Vijay Swarup, vice president for research and development at ExxonMobil Research and Engineering Company.[10]

The hunger for acquisitions, consortia, new ventures and technology startups seems to have started in earnest in early 2018 across the chemicals and petroleum industry. Leaders of Equinor, Shell, BP, Total—and to a lesser extent ExxonMobil—are working toward the energy transition through some or all of the following initiatives:

- Exploring cleaner ways of producing fossil fuels
- Shifting to gas from oil
- Accelerating the gas-to-power business
- Increasing their EV charging presence
- Purchasing electrical utilities
- Participating in alternative technology development around biofuels or hydrogen fuel
- Supporting reforestation or CCUS programs

Some people argue that these efforts are examples of greenwashing and that investments in renewable energies—although large—remain small compared to investments committed to new exploration and continued production of hydrocarbons. Indeed, oil and gas executives aren't halting exploration and production of oil and gas, because global energy demand continues to rise, and oil and gas prices are not expected to drop dramatically until 2030.[11]

Meanwhile, many industry initiatives are underway to produce hydrocarbons in the most energy efficient way, reduce green-house gas emissions by preventing methane leaks, and use the geoscience know-how from exploration for carbon sequestration and geothermal development. Oil and gas leaders are getting ready for when diversified energy portfolios, integration and balancing of different types of energy, and altered consumer behavior in transportation and housing fundamentally change the traditional energy ecosystem. Their investments signal that in terms of brand equity, technological know-how and financial portfolios, oil and gas executives are playing for long-term energy leadership in a more carbon-neutral world.

The same approach applies to leaders in the energy and utilities industry. Since 2014, executives with the French gas utility provider ENGIE have led a strategic shift by investing massively in renewable energies—including solar, wind, geothermal, biomass, hydroelectric and nuclear—and energy efficiency services. In 2015, ENGIE leaders announced their decision to stop new investments in coal plants and dispose of EUR 15 billion in assets to reinvest into projects that promote low-carbon, distributed energy. ENGIE executives also announced plans to invest EUR 22 billion in renewable energies, energy services such as heating and cooling networks, and decentralized energy technology.

The strategy of ENGIE leaders is to promote what they call decarbonized, decentralized and digitalized energy. To reach that goal, executives plan to invest EUR 1.5 billion on digital and new technologies related to energy.[12] ENGIE leaders are also promoting an open innovation approach that supports development of intelligent networks such as smart grids, Internet of Things, green mobility, energy storage and hydrogen.

In the face of the EV revolution, some automotive manufacturing executives have joined forces with major oil and gas leaders in consortia to develop an EV charging infrastructure. One example is Ionity, where executives from BMW, Daimler, Ford and Volkswagen work with their counterparts from Enel, ENI, OMV, Q8 and Shell. Ionity plans to have 400 EV charging stations in Europe by 2020 as the demand for electric vehicles is projected to rise exponentially in the coming decade.[13]

The use of hydrogen fuel cell powered electric vehicles are also increasing. Fuel cells convert compressed hydrogen into electricity to power the electric motor of a vehicle, with water vapor as the only emission. For hydrogen-electric transport to succeed, vehicle manufacturers, fuel suppliers and governments need to work together to build the vehicles and put in place the refueling infrastructure. To create a scalable solution, executives with energy majors Shell, Total and EMV; car manufacturers BMW, Volkswagen, Honda, Toyota and Hyundai; and industrial gas manufacturers Linde and Air Liquide have joined together to form H2 Mobility. This consortium is developing a German network of hydrogen refueling stations for hydrogen cars, with 100 stations ready by 2020 and an additional 300 planned.[14]

The development of these mobility infrastructures are examples of how new fuels, electrification and an evolving energy ecosystem are converging. Leaders of Shell, ENGIE, Volkswagen and their peers are competing with and promoting startups and alternative energy ecosystems that are using innovative technology to realize value from decarbonization. Startups, new entrants and incumbents from the traditional electric utilities, oil and gas, and automotive industries are disrupting the energy system, and all want to win in end-to-end service to mobility, power and heat value chains.

The incumbent advantage

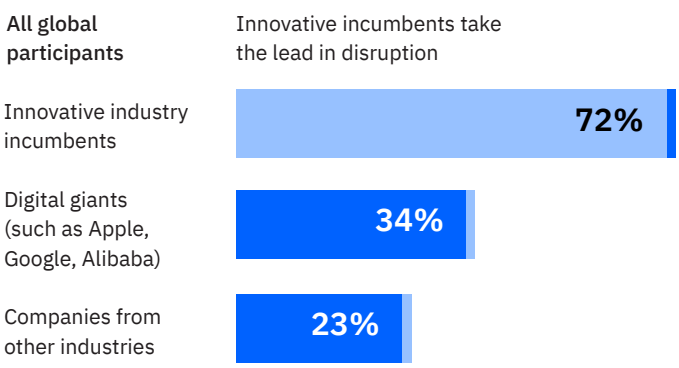

Figure 5. Innovative industry incumbents are taking the lead in industry disruption.[15]

While operators of startups initially led digital disruption, industry incumbents have transformed themselves. With their focus on the consumer experience, an agile culture and use of technologies born in the cloud, startup leaders provided new services and experiences at lower cost for much of the 2010s. However, research by the IBM® Institute for Business Value (IBV) suggests that incumbents are striking back.[16] Of approximately 13,000 C-suite executives interviewed by IBV, 72 percent indicate that innovative incumbents lead the industry disruption.

Within the energy industry, incumbents have three major advantages over nonestablished players:

Access to capital
The energy transition requires large investments in new physical assets and the scaling of breakthrough technologies to produce, transmit and distribute energy. As energy companies consistently rank among the largest and most valuable businesses in the world, their leaders have the means to finance expensive capital investments and acquisitions and act globally.

Deep expertise
In most countries, the energy market is heavily regulated, and complying with intricate local regulations takes knowledge, time, and in many geographies, a track record. Executives with industry incumbents have experience and expertise working with governments and regulators. Regulatory expertise, in particular, acts as a barrier to entry for many new players. Also, government leaders might consider new energies as a potential new source of income and seize the opportunity together with established players.

Abundance of data
In the industrialized world, utilities have access to massive amounts of data coming from households, especially from households with smart meters that provide behavioral data about energy use. Leaders of oil and gas and automotive companies have more information about the movements and habits of consumers and businesses who use fuels and derivative products such as lubricants and other chemical byproducts. The ability to combine and analyze data about people's homes, transportation, behaviors, buying preferences and business needs can differentiate winners from losers in the new energy ecosystem.

The future of energy might be entirely one of microgrids, peer-to-peer energy trades and digital energy retailers, making oil and gas, energy and utilities, and automotive incumbents defunct at some point. A fast-growing digital business model that greatly simplifies the production, distribution and consumption of old and new types of energy that disrupts the entire value chain is possible.

D(igital)-electricity

Utilities used to be low-risk investments that generated dividends dependably. They delivered such stable returns by efficiently deploying capital for a steady and predictable growth curve. This process satisfied customers by following a business model of meeting a "used and useful" standard in a regulatory context. The utility industry is asset intensive, and for a long time, its players have understood the value of operating assets safety and reliability.

Digital technologies present increased opportunities for industry leaders to operate those assets at lower cost by using more automation and autonomous operation. Those benefits might come back to customers as lower prices, or to local authorities as higher income.

A good example of digital asset operation is the UK's National Grid strategic asset management program. This operation combines life telemetry, maintenance records and historical information from hundreds of different National Grid sites and assets to make recommendations back to planners, engineers in the field, and key decision teams. With this process, the National Grid helps utilities leaders move to condition-based maintenance that takes into account risk and criticality.[17]

Digital technologies also facilitate the growth of new business models developed by new entrants into the industry who own legacy assets. Off-grid solar companies like Husk Power Systems, M-KOPA and SolarNow use blockchain technologies and deep analytics to power new microgrids and peer-to-peer exchanges. The difficult task of investing in assets for meager margins might be left to leaders of incumbent utilities, while the more profitable businesses might be for those utility executives who run microgrids or create an outstanding customer service experience.

Consumers compare their experience of buying energy to that of online shopping and expect a high-touch, multichannel interaction. This belief occurs particularly when consumers know that smart meters allow distributors to understand their profiles, behaviors and buying preferences intimately. These energy users might be willing to trade privacy for convenience. Smart devices like Google Nest have allowed homeowners to manage energy, watch for intruders at the front door and receive home-delivered packages. These devices deliver a real-time understanding of energy demand and can match that need with a renewable supply.

In 2017, approximately 1.4 million customers from 50 US utilities used smart thermostats to provide smart demand response capacity, which reduced energy loads during high-demand periods.[18] European transmission operator TenneT uses blockchain technology to store excess supply and cater to peak demand by using an interconnected pool of electric vehicles, charging stations and home storage systems.[19] The blockchain functions as a virtual power station in a distributed energy storage system. Consumers who make their car or home batteries available to this system receive a fee, enabling a profitable business model for TenneT and drivers and homeowners.

An interconnected energy system between vehicles, homes and grids can shift demand to off-peak times and potentially save billions of dollars from being spent on new electricity infrastructure. Building such an interconnected energy system requires sophisticated analytics to understand and manage demand and supply at every level—with consumers, neighborhoods, cities and so on—and maintain grid stability despite weather and behavior dependent fluctuations. This change means that electricity becomes fueled by Digital: (D)-Electricity.

E(lectric)-mobility

The same complex digital shift that impacts patterns of energy supply and demand applies to mobility, as well. The rollout of "smart charging" electric vehicles shows the need for a ubiquitous digital experience. Digitalization in transportation is well underway in at least the following three important ways:

- Improved in-car experiences offered using cognitive assistants
- Vehicle automation and autonomous driving
- The emergence of new transportation business models providing multimode transportation without requiring vehicle ownership

All of these digitalization movements impact the energy value chain.

Automotive manufacturing executives plan for smart vehicle assistants to take on bigger roles as vehicles become increasingly self-driving and the in-car experience differentiates brands. Autonomous driving can change a car's cockpit into a full-blown entertainment or work environment. This travel experience might not depend necessarily on a personally owned car but could occur through an in-car "digital twin" which duplicates the driver's environment, regardless of the vehicle.[20] Drivers who attach value to the properties of their car and the engine might find more value in the travel experience and perhaps the level of its emissions.

A range of automotive leaders and startups are working on integrated mobility platforms to conveniently take people from point A to point B. Uber, WHIM, car2go and HERE Mobility aim to offer Mobility as a Service (MaaS) to their customers. However, when—as predicted—in-car cognitive assistants advise on travel, autonomous vehicles refuel themselves, mobility become a service, and mobility platforms increase in popularity, the following questions arise:

- Who is responsible for energy choices?
- Who decides when, where and what to fuel or recharge?

Some mobility startups even aim to make recharging obsolete, such as Lightyear, whose vehicle fleet charges with solar power. In the future, the mobility industry might enter the energy industry with vehicles that produce rather than consume energy.

For as long as vehicle ownership remains and cars don't produce their own energy, the entire fuels retail value chain is intense competition for the best experience, brand, intimacy and loyalty. Energy providers must compete for customers' experiences as much as carmakers. E(lectic)-mobility changes the car into a travel experience and fueling into a customer experience.

N(ew)-fuels

Oil and gas retailers understand the need to capture the driver's mindshare and enhance the traveler's experience. Shell executives have invested in the startup Fitcar, a solution that monitors a vehicle's status and provides maintenance advice. These tools provide services beyond what customers expect from a gas station. Similarly, BP leaders have increased customer loyalty by connecting with drivers digitally using deep personalization through the BPme app. ExxonMobil retailers offer drivers a Speedpass app, which allows fast digital payment at refueling stations. Clearly, digital interactions drive old and new fuel operations.

The rise of electric vehicles offers energy executives an opportunity to enter the mobility industry. While predictions are that approximately 80 percent of EV charging might take place at home,[21] the public EV recharging infrastructure for the most part still needs to be built. To enable electric transportation, workers need the capital projects know-how to build out EV charging at scale. Additionally, energy company employees can create or participate in the creation of MaaS platforms, regardless of whether this transportation uses electrical vehicles or combustion engines fueled by gas, diesel, or hydrogen. N(ew) fuels can lead to new digital services and business models for even the most traditional industry players.

Compelling examples of electrification, new fuels and new energy ecosystems, and the application of digital transformation to traditional operations abound. This situation creates an intricate landscape of multimodal energy production, distribution and consumption systems that can enable the following possibilities:

- Energy and utility company executives can pursue digitalization to increase margins from their asset operations; develop consumer loyalty; manage distributed energy production and storage; ensure electrical grid stability; and sustain viable shareholder returns.
- Oil and gas company leaders can drive digitalization to refine their understanding of the earth, its resources and their own emissions; reposition their brands by selling new fuels; expand their reach from the driver to the home; integrate multiple energies; and guarantee their license to operate.
- Automotive retailers can adopt digitalization to offer superior in-vehicle experiences; connect drivers to vehicles, vehicles to fleets and fleets to multimodal mobility solutions; automate transportation; and increase fuel efficiency.

Paying for green

As consumers are increasingly concerned with reaching climate and sustainability goals, shareholders can benefit from company strategies that decarbonize the energy supply with digital consumer intimacy and automated operations to drive long-term profitability.

A global survey by Denmark power company Ørsted found that 82 percent of over 25,000 participants "believe it is important to create a world fully powered by renewable energy. The support is regardless of age, education level or political ideology." The survey reported the following main reasons to support renewable energy:

- National pride about technology leadership
- Concerns about climate change
- Expected economic benefits

Participants cite concerns about climate change as the second most pressing issue the world faces.[22]

The question is whether people who support decarbonization are also willing to pay for a new energy reality. In Europe at least, more evidence indicates that charging a premium for green is increasingly possible.

One national government leading the energy transition is Germany. In 2010, Germany launched the *Energiewende*, a long-term national initiative to develop a low-carbon energy system by 2050 by reducing greenhouse gas and scaling renewable energy. The *Energiewende* is popular, with 90 percent of German citizens considering it to be vital to the country's future.[23] Part of the German energy transition gets financed by a surcharge which German consumers pay on electricity. According to 56 percent of German consumers surveyed, the surcharge is appropriate or can even be increased.[24]

This supportive attitude for helping pay for the energy transition appears in other parts of the world as well. A meta-analysis of consumer willingness to pay for an increase in renewable energy in the energy mix shows that on average, households in Europe and the Americas are willing to spend approximately USD 15 per month. In Asia, it is approximately USD 15 per month.[25] While definite geographical differences exist, a global trend seems to emerge.

Perhaps even more challenging than paying more is changing consumer behavior. A study by the German utility company E.ON indicates that 77 percent of Germans are willing to change their mobility, eating, living or daily shopping pattern to protect the climate. Elsewhere in Europe, a similar trend is visible: 71 percent of the consumers surveyed in Italy and 67 percent of consumers surveyed in the UK are willing to change their behavior.[26]

The trend towards buying clean energy even if the energy comes at slightly higher cost is also evident in the commercial and industrial segments. The list of companies committed to go 100 percent renewable is growing fast and includes a large number of iconic brands across industries and geographies.[27] Renewable power purchase agreements have become increasingly common, despite the operational and financial risks associated with them. Nearly half of the Fortune 500 companies have climate or renewable energy targets or both, with an on average 81 percent success rate in meeting or even exceeding these targets.[28]

Asked who should take lead in the energy transition, the global survey of Ørsted found that "energy companies alongside large businesses and government are expected to lead."[29] In the US, consumers in California want a rapid transition to new energy business models by energy companies. The California Public Utilities Commission predicts that more than 85 percent of the state's retail electric load can be served by non-Investor-Owned Utilities by the mid-2020s.[30] Not coincidentally, California also happens to be the heartland of the digitalization.

If leaders of utilities and oil and gas companies in this rapidly changing energy ecosystem fail to visibly provide greener options for their customers, they're at risk of losing their customer base along with their revenues and margins.

Staying green

In modern business, it is widely accepted that good sustainable performance is also good business performance.[31] This relation most likely holds true when it comes to taking a proactive role, managing risk and making markets in the context of the energy transition. Leaders of the not-for-profit UK charity organization CDP analyzed the relationship between opportunity and risk versus climate governance and strategy in the oil and gas industry. The report indicated that companies with a stronger performance on climate governance and strategy are more resilient in the face of the opportunities and threats presented by the energy transition.[32]

This finding can explain why leaders of companies aiming to be a forerunner in this space, such as Shell and Equinor, are reframing the nature of their core business and are committing to reduce the net carbon footprint of their energy products. Shell's executive compensation might even be linked to progress against these energy transition goals. This example illustrates how a company that wants to lead in the energy industry for the long term has made the energy transition a central part of its vision and strategy. Additionally, Shell's leaders have formulated value propositions that align with their customers and shareholders alike.

First movers need to move together

Being a first mover in a digital energy ecosystem with decarbonization that is reconfiguring itself worldwide has three strategic advantages:

1. The energy ecosystem is a network of many interconnected parties involved in complex and rapidly changing value chains for supply, storage and demand. A larger network of parties can better balance these complexities. For energy ecosystems, offering ancillary service on top of the core task of availability and access to energy produces a very strong effect: The most valuable network provides the greatest diversity of services. Emerging energy networks are similar to social networks that arose in the 1990s and still have an incumbent advantage.
2. Unlike social networks, however, the energy transition requires significant capital investments. Whereas barriers to entry and switching costs for social networks and digital services are relatively low, exchanging energy assets or service providers in an energy network involves considerable effort, costs and know-how. That challenge is why first movers can capitalize on their position in the energy ecosystem for an extended period of time.
3. No single organization can fully own the energy ecosystem because of the combined technical challenges, societal constraints and regional variations expressed in the trilemma of energy security, energy equity and environmental sustainability. When first movers establish a viable ecosystem, challengers are likely to deal with less than ideal starting conditions compared to incumbents.

In the asset-intensive, network-based and increasingly digitalized energy ecosystem, first movers have an undeniable advantage. Incentivizing leaders of energy companies to be first movers can accelerate the energy transition to benefit their business and society.

The exact timeline of the energy transition will play out over the next few years, but for those who want to lead in the energy future of tomorrow, waiting is not an option. To win over the long term, energy leaders should consider:

- Deploying market strategies that decarbonize energy systems and combine those approaches with digital capabilities.
- Creating new energy ecosystems that make the best use of technological advances and break down traditional industry boundaries.
- Winning the hearts and minds of a broad set of stakeholders, starting with the customer.

No matter what the future will bring, the energy sector is likely to remain asset and capital-intensive in nature. This type of industry rewards first movers with a sustained competitive advantage, as they will be in a position to consolidate the emerging energy network. First movers will thrive in the energy transition, while actually helping accelerate this transition for societal good.

For more information

To learn more about the energy transition efforts in the oil and gas, energy and utilities, automotive, and information and communications technology industries, please contact your IBM representative or IBM Business Partner, or visit ibm.com/thought-leadership/institute-business-value

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About the authors

Sonia Van Ballaert, Client Director and Industry Academy Member

Keimpe Nevenzeel, Energy Managing Consultant

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Cristene Gonzalez-Wertz, Institute for Business Value, Energy, Environment and Utilities

David Womack, Chemicals and Petroleum Industry Strategy

Footnotes

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IBM Corporation
New Orchard Road
Armonk, NY 10504

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