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THE ENERGY TRANSITION:

CHALLENGES AND OPPORTUNITIES FOR RISK MANAGERS

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Introduction — The Next Decade: More Change Than in the Past 100 Years

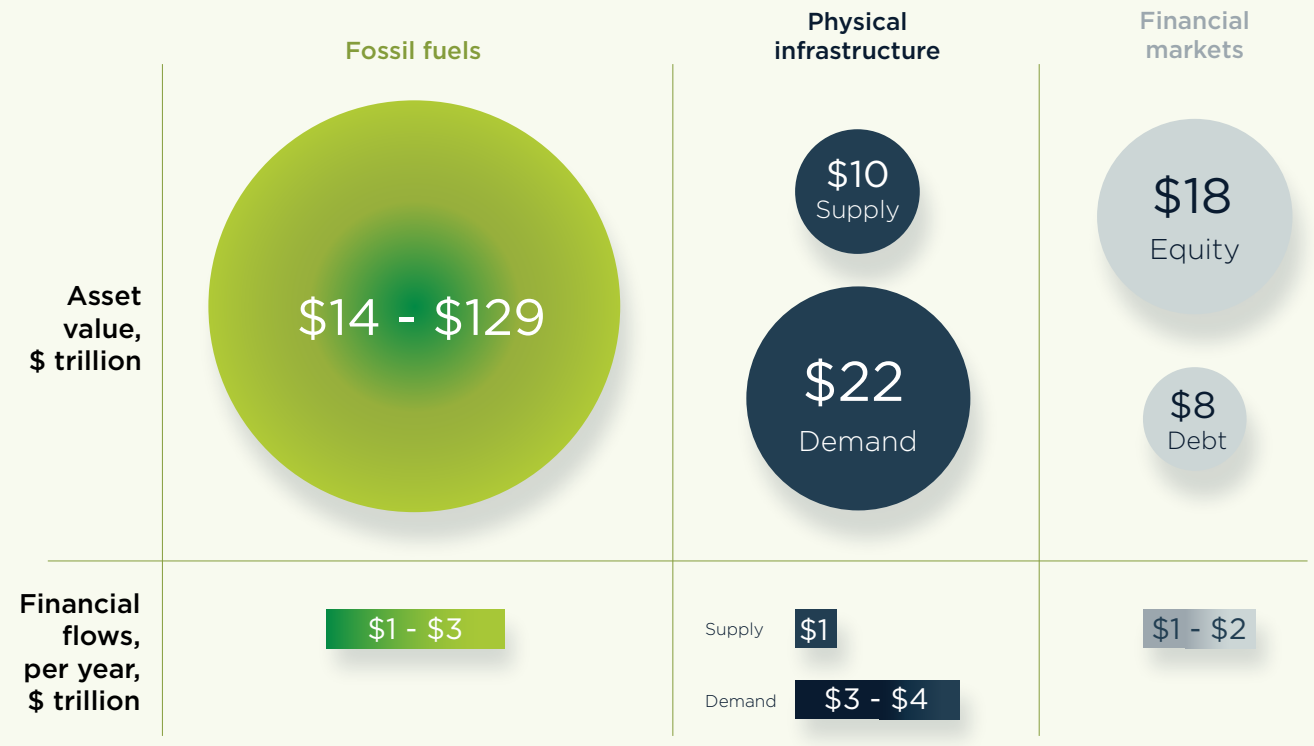
Few industries face the same scale or complexity of risk as the energy sector. Whether financing a decade-long, multi-billion-dollar offshore oil project or finessing the terms of a power purchase agreement between a utility, its customer, and the developer building a wind farm, risk managers in the energy sector must address financial, geopolitical, cyber, and other new and old challenges simultaneously, and in different combinations, day in and day out.

With the transition to renewable energy and the effects of the economic crisis caused by COVID-19, the energy sector faces even greater challenges as it heads into 2021. The evolution toward lower-carbon energy will remake not just the multi-trillion-dollar global energy industry but also the financial ecosystem that fuels it with capital. In 2019, not including the renewables sector, the fossil fuel industry transacted up to $10 trillion in financial flows, while managing more than $70 trillion worth of assets (Fig. 1).

FIG. 1: FOSSIL FUEL MARKETS

GLOBAL ENERGY SYSTEM ASSETS AND FINANCIAL FLOWS

Fossil fuels, financial market size, 2019



Source: CarbonTracker with Bloomberg, IEA, Tong, et al. https://carbontracker.org/reports/decline-and-fall/.

By adapting and extending techniques to calculate financial risk, the energy industry has already begun to cultivate tools to navigate these risks, built on a disciplined culture of expertise focused on markets, credit, and operations. Yet, as history suggests, the industry of the future will require new skills and expertise to manage risks that we know will evolve more rapidly and dramatically than anticipated. Indeed, given the array of variables the industry faces, and the looming climate change crisis, the science — and art — of managing risk in the energy industry will continue to evolve, creating a world of opportunity for risk managers.

Today the practice is pushing quickly into challenging new sub-specialties to address the emerging challenges of the energy transition. Over the past decade, climate has driven dramatic new risk dynamics into the world of energy, including risk to physical infrastructure, new realms of regulation, rapid technological change, and geopolitical factors. New skills, including the following, will be required to help the energy industry handle the issues it faces.

- **Physical risk** — For both energy companies and their customers, climate change is a risk like no other. Predicting energy demand has become difficult due to extreme temperatures and weather patterns. Drought has impacted the output of hydropower dams. More intense storms have overwhelmed utilities' responses and recovery plans. The implications of these intensifying physical risks are rippling through practically every layer of the energy industry.

- **Regulatory risk** — The energy sector rests on an intricate latticework of regional, national, and global rules, touching on everything from water quality to labor safety and financial practices. As the industry morphs to develop, fund, and operate more renewables, legacy rules are undergoing scrutiny and revision to match new market realities. Carbon-related regulations are emerging as a new front of rulemaking, with regulators establishing a mix of fees, caps, and taxes on global warming emissions and other unpriced externalities

- **Cybersecurity and technology risk** — Data links touch everything from household smart appliances to nuclear power plants. Energy infrastructure is an increasingly frequent target for hackers, whether curious teens or malicious state actors. Once insulated by data systems not connected to the wider grid, energy producers now face market pressures to digitize their operations. Adopting machine learning to model complex problems in energy means data completeness and accuracy are key. These advances promise to enhance efficiency but open up issues of data security and integrity.

- **Geopolitical risk** — The energy trade has long been global and thus has always been political. The 21st century brings big new energy markets such as Africa, China, and India into play. This increases the mix of global actors on both the demand and supply sides of energy markets, as billions of people ascend into the middle class and seek more energy services.

Through 2050, trillions of dollars will be mobilized to transform the energy industry, as low-carbon technologies claim a larger share of global supply. As this change unfolds, the decisions — and opportunities — facing risk managers will be increasingly varied.

A mix of regulatory pressures, technical innovation, and market incentives will change "business as usual," and spur a growing number of energy risk jobs inside traditional energy companies, at big corporate buyers of energy, and among banks, traders, and other financial intermediaries.

With a deeper understanding of the changing energy landscape, executives, energy consumers, and financiers can make smarter decisions on how to steer their companies, careers, and policy.

A MIX OF REGULATORY PRESSURES, TECHNICAL INNOVATION, AND MARKET INCENTIVES WILL

CHANGE "BUSINESS AS USUAL"

Beyond COVID-19 — Growth Creates New Opportunities and Novel Variables

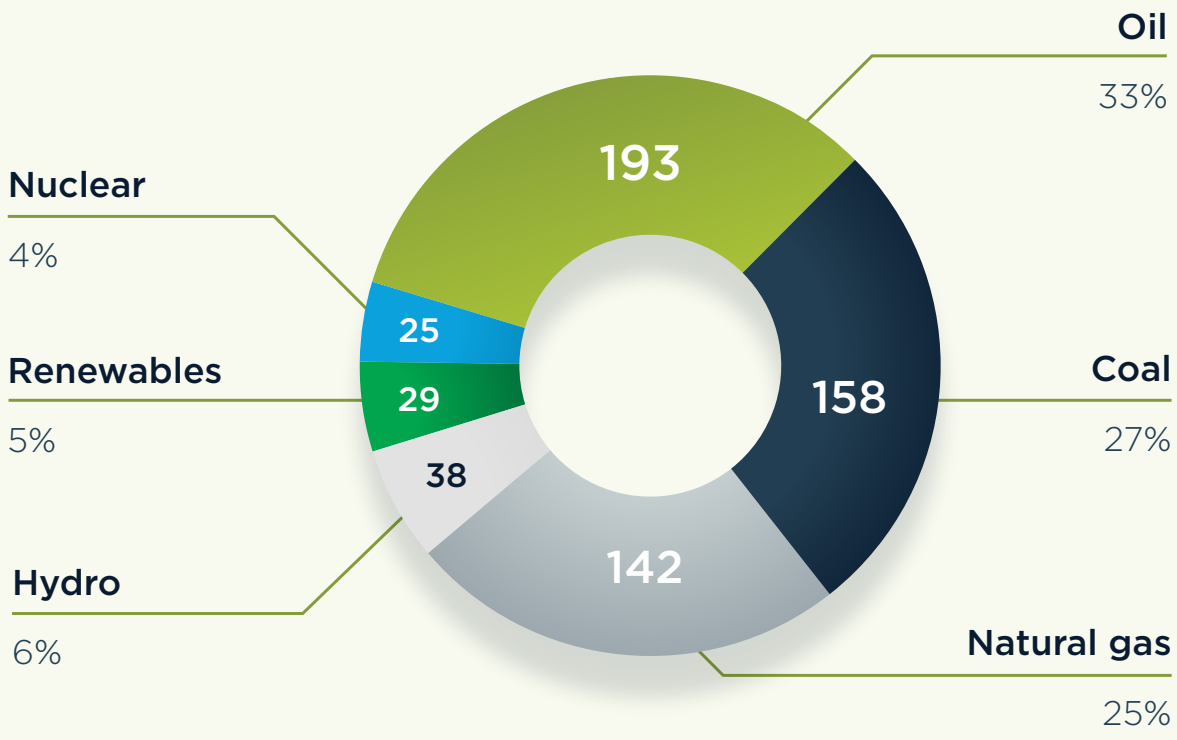
Today, the global energy industry remains predominantly fossil fuel-based even as low-carbon sources grow faster. Global primary energy consumption rose by 1.3% in 2019. China accounted for three-quarters of this growth, with India and Indonesia comprising the next largest shares.[1] Growth will continue to be centered in Asia through 2030. By comparison, energy demand is expected to fall in Europe and the U.S. in the same period.[2]

Though they account for a small share of total energy consumed, renewables such as solar and wind rule the industry's growth story, booking faster growth than all other forms of energy since 2010. In 2019, they accounted for about 11% of global demand (including hydropower), while oil, coal, and natural gas together supplied over 84% (Fig. 2).[3]

FIG. 2: FOSSIL FUELED

OIL, COAL, AND NATURAL GAS SUPPLY OVER 80% OF GLOBAL ENERGY DEMAND

World primary energy demand by fuel, 2019, exajoules



Source: BP Statistical Review of World Energy, 2020, page 4.

To be sure, the economic impact of COVID-19 has been massive and complicates the outlook in coming years. Hundreds of millions have lost jobs, and global economic activity briefly froze. In the second quarter of 2020, overall energy consumption collapsed by about 25%, as demand for road and air travel all but evaporated, according to the International Energy Agency (IEA). While billions quarantined at home, subways, shops, and offices all went dark, causing electric power consumption to fall by 10%-20%. For the year as a whole, sector-wide investment will shrink by about 20%, to around $1.5 trillion.[4]

Further out, the global energy sector is expected to resume its long-run average annual growth rate in the low single digits. Driven largely by growth in Asia, by mid-century, overall energy demand is slated to rise by 50%, the U.S. Energy Information Administration (EIA) anticipates.[5] In that period, fossil fuel's share will decline slowly, as a combination of falling costs and policy support continue to lift renewables.[6]

Although fossil fuels play a major role in the current energy mix — accounting for the lion's share of supply, employment, and investment — a growing flow of dollars, policy focus, and job creation is shifting toward renewables and other low-carbon technologies. Investment in low-carbon priorities is likely to not only recover, but surge, driven by a wave of multi-trillion-dollar COVID-19 recovery stimulus programs taking shape around the globe, led by proposals in China, Europe, and the U.S.[7]

Indeed, the net effect of layoffs in traditional energy firms, combined with increased spending on cleaner alternatives, may spur a shift in hiring, sector-wide. By 2023, the International Renewable Energy Agency (IRENA) sees the potential for 5.5 million new jobs globally in energy-transition-related fields, even as the fossil fuel sector bears the brunt of the COVID-related dip in energy consumption, shrinking by some 1.1 million jobs. Looking to mid-century, IRENA sees the potential for 40 million new jobs in energy-transition-related fields.[8]

The shift is underway already. European oil companies are hiring utility market experts as they enter power generation businesses. U.S. electricity firms are head hunting renewables gurus as they finance more exotic energy technologies such as offshore wind, demand reduction, and storage. And globally, big corporate energy buyers — from airlines to cloud data giants — are looking for trading and hedging expertise as they take greater control over the sourcing, use, and carbon-intensity of their energy supplies.

Implications for risk managers: As goes the wider energy industry, so goes the discipline of risk management. Traditionally centered in oil companies, on commodities desks, and at utilities, the ranks of energy risk managers are poised to track into new niches, too.

IRENA SEES THE POTENTIAL FOR

40 MILLION NEW JOBS

IN ENERGY-TRANSITION-RELATED FIELDS

Fossil Fuels — Conventional Energy Endures in a Volatile Environment

Oil and gas remain central to the global economy and are often embedded in ways that are invisible to consumers. Beyond supplying unprecedented volumes of affordable energy to power our industries — heating and cooling our buildings and propelling practically every form of transport — fossil fuels have also catalyzed access to many of the planet's other resources and accelerated the development of keystone industries.

The transition to zero-carbon alternatives will be challenging, given how deeply fossil fuels are embedded in the global economy. Nitrogen-based fertilizers, for example, a fossil fuel product, are heavily used in agriculture. Petroleum-derived asphalt is used to pave roads and the raw ingredients for plastics, used for a variety of household and commercial products, come from refineries where distillates of crude oil and natural gas are processed into secondary uses (Fig. 3).[9] Heavy industries, such as cement, steel, and pharmaceuticals, rely on fossil fuels in ways renewables can't yet match to achieve the very high temperatures — beyond 900 degrees Fahrenheit — necessary to transmute minerals and other raw materials into more valuable concrete, metals, and chemicals.[10]

Looking to mid-century, conventional fossil fuel firms face a complex mix of opportunity and unprecedented uncertainty. Demand for oil and gas will endure. Untangling hydrocarbons from the global economy is difficult. The pursuit of substitutes is underway, from electric vehicles (EVs) that may replace petrol-powered cars, to "green" hydrogen that could step in for natural gas. Yet there is serious debate over how quickly the world's energy habits will change. Some argue the transition could come in decades, far faster than past shifts from one class of fuel to another.[11] History suggests that past transitions have taken longer to unfold.

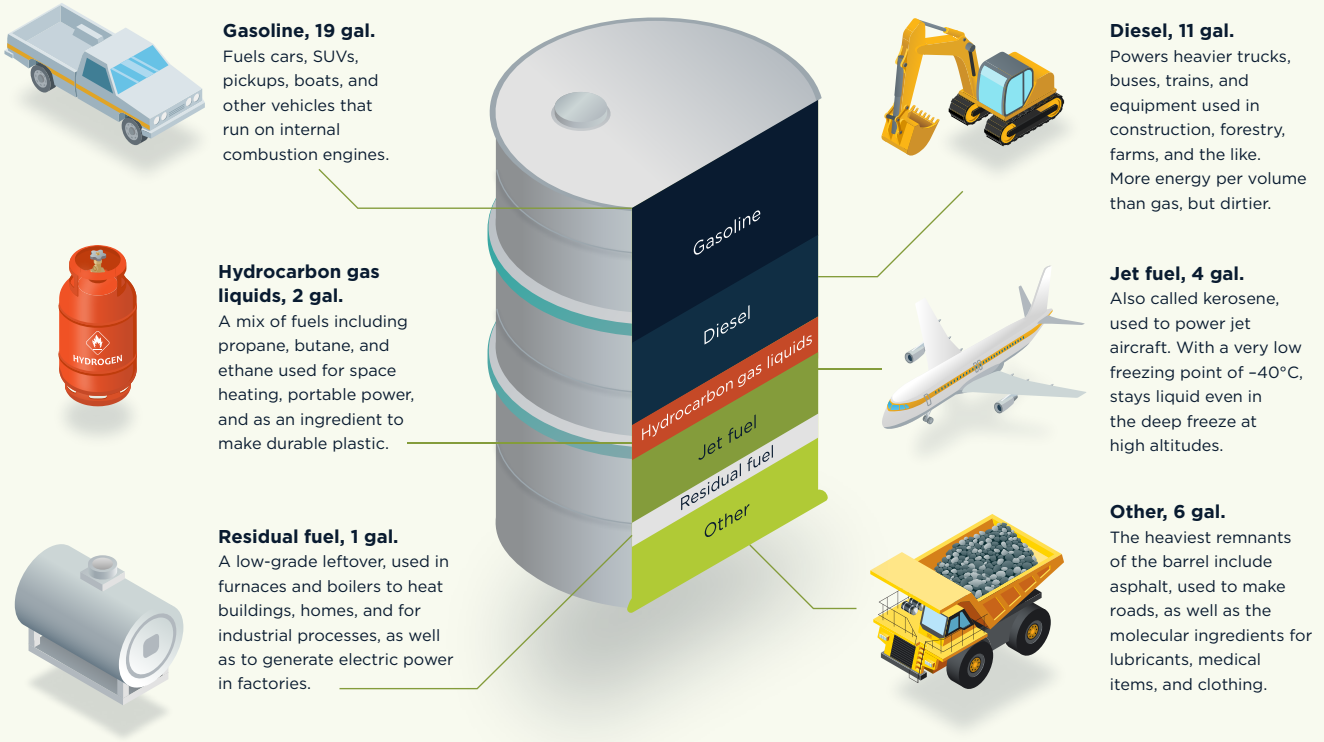
The outlook is further complicated by a strategic divergence that splits oil majors across the Atlantic. Guided by government policy and public opinion, European energy firms are moving more quickly toward climate-aggressive policies than are their U.S. peers. "In modern times, there's never been a bigger strategic spread among the major [oil] companies as exists today," said Dan Yergin, a Pulitzer Prize-winning energy historian and vice chairman of consultancy IHS Markit in an interview with Axios. "They're all looking at the same evidence, but how they define their role is quite different."[12]

CONVENTIONAL FOSSIL FUEL FIRMS FACE A COMPLEX MIX OF **OPPORTUNITY AND UNCERTAINTY**

FIG. 3: CRUDE PRODUCTS

WHEN REFINED, EACH BARREL OF CRUDE OIL CAN BE TRANSFORMED INTO MANY END USES

Based on an average 42-gallon barrel of U.S. crude, 2018



Gasoline, 19 gal.
Fuels cars, SUVs, pickups, boats, and other vehicles that run on internal combustion engines.

Hydrocarbon gas liquids, 2 gal.
A mix of fuels including propane, butane, and ethane used for space heating, portable power, and as an ingredient to make durable plastic.

Residual fuel, 1 gal.
A low-grade leftover, used in furnaces and boilers to heat buildings, homes, and for industrial processes, as well as to generate electric power in factories.

Diesel, 11 gal.
Powers heavier trucks, buses, trains, and equipment used in construction, forestry, farms, and the like. More energy per volume than gas, but dirtier.

Jet fuel, 4 gal.
Also called kerosene, used to power jet aircraft. With a very low freezing point of –40°C, stays liquid even in the deep freeze at high altitudes.

Other, 6 gal.
The heaviest remnants of the barrel include asphalt, used to make roads, as well as the molecular ingredients for lubricants, medical items, and clothing.

Note: Due to rounding, totals do not sum up to 42 gallons.
Source: Anjli Raval. "Can the World Kick Its Oil Habit?" Financial Times, February 13, 2020. https://www.ft.com/content/dddb57ec-4d2d-11ea-95a0-43d18ec715f5.

"To make a switch from a global economy that depends on fossil fuels for 80 percent of its energy to something else is a very, very big job," Yergin told The New York Times. But, he added, "These companies are really good at big, complex engineering management that will be required for a transition of that scale."[13]

Implications for risk managers: Against this backdrop, energy risk managers face a growing knowledge challenge. Those in the oil patch must learn the fundamentals — from extraction, to transportation, refining, and distribution — that make oil central to the global economy. They must also reckon with a fast-changing set of geopolitical issues. And risk managers in all energy sectors must also stay on top of how rapidly evolving alternative energy technologies could alter this web of dynamics.

Decarbonization — Renewables Rise, Transforming the Grid

Vast as petroleum's role has been in powering the economy of the 20th century, the scale of change facing the energy industry in the 21st may be even greater.

Some industry leaders are beginning to hedge strategic risks by steering their firms through supertanker-sized adjustments to their strategic courses. For instance, in interviews laying out plans to decarbonize aspects of their businesses, the CEOs of both BP and Shell said that there's a chance 2019 may mark the all-time high for global oil demand.[14, 15]

The cascading crises that hit the oil sector in the first half of 2020 offer a case study in the interplay of risk. In March and April, the COVID-19 shutdown suffocated energy demand globally, shortly after Saudi Arabia and Russia had taken steps to boost global supply. The sudden glut of oil shocked global markets, briefly crashing oil prices to near zero.

As they wrote down the value of oil reserves, oil companies in turn shaved billions of dollars from their balance sheets. Across the sector — from small wildcatters to pipeline operators to the supermajors — a credit and cash crunch set off a wave of spending cuts, consolidations, and bankruptcies.

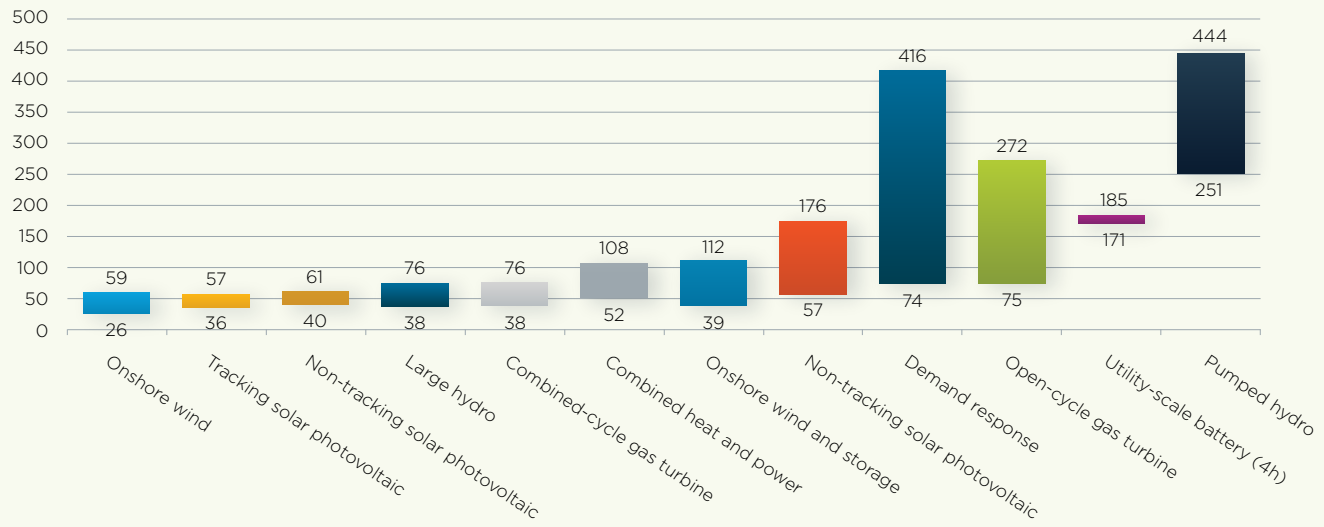
On both sides of the Atlantic, a shift toward renewables and electrification is emerging as a hedge against both near-term market volatility as well as long-term climate risks. As renewables have fallen below the cost of conventional methods of generating electricity, they have fundamentally altered the basic economics of the grid, accelerating the retirement of scores of legacy fossil fuel and nuclear power plants in developed economies. In 2019, the price of solar photovoltaic modules was just one-tenth of their 2010 price; batteries have fallen by a similar amount, and costs for wind turbines tumbled by half. In most markets, renewables are now cheaper than the lowest-cost form of fossil-fuel generation, irrespective of any subsidies that may still be available (Fig. 4).

The upshot has been a spectacular boom in renewable-energy installations. For the decade through 2019, worldwide installations of solar, wind, and hydro accounted for 1,377 gigawatts of new capacity, outpacing coal and natural gas by 27%.[16] Power from the sun and wind now accounts for around 7% of global electricity generation.[17]

FIG. 4: CHEAPER ELECTRONS

U.S. COSTS FOR NEWLY BUILT ELECTRICITY (LEVELIZED, UNSUBSIDIZED), 2019

$ per megawatt-hour, nominal



Source: 2020 Sustainable Energy in America Factbook, page 43. PDF file.
BloombergNEF and The Business Council for Sustainable Energy, 2020. http://bcse.org/factbook/#.

For non-renewables such as coal and nuclear, which generated the majority of U.S. power until recently, the outlook is diverging. Coal sparked the industrial revolution centuries ago but continues to taper out of the global supply mix, due to coal-phase-out policies and lower-cost competition from both natural gas and renewables.

Come 2030, global coal demand will be 8% less than in pre-COVID-19. And in advanced economies — such as Europe, Japan, and the U.S. — coal will fall by 45% over the 2020s, predicts IEA. With China planning to taper new coal plant construction, too, only India and Southeast Asia are expected to continue to see new coal capacity additions in that period.[18]

Nuclear, on the other hand, may yet thrive again, as the push to decarbonize renews the allure of its zero-emission virtues. New nuclear plants had been all but stalled in the West, the victim of high construction costs and the challenges of long-term nuclear waste disposal. The industry was pushed closer to the brink by the 2011 Fukushima disaster, when an earthquake and tsunami triggered a trio of meltdowns. Around the world, many existing reactors powered down in response to the crisis.

In the decade since, as energy and climate planners reckon with the challenges of migrating to net-zero carbon by mid-century, many have begun to gingerly reconsider nuclear energy. No zero-carbon technologies can match its blend of day-and-night reliability or large-scale output. Worldwide, new reactor builds are concentrated largely in China. But an emerging class of factory-assembled mini reactors promises to radically lower both construction costs and operating risks.[19]

While the grid is on track to decarbonize more quickly than other slices of the world's overall energy pie, it's helpful to keep in perspective that, even as new installations switch to renewables, the scale of existing capacity means deeper change will take time. To decarbonize even 50% of global electricity by 2030 would mean a five- to ten-fold increase in current renewable capacity.

DECARBONIZING

50%

OF GLOBAL ELECTRICITY BY 2030 WOULD MEAN A

FIVE- TO TEN-FOLD INCREASE

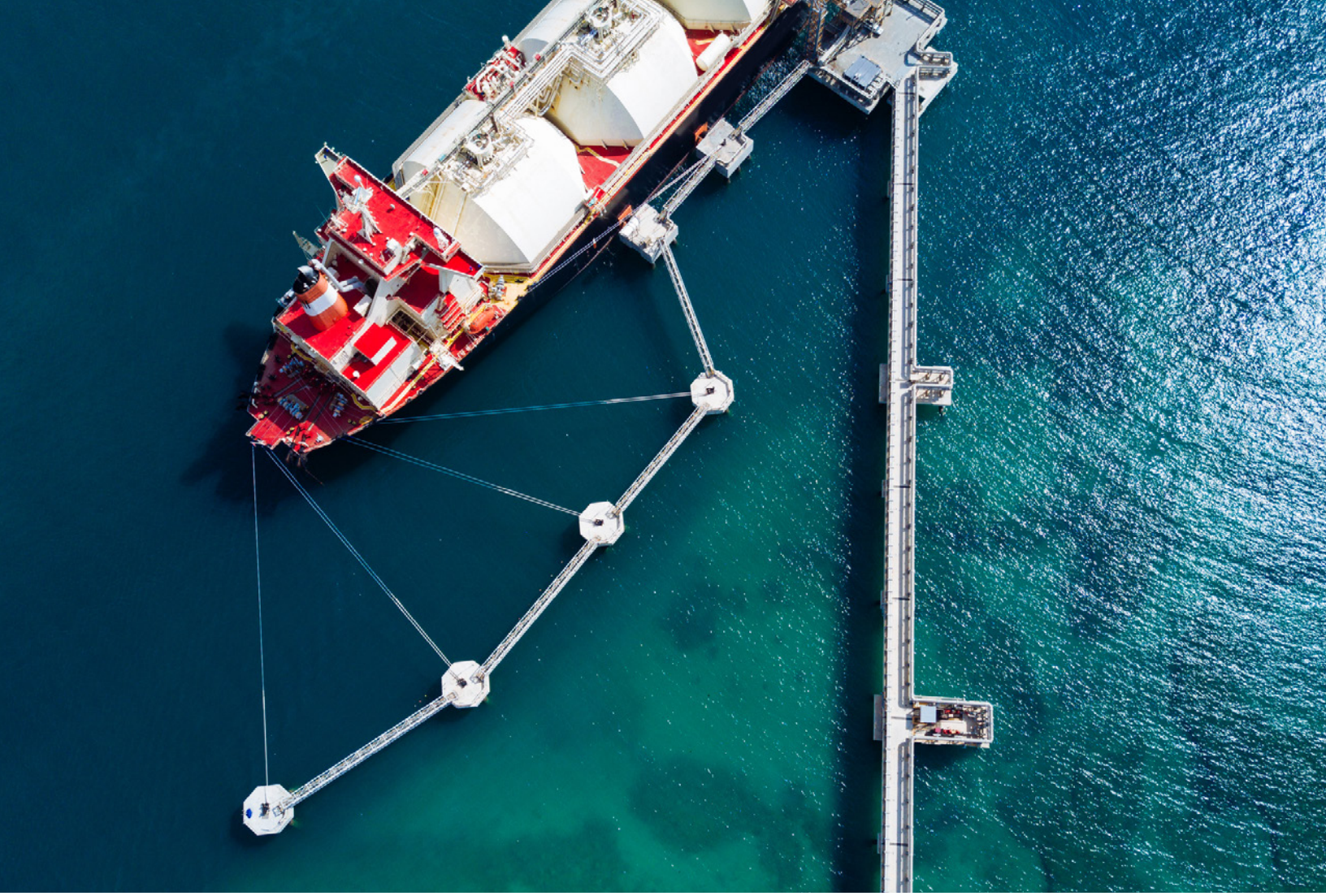
IN CURRENT RENEWABLE CAPACITY

That's a steep challenge given the need to plan, finance, site, source, and build millions of windmills and solar panels. Wind and solar facilities occupy a bigger footprint than thermal plants: for each megawatt, wind needs 7.6 hectares, and solar needs 1.7. Today, the world's solar and wind facilities occupy some 52,000 square kilometers (5.2 million hectares), roughly the size of Costa Rica.[20]

Other industries are pacing behind utilities as they decarbonize. The world's car companies are next in line to do so, as policy spurs a shift from a century-long reliance on gas- and diesel-fueled engines. A growing list of automakers has ceased funding development in internal-combustion engines, as they shift teams toward EVs.[21]

Spurred by falling prices and public incentives, EVs are the fastest-growing segment in the global auto market. Yet in 2020, only 0.5% are EVs, estimates BloombergNEF, and by 2030 that share could hit 8%.[22] Absent lower prices and/or stronger incentives to accelerate adoption, it may take a generation or longer to turn over the world's fleet of one billion-plus vehicles.

Other, major sources of carbon emissions — such as the industrial and transportation sectors — trail further behind in the shift to decarbonize. Some industries are taking the lead themselves, making deals to fund renewable power projects and committing to be carbon-free — consumer titans such as Amazon, Apple, Microsoft, and Unilever, among others, have all committed to carbon neutrality.



For more energy-intensive industries — like steel plants, pharmaceutical makers, and aviation — it's more difficult to decarbonize. Whether necessary to create volcanic temperatures (such as the coking coal used by steel mills), or to store energy in liquid that won't freeze (like the kerosene jet engines require) or as a versatile raw material (such as the methane petrochemical plants transform into plastic), low-carbon alternatives that can meet the performance standards of incumbent fossil fuels remain immature, and in some cases, are years away.

Implications for risk managers: The mix of fuels that power our planet is set to change more in the next decade than it has in the past century. Charting the interplay of new climate policy, disruptive clean technologies, the rise of renewables, the fate of legacy fuels, and the implications for financial risks across all these areas will occupy energy risk managers for a generation to come.

Conclusion — Energy Risk Redefined

Tomorrow's energy risk managers will need to cultivate a wider understanding of both conventional and emerging energy trends, as well as a deeper fluency in how local, national, and global regulations are rewriting the rules of energy markets (Table 1).

For many oil majors, this transition will be gradual, guided as much by the familiar logic of market returns as by more speculative judgments on where regulatory winds are blowing. Indeed, the two faces of the energy sector — established fossil fuels and emerging renewables — are increasingly intertwined. This is not new: Every past era of energy evolution has been heavily dependent on the energy infrastructure that came before.

Consider the very wind turbines and solar panels that are reordering the electricity sector. The gear amounts to "pure embodiments of fossil fuels," as energy historian Vaclav Smil writes. Whether the steel in the towers and trusses that secure solar photovoltaic (PV) panels, or the plastic resins and coatings that let turbine blades and solar panels last for decades, or the enormous ships, trucks, and cranes necessary to deliver and install these state-of-the-art energy systems — all of these inputs are made from and/or powered by fossil fuels.[23]

This blurring of boundaries between conventional and renewable goes both ways. As the price of renewables has plummeted, more oil firms are relying on solar and wind to run power-hungry equipment. In West Texas, for example, oil majors have built renewables to power the huge pumps and other gear needed to lift crude from deep in the earth into pipelines. Power from the wind and sun, it turns out, offered the cheapest energy.[24]

Looking out at the next 30 years of the energy industry, few things are certain, and the complexity of coming changes is without precedent. To be sure, the impacts of COVID on the global economy will retreat in time. And public recovery spending may tilt toward green jobs programs and decarbonization.

Yet, oil is a textbook commodity, a market wherein every price bust sets the stage for the next boom. As oil companies fail, investment retreats and supply shrinks, leading to shortages and a price spiral. Already, some market watchers are predicting oil could spike to $150 per barrel in the next few years, a roughly tenfold rebound from its COVID-era low in April 2020.[25]

THIS BLURRING OF BOUNDARIES BETWEEN **CONVENTIONAL AND RENEWABLE** GOES BOTH WAYS

This convergence of old and new dynamics in the energy industry can seem contradictory. Yet, viewed through the framework of risk assessment, the sector offers more opportunity — and challenges — than ever before.

Across the span of the next century and beyond, and unlike practically every other major future risk, climate change is nearly certain to happen. What happens before then is a multivariable thicket of risk, the likes of which financial engineers pride themselves on being able to model.

From month to month, and quarter to quarter, the nature of those risks is charted territory — whether it's the market risk of currency volatility or the credit risk of a new customer. Looking out further, to years and decades, the decisions energy professionals will face stretch into new, uncharted realms — whether a project manager should recommend a site in a flood-prone coastal region or a chief executive should push her board to exit a business line impaired by carbon risk.

These decisions will increasingly require a new breed of risk managers.

TABLE 1: REAL WORLD TALES OF ENERGY RISK

ONCE FOCUSED PRIMARILY ON FINANCIAL ANALYSIS, THE PRACTICE OF ENERGY RISK MANAGEMENT IS EXTENDING ACROSS STRATEGY AND OPERATIONS

RISK TYPE	EXAMPLES
Market	Market risk centers on pricing and the sometimes subtle factors that can affect it. In early 2020, U.S. oil prices briefly went negative even as global prices stayed positive. A key culprit behind this unprecedented inversion? Shortages of storage capacity. With no buyers to take oil still flowing from U.S. wells, storage sites maxed out. Tank farms in Cushing, Oklahoma, were full to the brim, and in the Gulf of Mexico a fleet of supertankers sat idle, full of excess output, but with nowhere to sell it.
Credit	Credit availability for traditional projects is drying up as investors seek greener alternatives. Energy projects depend on access to credit and collaboration where a primary project developer relies on scores of specialists to bring a project online. A credit crisis among any of those partners can halt all progress. Consider a wind project. Once financing, siting, and engineering are completed, the big turbines need to be hauled in, piece by piece. Blades can be up to 200 feet, four times the length of a regular tractor-trailer. These require exotic trucks driven by specialized teams able to execute hair-raising maneuvers.[26] If a transport provider's weak credit position went unnoticed, and financing for its big rigs fell through, the whole project could skid to a halt.
Health, safety, and environment (HSE)	Whether refueling a nuclear power plant, welding an underwater pipeline, or connecting high-voltage lines at a solar farm, the energy industry routinely reckons with some of the most extreme health, safety, and environmental risks of any industry. Even less exotic roles can face unusual demands. Consider a cook working on a North Sea oil rig. Her core expertise may be knowing how to nourish dozens of workers from cramped kitchen quarters. But she'll also need to be proficient in everything from fire suppression protocols to open water survival techniques.
Cost risk/ Operations	Scrutiny of a project's financial base and operating assumptions has never been more intense. And, while project finance and other capital expenditures define most deals, operating risk poses an often tougher-to-model challenge. Wall Street expects a wind farm project to perform as modeled, for instance. But what if long-term wind patterns unexpectedly fall off? Tracking such variables and building in terms to hedge the risk of such eventualities demands ever more resourceful — and creative — applications of risk modeling, financial engineering, and expertise in energy system behaviors.
Regulatory and reporting	Over the past couple of past decades, the variety of reports energy companies issue has soared. Once limited mostly to financial, safety, and environmental regulatory filings, a risk professional today must also navigate an emerging array of voluntary self-assessments, including sustainability reports, industry-backed ESG statements, and other voluntary measures of sustainability risk exposure led by the likes of the UN, EU, and NGO's. These additional measures of corporate performance can aid risk assessment but are often fast-evolving as standards and practices go from draft to official.

RISK TYPE	EXAMPLES
Cyber	In 2017, the U.S. Dept. of Homeland Security identified a wave of cyberattacks aimed at contractors to large utilities. By gaining access to the servers of power companies' trusted business partners, the suspected Russian hackers were able to access major U.S. utility management systems previously considered secure. No harm was done. But one expert said that, for Russia, the highly sophisticated operation "prepared the battlefield without pulling the trigger." U.S. and industry initiatives have increased vigilance, but state and non-state actors — including China and North Korea — continue to advance more sophisticated tactics.[27]
Sustainability	In recent years, "sustainability" has emerged as a set of priorities and related risks that extend beyond the corporate balance sheet to the people and communities where energy companies and their suppliers operate. For example, oil companies and other extractive energy firms working in emerging markets face scrutiny over the potential impacts on local communities. And, as batteries become more commonplace in EVs and renewable energy projects, companies are reckoning with the risk of forced- and/or child-labor in supply chains for key minerals such as cobalt.[28]
Policy	In Washington, D.C., Brussels, and beyond, energy and climate-related policies are evolving at an unprecedented pace. Rule makers are increasingly evaluating physical, regulatory, and legal risks arising from climate change. For example, in November 2020, the U.K. unveiled requirements in line with the Task Force on Climate-related Financial Disclosures. Under the new rules, effective 2025, British companies must disclose the degree to which their operations are exposed to risks posed by global warming. While the U.K. is the first major economy to mandate climate reporting, others are expected to follow suit.[29]
Transition	Transition risk, in many ways, represents the overarching mix of all energy- and climate-related risks. Firms who prove unable, or unwilling, to transition their strategy could face sharp shifts in their competitive positions. For instance, between 2009 and 2015, Moody's cut the average credit rating of European power utilities by three notches, in part due to climate risk. And since 2000, coal producers in the U.S. have seen their market capitalizations decimated, as natural gas has taken market share and investors looked elsewhere for higher returns. From oil reserves to legacy power plants, owners of fossil-fuel heavy assets are reckoning with prospects that their assets will have shorter lives, or even become stranded, faster than anticipated.

Source: GARP

Endnotes

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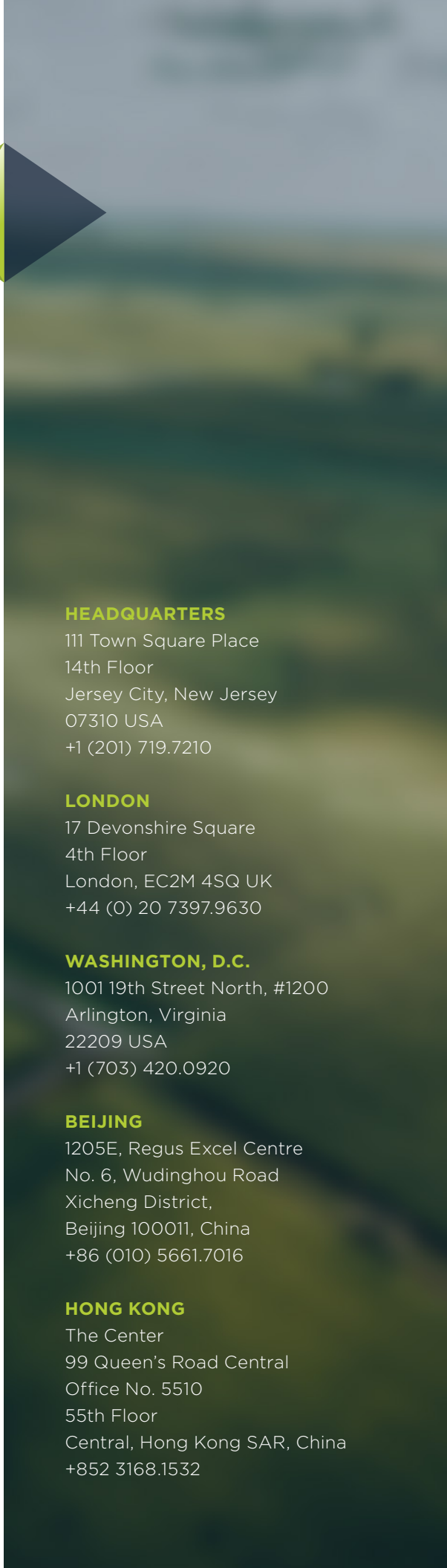

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