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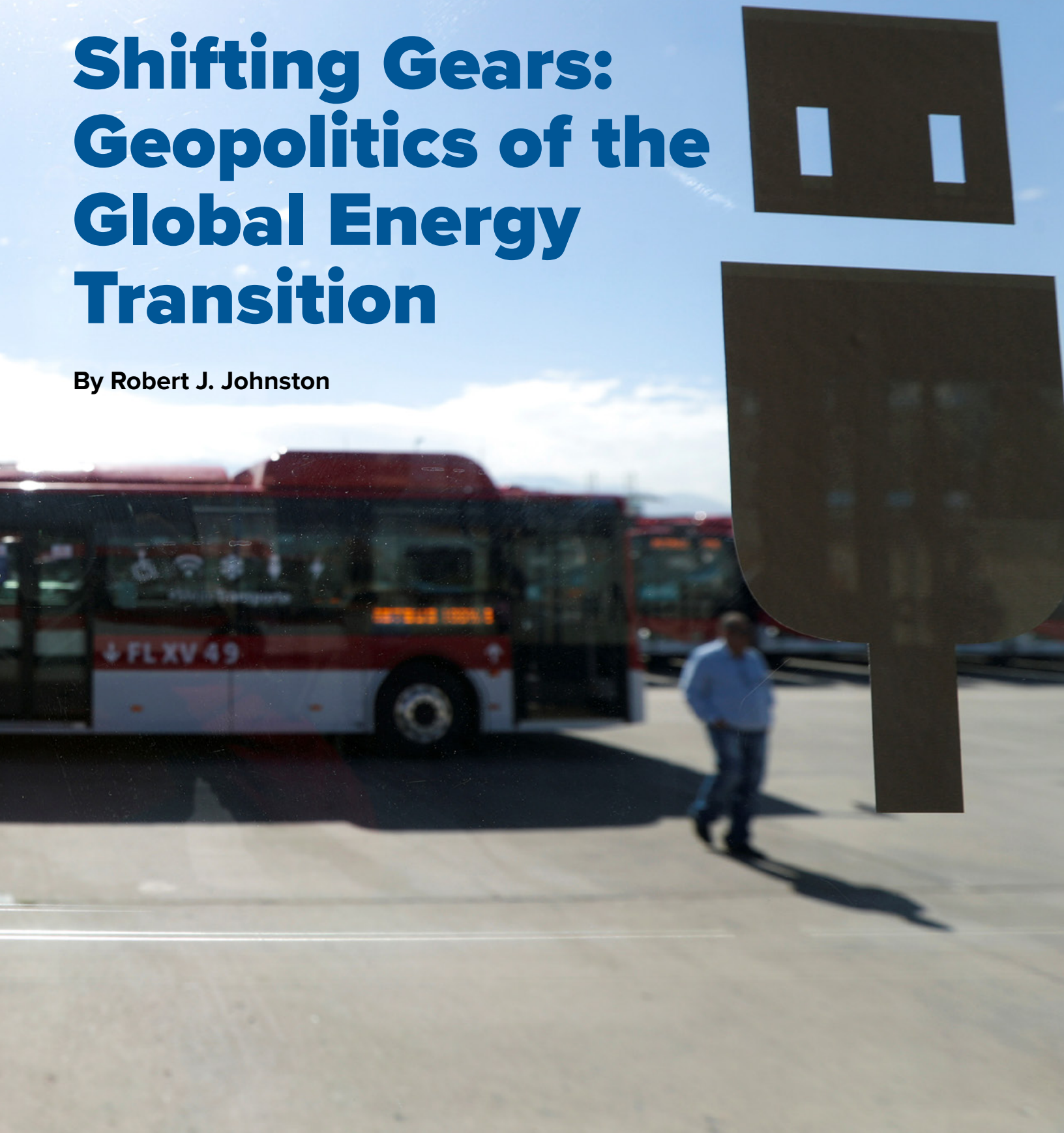
Shifting Gears: Geopolitics of the Global Energy Transition

By Robert J. Johnston



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Cover: An electric bus, which is part of the new fleet of electric buses for public transport launched by Chile's government, is seen parked in Santiago, Chile, in December 2018.
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I. Executive Summary

Driven largely by technological advancements and policies aimed at decarbonization, the prospect that oil demand will peak in the not-too-distant future has become a topic of debate in energy circles over the past several years. So-called "peak demand" would have significant geopolitical and geoeconomic consequences for oil-producing and importing nations alike.

Oil resources have afforded geopolitical and economic leverage to producing nations, even though many of these countries do not have diversified economies and are highly dependent on oil revenues for the majority of their budgets. Revenue declines can have a destabilizing effect, particularly on countries that have fragile political institutions, such as Venezuela, Iran, Nigeria, and Algeria, or that are in regions rife with political, cultural, or economic fractures, such as Libya or Iraq.

Longer-term shifts toward lower oil demand might also have other impacts at the macro level, as technological leadership in clean energy creates a group of countries that "win" in the energy transition, while other, poorer countries still rely on oil-based technologies.

Ambitious transportation sector policies and plans will be a key driver of a peak in oil demand, especially government programs to improve fuel efficiency, promote alternative fuels, and support electric vehicles (EVs), which are seen as the most significant drivers of any prospective peak, given the transportation sector's 56 percent share of global oil demand. While Asia still is the major driver of global demand for fossil fuels, a combination of concerns about energy security related to import reliance, industrial strategies, and commitments to the Paris Climate Agreement, as well as air quality and other environmental issues, have triggered a strategic imperative for these countries to begin distancing themselves from coal-fired power and petroleum-derived fuels.

Rather than determining when, or if, oil demand will peak, this report examines major geopolitical questions related to the prospect of a peak in oil demand that include the likely redistribution of oil market share between major producers; the potential for failed states or material internal political instability in major oil-producing countries; and the geopolitical impact of peak demand on major oil-consuming nations. This report assesses these questions against the backdrop of two well-known, markedly different peak oil demand scenarios: the International Energy Agency's (IEA) 2019 Sustainable Development Scenario, which shows 67 million barrels per day (mbd) in oil demand by 2040, and the even more transformational Production Gap Report Scenario from the United Nations Environmental Programme (UNEP), which shows oil demand plunging to 40 mbd by 2040.[1]

The two scenarios assess varying speeds at which the energy transition might take place. Oil producers in the Sustainable Development Scenario would have more time to diversify their economies away from a dependency on oil revenues, but this would require significant institutional stability and financial/technological resources that only a handful of states are able to leverage. The Production Gap Report Scenario suggests more countries will still be exporting oil, though some of those barrels will surely be sold by the same low-cost, low carbon, low geopolitical risk countries, further reinforcing their success as compared to the higher-price, less stable countries.

Regardless of whether peak oil demand is reached quickly or slowly, the outlook for oil prices and upstream oil investment is highly uncertain, and the ability of oil projects to attract capital will become more challenging. This report argues that investment capital will likely flow to oil producers with **low-cost**, **low-risk**, and **low-carbon** resources in a context of slower demand growth. This will have a significant bearing on the ability of producers to secure market share in a peak demand scenario, maintain oil revenues, and support diversification plans necessary to ensure financial stability over the long term.

This report provides an Oil Market Transition Resilience Index to establish a benchmark by which to assess the geopolitical resiliency of countries in a peak oil demand scenario. This report provides a system of weighted

1 *Sustainable Development Scenario, Report Extract*, International Energy Agency, accessed on May 18, 2021, https://www.iea.org/reports/world-energy-model/sustainable-development-scenario; *The Production Gap: The Discrepancy Between Countries' Planned Fossil Fuel Production and Global Production Levels Consistent with Limiting Warming to 1.5°C or 2°C*, Stockholm Environment Institute, International Institute for Sustainable Development, ODI, Climate Analytics, Center for International Climate Research (CICERO), and United Nations Environment Program, 2019, https://productiongap.org/2019report/. This report analysis was conducted prior to the May 2021 release of the IEA's report, *Net Zero by 2050: A Roadmap for the Global Energy System*. Nonetheless, the oil demand outlook described in the IEA's Net Zero by 2050 Scenario describes a rapid decline in global oil demand similar to the outlook described in the UN Production Gap Report Scenario evaluated in this report. Therefore, the author recommends the analysis of the PGR scenario as a close parallel to the IEA's report in light of growing net-zero commitments from key sources of oil demand.

rankings that take into account the cost, risk, and low carbon/ESG factors associated with groupings of producer countries. Based on these weighted rankings, this report assesses that the following groupings could face challenges and loss of investment in the energy transition (ranked from lowest to highest risk):

- Core GCC (Saudi Arabia, Kuwait, UAE)
- North America+ (United States, Canada, Mexico, Brazil, Norway)
- Russia
- Fragile and failing states (Iraq, Iran, Libya, Nigeria, Angola, Algeria, Venezuela, and Kazakhstan)

If peak demand is realized along the lines of either scenario, even though overall production levels will decline, the Core GCC, Russia, and North American+ oil-producing regions will hold or grow market share, while the group of fragile and failed oil producers will see a significant decline. The GCC and North America+ are likely to be able to weather the overall drop in production and revenue, while fragile and failing states will be further destabilized. Russia is the wildcard, but it seems unlikely that in the Production Gap Report Scenario, Russia would to be able to diversify the economy soon enough and, as a result, would face economic deterioration. Both peak demand scenarios and expected economic stress in Russia and could ignite a growing opposition movement to Putin's lasting power.

Oil-importing countries, on the other hand, see significant benefit as their oil imports drop, the price of those remaining imports drop, and their economies grow. As producers compete for market share in a buyer's market, the ability of producing countries to use oil exports as a foreign policy tool diminishes, reducing geopolitical vulnerabilities, and in some cases, potentially increasing geopolitical power for importers. Of the oil importers who experience a windfall of geopolitical leverage, China is the biggest winner. The remaining question is how peak demand would reshape US engagement with the rest of the world, including as a provider of geopolitical leadership in managing the disruptions that will follow the energy transition.

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II. Introduction

Driven largely by technological advancements and policies aimed at decarbonization, the prospect that oil demand will peak in the not-too-distant future has become a topic of debate in energy circles over the past several years. So-called "peak demand" would have significant geopolitical and geoeconomic consequences for oil-producing and importing nations alike. This report, the third in a series about the changing outlook for oil demand, aims to explore how these prospective changes could contribute to a reshaping of the global order and what the implications of these changes would be for policymakers and business leaders.

Many studies have looked at the factors most likely to lead to peak demand, modeling comprehensive scenarios including predictions and probabilities around the timing of a peak and the rate of decline in demand.[2] Serious predictions range from a peak in the early 2020s to no peak at all through at least 2040. Across these scenarios, the timing of a peak is closely linked to efforts to decarbonize the economy and achieve the goal of the Paris Agreement to limit global warming to below 2 degrees Celsius (and as close to 1.5 degrees as possible) by 2050. Prior Atlantic Council work focused on structural changes to energy consumption that have the potential to undermine demand for oil over the long term; namely, changes within the transportation sector, the role of transportation policy in shaping peak demand, and the drivers of transportation sector transformation (particularly in Asia, the world's fastest-growing region for oil demand).[3]

However, the rate of decarbonization in the transportation sector, and beyond into the broader economy, will be very closely linked to national election outcomes, particularly in countries like the United States, where there are stark differences between the two major parties on climate and energy policy. The uncertainties of climate policy are one factor complicating estimates of a timing for peak demand, alongside volatile fuel prices and changing consumer and investor preferences and corporate strategies, all of which influence the decline in demand for oil in the transport sector and the attractiveness of alternatives.

Nonetheless, even though the exact timing of an oil peak cannot be predicted, an end to oil demand growth—a microcosm of which was briefly seen during the COVID-19 pandemic and resulting crash in oil demand—would transform traditional power dynamics and geopolitics. Oil resources have afforded leverage to producing nations, even though many of these countries do not have diversified economies and are highly dependent on oil revenues for the majority of their budgets.

These revenue declines can have a destabilizing effect, particularly on countries that have fragile political institutions, such as Russia, Iran, Nigeria, and Algeria, or that are in regions rife with political, cultural, or economic fractures, such as Libya or Iraq. The 2020 oil price drop has already contributed to or exacerbated destabilization in economies dependent on oil revenue, such as Venezuela, Libya, Iran, and Yemen. At the time of writing, the unprecedented demand destruction from COVID-19 could push several oil-producing states from "fragile" to "failed," and could put the long-term stability of even the wealthiest oil producers to the test.[4]

Longer-term shifts toward lower oil demand might also have other impacts at the macro level, as technological leadership in clean energy creates a group of countries that "win" in the energy transition, while other, poorer countries still rely on increasingly inexpensive oil-based technologies.

As such, the purpose of this report is not to predict when, or if, oil demand will peak. Instead, the intention of this work is to look for commonalities across scenarios in order

2 "Peak Oil Demand Workshop – March 2018," Columbia University School of International and Public Affairs Center on Global Energy Policy, March 1, 2018, https://energypolicy.columbia.edu/research/global-energy-dialogue/peak-oil-demand-workshop-march-2018/; Marianne Kah, *Electric Vehicles and Their Impact on Oil Demand: Why Forecasts Differ*, *Columbia University School of International and Public Affairs Center on Global Energy Policy*, July 24, 2018, https://energypolicy.columbia.edu/research/commentary/electric-vehicles-and-their-impact-oil-demand-why-forecasts-differ/; Spencer Dale and Bassam Fattouh, *Peak Oil Demand and Long-Run Prices*, *bp*, January 2018, https://www.bp.com/en/global/corporate/energy-economics/spencer-dale-group-chief-economist/peak-oil-demand-and-long-run-oil-prices.html; Jessica Shankleman and Hayley Warren, "Why the Prospect of 'Peak Oil' is Hotly Debated," *BloombergNEF*, December 22, 2017, https://about.bnef.com/blog/why-the-prospect-of-peak-oil-is-hotly-debated/ ; Nathaniel Bullard, "Bullard: A New Era of Transportation Transformation," *BloombergNEF*, February 5, 2018, https://about.bnef.com/blog/bullard-new-era-transportation-transformation/; and Spencer Dale and Bassam Fattouh, *Peak Oil Demand and Long-Run Oil Prices*, January 2018, Oxford Institute for Energy Studies: https://www.oxfordenergy.org/publications/peak-oil-demand-long-run-oil-prices/.

3 Robert J. Johnston, *Asian Energy Transition: Moving the Oil Market One Step Closer to Peak Demand*, Atlantic Council, January 8, 2018, https://www.atlanticcouncil.org/in-depth-research-reports/issue-brief/asian-energy-transition-moving-the-oil-market-one-step-closer-to-peak-demand/; Robert J. Johnston and Hilary Novik Sandberg, *Decarbonization and Peak Oil Demand: The Role of Policy in the Transportation Sector*, Atlantic Council, July 18, 2018, https://www.atlanticcouncil.org/in-depth-research-reports/report/decarbonization-and-peak-oil-demand-the-role-of-policy-in-the-transportation-sector/.

4 *The Global Oil Industry is Experiencing a Shock like no Other in its History*, International Energy Agency, April 1, 2020, https://www.iea.org/articles/the-global-oil-industry-is-experiencing-shock-like-no-other-in-its-history.

to understand what geopolitical consequences might stem from this potential dramatic change, while also recognizing that these changes might not arrive at all. In particular, this study is focused on three major geopolitical questions related to the prospect of a peak in oil demand, including:

1. the likely redistribution of oil market share between major producers;
2. the potential for failed states or material internal political instability in major oil-producing countries; and
3. the geopolitical impact of peak demand on major oil-consuming nations.

Given the various pathways to peak oil demand, this paper examines two well-known, markedly different peak oil demand scenarios: the International Energy Agency's (IEA) 2019 Sustainable Development Scenario, which shows 67 million barrels per day (mbd) in oil demand by 2040, and the even more transformational Production Gap Report Scenario from the United Nations Environmental Programme (UNEP), which shows oil demand plunging to 40 mbd by 2040.[5] First, it will assess the assumptions and drivers underpinning each scenario and, second, will analyze the resulting geopolitical and geoeconomic implications of each. The author chose these scenarios from the array of existing ones because they are from well-respected sources and show relatively more disruptive and transformational timeframes and pathways for a rapid peak and decline in oil demand. The goal of this report is not to comprehensively assess or model the econometric impacts of various price scenarios on each country, but rather to look at what unique vulnerabilities and assets various regions may bring to bear in managing a rapid transition away from oil.

To assess the geopolitical implications of each scenario, this report evaluates the effects on four key groups of oil-producing countries, and the geopolitical interests of four major consuming regions.

Producers

- Organization of the Petroleum Exporting Countries (OPEC)/Core Gulf Cooperation Council (GCC): Saudi Arabia, United Arab Emirates (UAE), Kuwait
- North America+: United States, Canada, Mexico, Brazil, Norway
- Russia
- Fragile and failed producers: Libya, Iran, Iraq, Nigeria, Venezuela, Algeria

Consumers

- European Union (EU)
- Japan and South Korea (ROK)
- China
- India
- United States

In doing so, this report aims to lay out the geopolitical and geoeconomic consequences of a world in which global oil demand undergoes dramatic, structural changes beyond those seen in today's COVID-19-affected market. This work, therefore, offers a useful roadmap for policymakers, industry players, and investors to understand these changes and act accordingly.

5 *Sustainable Development Scenario, Report Extract*, International Energy Agency, accessed on May 18, 2021, https://www.iea.org/reports/world-energy-model/sustainable-development-scenario; *The Production Gap: The Discrepancy Between Countries' Planned Fossil Fuel Production and Global Production Levels Consistent with Limiting Warming to 1.5°C or 2°C*, Stockholm Environment Institute, International Institute for Sustainable Development, ODI, Climate Analytics, Center for International Climate Research (CICERO), and United Nations Environment Program, 2019, https://productiongap.org/2019report/.

III. Background And Context

Summary of the Drivers of Peak Demand

Previous work in this series of reports analyzed key drivers of a prospective peak in oil demand, in particular, the considerable role that the transportation sector will play in any peak demand scenario. The inaugural report analyzed why Asia is emerging as an increasingly important player in the energy transition, and in the transformation of the transportation sector.[6] The second report examined the role of policy aimed at decarbonizing the transportation sector.[7]

The Role of the Transportation Sector

The transportation sector has the potential to adopt new technologies at an exponential and unpredictable rate. Ambitious transportation sector policies and plans are, therefore, of particular relevance for oil, especially government programs to improve fuel efficiency, promote alternative fuels, and support electric vehicles (EVs), which are seen as the most significant drivers of any prospective peak, given the transportation sector's 56 percent share of global oil demand.

Innovations in vehicle efficiency and battery storage have made electric vehicles increasingly viable alternatives to traditional combustion-only options, and new trends in mobility suggest that consumer vehicle use could be moving in a new, less energy-intensive direction. Other innovations, such as the further integration of advanced biofuels and automation into the transportation sector, are on the horizon and will be disruptive to the energy supply chain. Additionally, policy intervention by countries seeking to improve air-quality-related public health or adhere to recent climate commitments will put further downward pressure on oil demand. The COVID-19 crisis has shown how quickly demand patterns can shift, not because of technological breakthroughs, but through government policy around stay-at-home orders. Such policies in the United States and many other countries led to a plunge of 27 mbd in global oil demand within weeks.

Asia as a Catalyst

Asia's incredible economic growth—led by China and, more recently, by others in the Southeast Asia—has been followed by an equally transformative expansion of energy demand across the region. China, in particular, has played a central role in this demand growth, as its oil demand has tripled since 1999, with the country now the largest crude oil importer in the world.[8]

For many years, the majority of this energy demand growth was met by coal and oil, but a combination of concerns about energy security related to import reliance, industrial strategies, and commitments to the Paris Climate Agreement, as well as air quality and other environmental issues, have triggered a strategic imperative for these countries to distance themselves from coal-fired power and petroleum-derived fuels.

At the nexus of this transition is the electrification of the transportation sector, which has dovetailed with the electrification goals of the broader economy, while simultaneously reducing reliance on crude oil-based imports. China has made new energy vehicles and equipment, as well as modern rail transport equipment, two of the ten priority sectors in its "Made in China 2025" effort, which aims to create national champions and replace sales by foreign competitors. As a result, Chinese electric vehicle sales surpassed 1.2 million per year in 2018, and new rules will require 12 percent of all vehicle sales in the country to be electric by 2020, and 40 percent by 2040, putting China in a position to meet an official target of 32 million new energy vehicles on the road by 2025.[9] In Japan, the push for a hydrogen society, if ultimately successful, will impact the entire oil value chain, with a target of 800,000 fuel-cell vehicles on the road by 2030. In South Korea, the development of smart cities is supporting declines in individual car ownership, all while facilitating the electrification of public transport and low-carbon infrastructure.

While East Asia has proven to be a leader in the electric mobility space, as key technologies in the electrification of the transportation sector take hold, a major unknown is when these technologies will gain traction in other places

6 Johnston, *Asian Energy Transition*.

7 Johnston and Novik Sandberg, *Decarbonization and Peak Oil Demand*.

8 *World Energy Outlook 2017: China, International Energy Agency*, November 2017, https://www.iea.org/weo/china/.

9 Johnston, *Asian Energy Transition*.

where similar energy consumption patterns are emerging. India has equaled China in its transformative public policy ambitions to decarbonize the transportation sector, but infrastructure and state-level implementation obstacles remain. Across the rest of Southeast Asia, car ownership is rapidly increasing, but electric small-body vehicles and two- and three-wheelers are increasingly price competitive with their internal combustion engine (ICE) counterparts and are capturing a greater share of markets. The growth of fuel-efficient and electric vehicles helps support energy policy and climate goals throughout the region.

A Global Transportation Transition

While Asia is driving the transition away from ICE transportation, countries around the world are also enacting transportation policies that will impact oil demand. These policy options fall into four broad categories: efficiency mandates, lower- and zero-carbon fuels, replacement of the internal combustion engine, and social engineering (through support for ridesharing, smart cities, and mass transit electrification).

Fuel-efficiency standards, such as the Corporate Average Fuel Economy (CAFE) standard in the United States, are the most common policy tool for increasing efficiency in transportation. Other policies include programs like "cash for clunkers," that encourage the removal of older vehicles from the road. Low-carbon fuel standards and biofuel mandates reduce the carbon footprint and (sometimes) oil consumed in transportation by introducing carbon standards to fuel production or imports. Efforts to replace the internal combustion engine include incentives for electric vehicles and more aggressive policies that ban the sale of new internal combustion engines by a prescribed date. Finally, efforts to encourage ridesharing, promote cycling, and develop smart cities all aim to reduce transportation oil demand by cutting the number of cars on the road per capita.

While these policies have had the most obvious (and well-publicized) impact on the passenger vehicle sector, additional forthcoming policies will likely impact heavy trucking, shipping, and aviation, though these sectors are—at least for now—proving technologically more challenging to transition away from greenhouse-gas-intensive fuels. Additionally, single-use plastics bans, which are rapidly proliferating in jurisdictions across the globe, could also impact future oil demand by introducing downward pressure on the petrochemical sector.

Importantly, the effectiveness of and commitment to these policy measures vary from country to country, and even from city to city, suggesting that changes in transportation will be adopted unevenly across the globe. Some policy tools, like low-carbon fuel standards, may have wider reaching impacts on greenhouse gases (GHGs) beyond the jurisdiction in which they are implemented, but they are very complex and increasingly politically contentious. While the impacts of a reduction in global oil demand will be relatively similar whichever country or set of countries drives that demand destruction, the uneven transition to low-carbon transportation could have vastly different geoeconomic and geopolitical implications, depending on which countries lead the charge.

Traffic on the Golden Gate Bridge in San Francisco, California. Unsplash/Tanya Nevidoma (@nevidoma)

ESG Investing and "Stranded Assets"

Meanwhile, the uncertainty of the future demand curve due to market penetration of EVs and low-carbon fuel policies has given rise to the prospect of "stranded assets," i.e., the idea that, in a lower oil demand scenario, much of the world's proven oil reserves would not be exploited due to long-term demand destruction. This means their economic value would be effectively zero, creating material financial risk for both the companies that own the reserves and the governments that depend on their production for revenue. Former Bank of England Governor Mark Carney has highlighted the risk of stranded fossil fuel assets as a key systemic challenge for global financial markets as the world moves toward Paris Agreement implementation.[10]

The concern about stranded assets in scenarios of rapid decarbonization is reinforced by, and closely connected to, growing investor focus on environmental, social, and governance (ESG) investing. While the ESG rubric contains a range of investment strategies, the overall size of assets under management tied to an ESG focus has grown dramatically over the past several years, with corporate performance on climate being arguably the most measured and impactful variable within the class. Investment groups such as the Net-Zero Asset Owner Alliance, collectively representing $4 trillion in assets under management, are using their influence to drive changes in companies and government policy as shareholders press for alignment with the Paris Agreement.[11] The broader United Nations Principles for Responsible Investment (UNPRI) have 2,250 institutional investors, representing $80 trillion in assets, that have signed on to UNPRI's ESG commitment, a trend and capital pool that is simply impossible for the global oil and gas sector to ignore.[12]

So long as sustainable finance broadly is a key growth area for the entire global financial sector, banks, insurers, asset management firms, and pensions will adopt their own GHG reduction targets, which shape their portfolio of loans and investments.[13] Within this context, the ESG investment community is evaluating individual companies within the oil and gas sector based on their respective long-term viability within these peak demand scenarios.

In some cases, ESG funds are simply divesting from fossil fuels (coal as well as oil and gas) because they believe in the materiality of the stranded asset risk, are mindful of public perception issues, or want to steer capital away from emissions-intensive industries. In other cases, ESG funds are building products for investors (whether individuals or institutions) that allow them to direct capital toward the "cleanest and greenest" performers.[14] Investment industry terminology characterizes these distinctions as "light green," directing capital to help improve the performance of GHG-intensive sectors, or "dark green," which entails focusing exclusively on renewable energy and zero emissions technologies, and excluding fossil fuels entirely.[15] The oil and gas sector is working to maximize the opportunities around light green efforts, but some financial institutions will exclusively focus on dark green, seeing that as the best path to achieving Paris Agreement goals.

Therefore, it is likely that ESG investing will accelerate a peak or decline in oil demand by shifting available capital toward low-carbon fuels or the electrification of the transportation sector. As demand peaks and the risks of stranded assets grow, ESG-minded portfolios will impinge on oil sector investment, exhibiting preferences for low political risk or lower GHG suppliers, further constraining the available market share for certain oil producers.

10 Pilita Clark, "Mark Carney Warns Investors Face "Huge" Climate Change Losses," *Financial Times*, September 29, 2015, https://www.ft.com/content/622de3da-66e6-11e5-97d0-1456a776a4f5.

11 "Investors Make Unprecedented Commitment to Net Zero Emissions," UN Environment Program, September 23, 2019, https://www.unenvironment.org/news-and-stories/press-release/investors-make-unprecedented-commitment-net-zero-emissions.

12 "PRI 2021 – 24 Strategy," UN Principles fo Responsible Investment, accessed on May 18, 2021, https://www.unpri.org/pri/pri-2021-24-strategy.

13 George Inderst, Christopher Kaminker and Fiona Stewart, *Defining and Measuring Green Investments: Implications for Institutional Investors' Asset Allocations,* OECD, August 2012, https://www.oecd.org/finance/WP_24_Defining_and_Measuring_Green_Investments.pdf.

14 Pippa Stevens, "Your Complete Guide to Investing Conscience, a $30 Trillion Market Just Getting Started," *CNBC*, December 2019, https://www.cnbc.com/2019/12/14/your-complete-guide-to-socially-responsible-investing.html.

15 Helen McGill, "Shades of Green," *Investment Week*, June 14, 2001, https://www.investmentweek.co.uk/investment-week/news/1388327/shades-green.

Oil Market Context

Recent turmoil has wracked oil markets, first driven by the rise of lower cost oil resources from US shale, and then dramatically by the COVID-19 demand shock beginning in February 2020. The "shale gale" contributed to large swings in net income from oil and natural gas revenues for petrostates between 2010–2017, even amidst healthy short-term oil demand growth over the past five years. For example, Iraq's budget was about 25 percent smaller in 2018 than in 2013, according to the International Energy Agency.[16]

Prior to the 2020 global COVID-19 pandemic, the dramatic growth of US oil production had been the single most important global oil market trend of the past decade. From a low of below 5 mbd on average in 2008, the United States more than doubled its production over the following decade to produce an average of just below 13 mbd by the end of 2019, when it surpassed Russian and Saudi Arabian production to become the world's largest oil producer. By the end of 2020, US crude oil production had fallen to 11 mbd in the aftermath of major industry spending cuts during the COVID-19 demand shock.[17] Even with COVID-19 ravaging global oil demand and expected to drive producer bankruptcies and a disjointed reduction in oil production, US shale will continue to shape peak demand and the geopolitics of energy dynamics for at least the next decade, and probably longer. The interplay between US shale and the three other major producing regions, as classified in this study, will be the dominant context in which the peak oil demand scenarios will play out.

The rise of US shale has resulted in a number of dramatic, structural changes in the global oil system. These include:

Rethinking of OPEC: The impact of the shale revolution on oil markets was first truly felt in mid-2014, when immense oversupply led to a rapid decline in oil prices, which bottomed out at $24 per barrel in 2016. As prices began their initial drop, OPEC decided to fight for market share and continue producing at high levels, operating under the assumption that US producers' higher breakeven price would eventually force them out of business as prices remained low.

In the face of continued resiliency from US shale, OPEC changed its strategy at the end of 2016, banding together with a group of non-OPEC oil producers to create what is now known as the OPEC+ group

The timing of the recovery from COVID-19 is a wildcard that cannot be addressed in this study, and there is a wide range of opinions as to whether COVID-19 will accelerate climate action and the energy transition or shift the attention of governments to other areas that would result in either emissions intensification or a lessening of climate ambition. Though this study is underpinned by the assumption that COVID-19 will not fundamentally change the trajectories of the two peak demand scenarios from the IEA and UNEP that form the basis of this analysis, the full effects of the pandemic will only be clear long after this study is published.

16 *World Energy Outlook Special Report: Outlook for Producer Economies 2018,* International Energy Agency, 2018, https://www.iea.org/reports/outlook-for-producer-economies.

17 Emily Geary, "US Crude Oil Production Fell by 8% in 2020, the Largest Annual Decrease on Record," US Energy Information Administration, March 9, 2021, https://www.eia.gov/todayinenergy/detail.php?id=47056.

and collectively cutting production to bring the market back into balance. This group is dominated by the two largest producers, Saudi Arabia and Russia; however, it has created new tensions in an alliance that was already strained, particularly among a group of "failed and fragile" OPEC members. In April 2020, OPEC+ concluded a price war and came together with unprecedented production cuts in an attempt to manage markets thrown into massive imbalance by their own supply struggles, compounded by the demand destruction from COVID-19.[18]

Focus on short-cycle investment: Conventional and offshore oil plays take between five to twenty years to break even, and the projects often last much longer. In contrast, shale plays are considered short cycle, and can often break even in less than three years, resulting in significantly less risk. These plays also are more readily responsive to the price environment, allowing producers to surge or limit production. In the context of COVID-19, the investment picture is severely clouded, but it is likely to further challenge investor and industry risk appetite for long-cycle projects. Long-cycle investment is exposed to investor skepticism not just regarding peak demand, but also a mixed record of execution by international oil companies (IOCs) and inconsistent policy treatment by governments with resource nationalist ambitions.[19]

US geopolitical leverage: The United States' emergence as a net energy exporter in 2019, assuming such a trend continues post-COVID, has given the country a freer hand to act—or not act—on the global stage. For instance, even as Venezuelan production dropped dramatically, US President Donald Trump was able to reimpose sanctions on Iranian oil exports with minimal impact on the domestic price of oil. At the same time, US officials stated they no longer feel the need to fight wars over oil.[20] Whether US energy dominance will survive COVID-19 and will continue under the Joe Biden administration is uncertain, given a shift in focus to clean energy technology and climate policy, but the United States will likely remain more energy resilient and less likely to be driven by global energy geopolitics over the medium term.

These broader oil market factors will impact—and be impacted by—the realization of peak demand. If prices remain low because of abundant and flexible crude oil supply and COVID-19 slowing economic growth, the transition to EVs and other non-oil modes of transportation will likely take longer, as it will be driven by policy and politics, and not necessarily by economics. However, higher prices, whether caused by a slowdown in US shale growth or other factors such as geopolitical instability or strong coordination by OPEC+, could hasten the transition as individuals respond to financial incentives to switch away from ICE vehicles and policymakers work to insulate voters from potential shocks. Given the growing availability of EVs and other clean technologies in the transportation sector, high oil prices have the potential to permanently destroy demand by encouraging substitution. After the oil shocks in the 1970s, there was a similar structural transformation of oil demand as the electric power industry abandoned oil in favor of coal and nuclear generation. The change did not happen overnight, but was accelerated by the availability of substitutes and by policy intervention.[21]

The Range of Future Energy Mix Scenarios

Numerous energy companies, consultancies, and research organizations produce annual, publicly available future energy mix scenarios based on economic modeling of energy supply and demand. These scenarios also model assumptions about energy and climate policy, economic growth, demographic change, and consumer preference, among many other variables. Even more groups produce proprietary scenarios. These documents help signal to businesses where the market is or could be going, and help policymakers shape the outcomes they desire with only a very broad understanding of the potential economic impacts. Many groups produce multiple scenarios, usually with one base case that outlines their business-as-usual projections if current trends remain steady, and then other scenarios in which assumptions are varied to include policy changes (such as public investment in renewable energy) and the introduction of technological innovations (such as new battery storage developments).

These scenarios, and the models that underpin them, vary in sophistication, detail, and rigor. They generally project out twenty to thirty years, though some go far further. Even

18 Javier Blas, Grant Smith, and Salma El Wardany, "OPEC+ Ministers Meet in Race Against Market to Clinch Deal," *Bloomberg*, April 12, 2020, https://www.bloomberg.com/news/articles/2020-04-12/oil-negotiators-race-against-clock-to-get-oil-supply-deal-done.

19 A 2014 study by Ernst and Young found that 64 percent of the 365 oil and gas megaprojects in its database had cost overruns and a further 73 percent were behind schedule; *Spotlight on Oil and Gas Projects,* Ernst & Young, 2014, http://globalsustain.org/files/EY-spotlight-on-oil-and-gas-megaprojects.pdf.

20 "US Policy Dialog with Ryan Zinke," CERAWeek by IHS Markit, July 3, 2018, https://ondemand.ceraweek.com/detail/video/5804882132001/us-policy-dialog-with-ryan-zinke.

21 The share of global electric power generation from oil fell from 21% in 1973 to just 3% by 2015, according to World Bank data; "Electricity Production from Oil Sources (% of total)," World Bank, 2014, https://data.worldbank.org/indicator/EG.ELC.PETR.ZS.

the very best scenarios vary widely based on differences in assumptions and modeling techniques.

A significant challenge for each of these scenarios—as well as the assessment of the trajectory of a peak oil demand scenario in general—is the nature of the change in oil demand itself, which remains difficult to determine.

Various factors—including competing policy priorities, variances in economic growth and energy prices, and the actual specifics of decarbonization policies in terms of economic effects on voters and key industries—have already undermined rapid progress toward peak demand from both policy and political perspectives.[22] As a result, the 1.5-degree scenario may be slipping out of reach as most major emitters are well behind their stated Nationally Determined Contributions on GHG reduction, which were embedded in the Paris Agreement.[23]

It could also be argued that the recent changes in supply and demand—and the associated political, economic, and industrial effects—are cyclical, rather than structural. Because of the lag time to produce new resources at times of high demand, and to change consumer behavior at times of high prices, cyclical booms and busts have characterized the oil industry and associated supply and demand factors for its nearly one-hundred-year history.[24] Previous supply and demand imbalances in the late 1980s and 1990s also led to geopolitical upheavals and funereal outlooks for the upstream oil industry.

On the other hand, the scale of potential disruption brought to bear by what the *Economist* summarized as "the death of the internal combustion engine," points to a markedly different situation than that in prior years.[25] Should these forces alter oil's value in the transportation sector in comparison to a growing suite of alternatives, the changes we see today could quite possibly be structural. For structural change to take place, electric passenger vehicles are not enough. Further transformation of oil demand in areas such as shipping, aviation, trucking, and petrochemicals would also need to occur. Indeed, the global oil industry is still developing new upstream capacity, based in large part on a view that such transformation will take decades to occur.

Regardless, the fact that this debate is even being held speaks to the questions surrounding the trajectory of global oil demand out to 2050 and beyond. Though policy change may fluctuate the severity of a flattening or decline in the demand curve, there is scant evidence to suggest that the demand growth will instead accelerate past the average of 1.4 percent mbd per year of the past ten years.[26]

22 Ian Bremmer and Cliff Kupchan, "Eurasia Group's Top Risks for 2020, Risk #7: Politics vs Economics of Climate Change," Eurasia Group, March 19, 2020, https://www.eurasiagroup.net/issues/top-risks-2020.

23 *Global Warming of 1.5°C, Intergovernmental Panel on Climate Change*, 2018, https://www.ipcc.ch/sr15/.

24 Robert McNally, *Crude Volatility: The History and Future of Oil Boom-Bust Cycles* (New York: Columbia University Press, 2017).

25 "The Death of the Internal Combustion Engine," *The Economist*, April 12, 2017, https://www.economist.com/leaders/2017/08/12/the-death-of-the-internal-combustion-engine.

26 *bp Statistical Review of World Energy 2020,* June 2020, https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf.

IV. The Scenarios

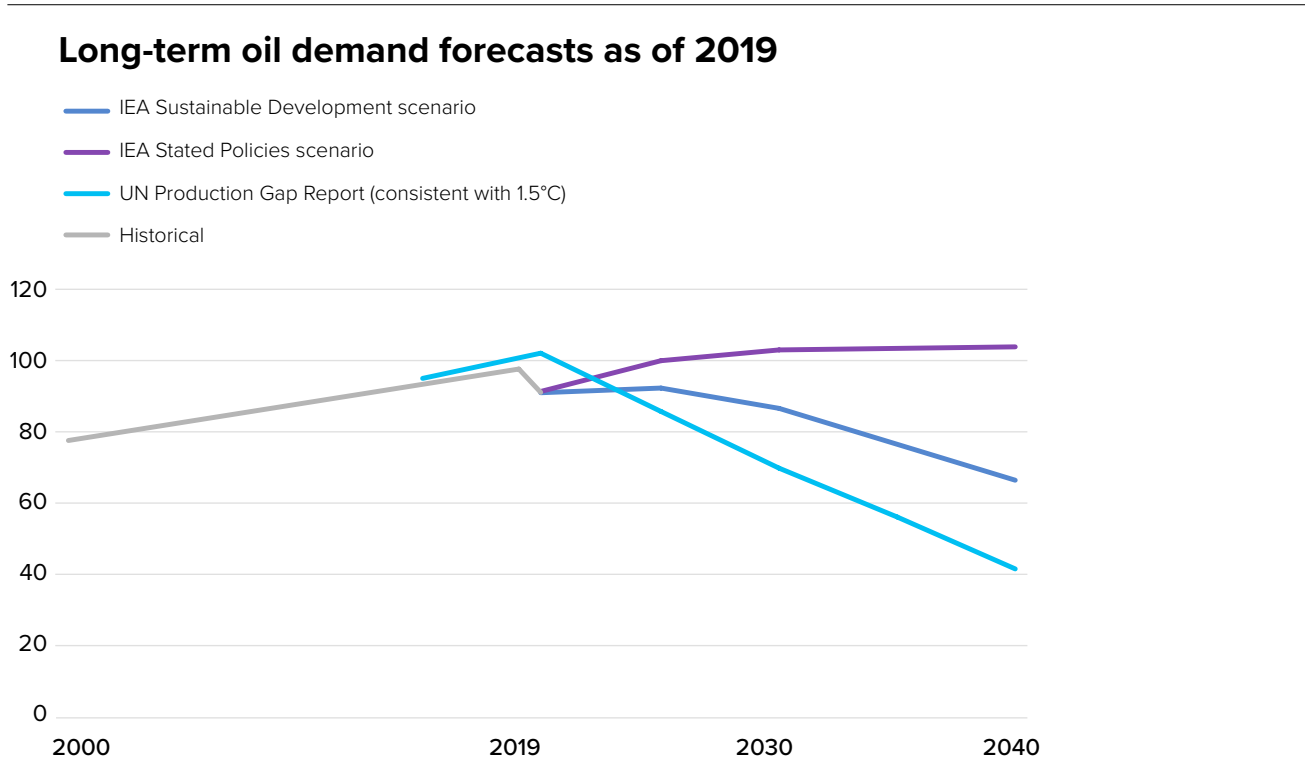
Absent from much of today's discussion about the transformation of the global transportation sector and peak oil demand is how these changes would impact geopolitics. However, the geopolitical impact will vary depending on the timing and scope of the transition.

To better illustrate the potential geopolitical impacts, the author selected two prominent decarbonization scenarios: the IEA's Sustainable Development Scenario and the UNEP's Production Gap Report Scenario. These two scenarios were chosen because they come from well-respected sources and represent distinctly different outcomes for global energy geopolitics, although both tend to reflect the more rapid and transformational end of peak demand forecasts.

The rate of oil demand decline is particularly important for this report's analysis of the corresponding changes in the oil market and, consequently, the economic and political impacts at a country level. Simply put, a rapid decline places more economic and political stress on producers than a plateau and slow decline. (Both scenarios here include more rapid decline.) The bottom of the post peak decline will have key implications for which producers, companies, and countries remain viable depending on a number of factors, including their GHG intensity, their political stability, the cost and rate-of-return expectations, and other factors this report explores further below.

The Sustainable Development Scenario Compared to the Production Gap Report Scenario: Speed of Transition

The speed of transition away from oil will be a key factor shaping the intensity of economic pressure on oil producing countries. In 2040, there are twenty-nine million more barrels of demand in the Sustainable Development Scenario than in the Production Gap Report Scenario, which suggests more countries will still be exporting oil, though some of those barrels will surely be sold by the same low-cost, low geopolitical risk



SOURCE: This chart is based on data from the International Energy Agency and the UN's *The Production Gap (Special Report 2020)*.

Energy Transitions Scenarios Summary

IEA Sustainable Development Scenario

Peak Demand Outlook	Oil production peaks in the mid-2020s and falls to 67 mbd by 2040.
Major Underlying Assumptions	Built around the Paris Agreement but also other UN Sustainable Development Goals, such as reducing air pollution and expanding access to energy. In the Sustainable Development Scenario, a higher and broader CO_2 price is assumed, rising to $140/tonne in 2040 in advanced economies and to $125/tonne in selected developing economies such as Brazil, China, Russia and South Africa. There is an interplay between the CO_2 prices assumed and a variety of other policy measures, such as vehicle and building efficiency standards, renewable energy targets and support for new technology development. Reductions in oil use in road transport are particularly significant. By 2040, 50 percent of cars are electric (with 900 million electric cars on the road), as are most of the world's urban buses; almost two million barrels of oil equivalent (mboe) per day of biofuels are consumed in the aviation and shipping sectors; and almost 20 percent of the fuel used by trucks worldwide is low-carbon. The only sector to see demand growth is petrochemicals; while the rate of plastics recycling more than doubles (from around 15 percent today to 35 percent in 2040), demand increases by almost 3 mb/d to 2040.
Geopolitical Implications	In the Sustainable Development Scenario there is less need to develop higher cost oil and the market finds a balance at a much lower price. The risk of market volatility in this scenario remains significant, however, not least because of the strains that this scenario implies for many large producer countries in the light of their high dependence on hydrocarbon revenues.

UNEP Production Gap Report Scenario

Peak Demand Outlook	Oil production is assumed to peak in the early 2020s and fall to 40 mbd by 2040.
Major Underlying Assumptions	The "Production Gap" refers to the gap between expected oil production based on current rates and announced investment plans in contrast tothe level of production that would be consistent with the 1.5-degree scenario. According to the report, the world should be producing no more than 40 mbd in 2040 in order to be consistent with the 1.5-degree scenario, versus 120 mbd in the business-as-usual case. The study argues for an emphasis on "supply side climate policy," in which governments will eliminate fossil fuel production subsidies and put limits on new extraction, supported by the UN COP process taking on fossil fuel production more directly. Unlike the Sustainable Development Scenario, the Production Gap Report Scenario does not outline specific changes to transportation policy.
Geopolitical Implications	The study finds GHG emissions from oil production in the business-as-usual case would be 210 percent higher than emissions levels needed to achieve the 1.5-degree scenario. The study argues that continuing to "lock in" oil and gas production through continued investment will make the eventual transition even more disruptive for countries dependent on oil and gas revenues. The study highlights the importance of a "just transition" in limiting political, social, and economic disruption from the phaseout of oil production.

Key Transportation Policy Assumptions in IEA's Sustainable Development Scenario

- Strong support for electric mobility, alternative fuels, and energy efficiency.
- Retail fuel prices kept at a level similar to the Stated Policy Scenarios (STEPS), applying carbon-dioxide (CO_2) tax across World Energy Model (WEM) regions.
- Passenger light-duty vehicles (PLDVs): on-road stock emissions intensity limited to 55 grams of carbon dioxide per kilometer (g CO_2/km) in advanced economies and 70 g CO_2/km elsewhere by 2040.
- Two- and three-wheelers: phase out two-stroke engines.
- Light-duty gasoline vehicles: three-way catalysts and tight evaporative controls required.
- Light-duty diesel vehicles: limit emissions to 0.1 g/km nitrogen oxide (NOX) and 0.01 g/km particulate matter (PM).
- Light commercial vehicles: full technology spillover from PLDVs.
- Medium- and heavy-freight vehicles: 25 percent more efficient by 2040 than in the STEPS.
- Heavy-duty diesel vehicles: limit emissions to 3.5 g/km NOX and 0.03 g/km PM.
- Aviation: fuel intensity reduced by 2.6 percent per year; scale-up of biofuels driven by long-term CO_2 emissions target (50 percent below 2005 levels in 2050).
- International shipping: annual Greenhouse Gas (GHG) emissions trajectory consistent with 50 percent below 2008 levels in 2050, in line with International Maritime Organization GHG emissions-reduction strategy.

countries, further reinforcing their success as compared to the higher-price, less stable countries.

Wealthier oil-producing nations are already focusing on efforts to diversify away from heavy reliance on oil revenues, but the speed and severity of a decline in oil demand in both scenarios not only introduces urgency for these reforms, but also bolsters their ability to gain traction and be successful during a short period of time. In some cases, a shortfall in oil revenue will create a funding gap for diversification efforts, putting pressure on official reserves as well as the financing needs of other sectors. Wealthier countries have exhibited an ability to successfully incubate these diversification plans, but not all have been successful in creating real diversification as measured by increases in key indicators like oil rents as a percentage of gross domestic profit (GDP) or oil exports' share of overall exports. Moreover, those states without the financial resources and political structures to pursue diversification risk missing the opportunity to diversify, or they may become heavily dependent on foreign partners and investors to incubate new industries outside oil. This, in turn, introduces a disjointed and unstable outlook for both oil and other industries.

The following chart lays out the major policies and targets of several of these plans.

Moreover, even though oil producers in the Sustainable Development Scenario would have more time to diversify their economies away from a dependency on oil revenues, this would require significant institutional stability and resources that only a handful of states are able to adequately leverage. The economies of weaker and less politically stable countries such as Libya, Venezuela, and Iraq still suffer considerably, especially as they meet significant challenges trying to compete for market share without the OPEC backstop. Russia would likely fall under this category as, in the longer term, the country shifts toward developing a higher-cost resource and, at the same time, does not invest enough in sustainable upstream strategies and broader economic diversification. On the other hand, GCC countries, in particular, are better able to manage these headwinds for a longer period of time, especially when compared to the rapid transition scenario.

Overall, the Sustainable Development Scenario provides more room and time for the high-risk producers to try to diversify their economies, and for the high-carbon, high-cost producers to leverage technology to become cleaner and more competitive. By contrast, the Production Gap Report Scenario encompasses a 60 percent drop in crude demand from 2019 levels by 2040, implying a deeper range of economic pressures on a wider range of producers. But, in both scenarios, the

Select Reform Initiatives from Producer Economies	
Producer and program	**Major policies and targets**
Bahrain: Economic Vision 2030	At least double the disposable income of every household in real terms by 2030. Stimulate growth by enhancing productivity and skills. Build and diversify the economy by focusing on existing high-potential sectors. Transform the economy in the longer term by capturing emerging opportunities.
Iran: Sixth National Development Plan (2016–2021)	8 percent economic growth rate. Lower share of oil revenues in the budget to 22 percent. Increase power generation capacity by 25 gigawatts. Lower energy intensity by 15 percent. Lower unemployment to 8.9 percent and inflation rate to 7 percent.
Kuwait: National Development Plan 2035	Develop a prosperous and diversified economy to reduce the country's dependence on oil export revenues. Increase the number of small businesses by 3,500. Realize the goal of producing 15 percent of electricity by renewable resources by 2030. Increase investment by 11 percent.
Nigeria: Economic Recovery and Growth Plan 2017–2020	Real GDP growth rate of 4.62 percent projected. Stabilize macroeconomic environment, ensuring energy sufficiency, driving industrialization, focusing on small and medium-sized enterprises (SMEs). Create more than 15 million jobs by 2020. Increase oil production to 2.5 mbd by 2020.
Oman: The Ninth Five Year Development Plan 2016–2020	Maintain an annual real GDP growth rate of around 3 percent. Non-oil sector growth rate of 4.3 percent. Promote a diversified sustainable economy (share of oil sector in total GDP is expected to decrease from 44 percent to 30 percent). Increase the share of non-oil exports in total exports.
Qatar: National Vision 2030	Reasonable and sustained rates of economic growth. Stimulate business climate to attract foreign funds and technologies. Optimize exploitation of hydrocarbon resources, establishing a balance between reserves and production. A diversified economy that gradually reduces its dependence on hydrocarbon industries, enhances the role of the private sector, and maintains its competitiveness. Expansion of industries and services with competitive advantages derived from hydrocarbon industries.

Select Reform Initiatives from Producer Economies	
Saudi Arabia: Vision 2030	Lower the rate of unemployment from 11.6 percent to 7 percent. Generate 9.5 gigawatts from renewable energy sources. Increase the private sector contribution from 40 percent to 65 percent of GDP. Raise the share of non-oil exports in non-oil GDP from 16 percent to 50 percent. Increase non-oil government revenue from SAR 163 billion to SAR 1 trillion. Increase SME contribution to GDP from 20 percent to 35 percent.
UAE: Abu Dhabi Economic Vision 2030	Reduce GDP volatility through diversification. Enlarge enterprise base. Equip the UAE youth to enter the workforce. Diversify fiscal revenue sources.
Source: International Energy Agency's World Energy Outlook Special Report.	

stranded asset reality will quickly emerge for those producers that cannot adjust, and will likely be accelerated by increasingly discriminatory global capital pools.

The Sustainable Development Scenario Compared to the Production Gap Report Scenario: Transportation, Climate Policy, and ESG

In the Sustainable Development Scenario, oil's role in the transportation sector sees a major decline given a rapid proliferation of new energy vehicles, primarily electric and hydrogen fueled, owing to more aggressive policy mandates and technology advancements that reduce costs and other technological barriers. This is especially true in China and in the United States, after early successes of EV sales and higher fuel efficiency standards incubated in the California auto market spread across the country.

These developments further weaken traditional sources of oil demand in the transportation sector and beyond, thereby exponentially increasing demand destruction year over year. The Sustainable Development Scenario highlights the need for clear and unwavering national policy priorities, and strong global momentum expanding commitments to decarbonization, as necessary preconditions for oil demand to begin a rapid decline in the early 2020s.

This transition to low-carbon or clean transportation is further supported by stronger and more predictable policy consistency, which gives investors more confidence in allocating capital to new energy technologies, speeding up cost reductions and other advancements. The increasing capital flight away from exploration and production of oil across the industry accelerates the arrival of a peak in demand.

The Production Gap Report Scenario takes an entirely different approach. The focus is on the supply side, rather than demand side. While the scenario is intended to support the implementation of the UN Intergovernmental Panel on Climate Change (IPCC) 1.5-degree scenario, the focus is on limiting production of fossil fuels rather than encouraging alternatives. As such, the focus is less directly on consumption, but rather on the elimination of "planning, policies, and public finance" of oil and other fossil fuel production.[27] The scenario is also closely aligned with the growing ESG movement in the financial community, which highlights the need for oil companies to disclose how their plans for future production align with the 1.5-degree scenario. The Production Gap Report Scenario argues that, as part of their UN Nationally Determined Contributions

27 *The Production Gap: The Discrepancy Between Countries' Planned Fossil Fuel Production and Global Production Levels Consistent with Limiting Warming to 1.5°C or 2°C*, Stockholm Environment Institute, International Institute for Sustainable Development, ODI, Climate Analytics, Center for International Climate Research (CICERO), and United Nations Environment Program, 2019, https://productiongap.org/2019report/.

to the Paris Agreement, "countries could adopt a range of supply side policies … including: moratoria on new fossil fuel infrastructure; removal of subsidies for fossil fuel producers; fossil fuel production and export taxes; and divestment of public funds from fossil fuel holdings."[28]

The Production Gap Report Scenario's goal of 38 mbd in 2040 may seem impossible to many market observers, given the scale of transformation required. And, there are many barriers, including the "carbon entanglement" and "just transition" risks described in the report and the supporting modeling. Yet, by aligning with the ESG movement goals globally, the goal has a powerful tailwind: the major institutional investors, banks, and insurers that lend money to the oil sector, sit on its boards, and underwrite the industry's risks and growth needs. The market forces generated by the Production Gap Report Scenario would also likely accelerate peak demand and a low-carbon transition. If government policy moved against oil production along the lines of the Production Gap Report Scenario, there would likely be a price spike as supply rapidly contracts, with the elasticity of demand being limited by the availability of substitutes such as electric vehicles, hydrogen trucks and ships, etc. The resulting oil price spike would then likely spur further consumer uptake for new energy vehicles, with higher oil prices creating a shorter "payback period" for consumers to recoup the savings from not purchasing gasoline.[29]

28 Ibid.

29 Colleen Jansen, "How Much Money Could You Save by Driving Electric?" ChargePoint, October 24, 2017, https://www.chargepoint.com/blog/how-much-money-could-you-save-driving-electric/; Marianne Kah, *Electric Vehicles and Their Impact on Oil Demand: Why Forecasts Differ,* Columbia University School of International and Public Affairs Center on Global Energy Policy, July 2018, https://energypolicy.columbia.edu/sites/default/files/pictures/CGEP_Electric%20Vehicles%20and%20Their%20Impact%20on%20Oil%20Demand-Why%20Forecasts%20Differ.pdf.

V. Methodology and Overview of Implications for Key Producing Regions

In a world trending toward decarbonization, innovation and changing consumer preferences for transportation fuel and technologies, and an uncertain recovery from the COVID-19 pandemic, the outlook for oil prices and upstream oil investment is highly uncertain. Accordingly, the ability to attract capital will become more challenging, as oil demand peaks and the overall pool of investable capital contracts from already-diminishing levels over the next decade. Nonetheless, capital will still flow into the oil sector in the two peak demand scenarios, which is necessary to sustain production at 67 mbd and 38 mbd in 2040, albeit at significantly reduced levels.

The author's core hypothesis is that investment capital will likely flow to oil producers with **low-cost**, **low-risk**, and **low-carbon** resources in a context of slower demand growth. This will have a significant bearing on the ability of producers to secure market share in a peak demand scenario, maintain oil revenues, and support diversification plans necessary to ensure financial stability over the long term.

Cost

Cost is the most straightforward factor, although not without some complexity. The basic concept in the oil and gas industry is that low-cost projects are desirable because they will generate the highest returns based on the difference between cost and price. The history of the oil market also shows a cost curve, where higher-cost resources have a more cyclical profile, with investment ebbing and flowing along with the price outlook. Most resources are long cycle, meaning they take years to develop once approved, and often decades to fully pay out and generate a return on initial investment. Costs usually break down between land acquisition, field development, extraction costs, transportation, capital costs, overhead, royalties, taxes, and often a target rate of return (typically 10–15 percent). A so-called full-cycle cost will encompass all of these, while a half-cycle cost calculation is based on the cost of adding new wells in an existing field.[30] Data on all the above are elusive—proprietary to companies in some cases, to private consultants in others—and often both conflicting and changing over time. Nonetheless, there is broad, if imperfect, consensus at the highest levels on the industry cost curve at the national level, which is the focus of this study.

Risk

The second core factor is risk, which like cost can be measured through a number of metrics in the oil and gas sector. The industry often differentiates between below-ground risks and above-ground risks. In the context of the two peak demand scenarios discussed here, both types of risk would be relevant. Projects with complex geology or engineering challenges will likely be higher cost, and more likely to fall off the cost curve in a peak demand scenario. Similarly, projects with above-ground risk, whether political instability, complex and extended supply chains, currency conversion risk and volatility, or labor market problems, will also be less likely to attract or sustain capital in a peak demand scenario.[31] The relationship between risk and industry investment in oil and gas is often evaluated through a hurdle rate, specifically, a calculation of a risk premium that a company or investor will allocate to a project.[32] The practical effect of this is that projects with below- or

30 R.L. Kleinberg et al., "Tight Oil Market Dynamics: Benchmarks, Breakeven Points, and Inelasticities," *Energy Economics*, Vol. 70 (February 2018), 70-83, https://www.sciencedirect.com/science/article/pii/S0140988317304103.

31 Above-ground risk in the oil and gas sector has been studied extensively since the creation of OPEC and the wave of oil industry nationalizations and violent conflicts beginning in the 1970s. Daniel Yergin's *The Prize* and *The Quest* offer a comprehensive history. For a more specific discussion of political risk in the oil and gas industry see Stephen A. Mucci, *Political and Investment Risk in the Oil and Gas Industry* (London: Rowman 2017).

32 Amy Gallo, "A Refresher on the Cost of Capital," *Harvard Business Review*, April 30, 2015, https://hbr.org/2015/04/a-refresher-on-cost-of-capital.

A view of the Safer oil refinery in Marib, Yemen, in September 2020. REUTERS/Ali Owidha

above-ground risks will require a higher rate of return in order to attract capital.[33] Oil and gas companies will tend to allocate capital first to projects with the highest risk-adjusted returns.[34]

Importantly for this study, above-ground risk can not only deter new investment, but can also, in some cases, affect industry's willingness and ability to sustain ongoing investment in fully operating oil and gas production. The history of the oil industry is replete with oil production developments that have been abandoned or scaled back through political unrest, war, and nationalizations. Sometimes such projects come back after a period of time, particularly as political conditions change and prices reach levels to incent new risk taking by industry. Recent examples can be found in Libya, Yemen, Colombia, Iraq, and Iran, among others.

The importance of above-ground risk in a context of growing upstream investment and rising oil demand is clear from history, but the author argues it will be even more critical as upstream investment and global oil demand peak and then decline. In other words, peak demand could both make existing above- ground risks worse and destabilize producers that have been historically stable. In this context, economic diversification and the degree of dependence on oil revenue will be key variables. Countries that cannot sustain oil sector investment from internal or external resources will be less likely to mitigate potential economic instability or political unrest from peak demand and resulting declines in oil revenue. In contrast, countries that can diversify and reduce dependence on oil overall will face less disruption risk. The World Bank summarizes the challenge well: most countries, it says, "start out with a relatively high dependence on natural capital and those that progress most successfully manage their assets for the long term and reinvest in human and social capital as well as in building strong institutions and systems of governance."[35]

33 Jess Chun and R. Woodward, "Hurdle-Rate Measurement for Non-U.S. Projects in the Energy Industry (includes associated papers 25287 and 25305)," *Journal of Petroleum Technology*, Vol. 44 (April 1, 1992), 502-505, https://onepetro.org/JPT/article-abstract/44/04/502/69851/Hurdle-Rate-Measurement-for-Non-U-S-Projects-in?redirectedFrom=fulltext.

34 Martin Pergler and Anders Rasmussen, "Making Better Decisions about the Risks of Capital Projects," *McKinsey on Finance*, No. 50 (Spring 2014), 16-22, https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/corporate%20finance/mof/issue%2050/mof50_making_better_decisions.ashx.

35 *The Changing Wealth of Nations: Measuring Sustainable Development for the New Millennium,* World Bank, January 20, 2011, https://issuu.com/world.bank.publications/docs/9780821384886.

Oil Market Transition Resilience Index: Projected Considerations in New Oil Investment

Factor	Indicators	Weighting
Cost	Lifting costs and cash costs Moody's country risk premium, weighted average cost of capital Fiscal breakeven	30 percent
Risk	Eurasia Group Global Political Risk Index World Bank Ease of Doing Business Index Ratio of official reserves to oil export revenue Ratio of official reserves to oil fiscal revenue	50 percent
Low-Carbon/ ESG-Friendly	Grams carbon dioxide equivalent (CO_2E)/megajoule Barrels/ton GHG emissions Yale Environmental Index S&P Robeco Country ESG Ratings	20 percent

Carbon and Emissions Intensity

Until very recently, questions around GHG intensity, Paris Agreement compliance, or Scope I emissions were entirely absent from analysis of the attractiveness of various oil plays and producers to capital markets. This assumption is at the very core of the Sustainable Development and Production Gap Report Scenarios; in a global, low-carbon transition, the highest GHG resources should be shut in first. Carbon capture, utilization, and sequestration (CCUS), or various forms of offsets, may affect this, but those investments come with their own cost and risk calculations. Whether this pattern is enforced by governments, or by companies and ESG investors, the trend toward restricting capital from more GHG-intensive oil sources is gaining momentum.[36] Yet, the data underpinnings for evaluating the various climate metrics of oil production are very early stage and incomplete. There is further ambiguity about whether oil production should be assessed according to its Scope I (direct), Scope II (emissions from electricity generated to support production), or Scope III (combustion-level) emissions. This is a critical question, given that 85 percent of total emissions are Scope III and take place after the crude has been produced, refined, and sold to consumers.

Oil Market Transition Resilience Index

To evaluate these factors across oil-producing countries, this paper sets out an Oil Market Transition Resilience Index to establish a benchmark by which to assess the geopolitical resiliency of countries in a peak oil demand scenario. The index assesses each of these factors—cost, risk, and carbon emissions—and their relative importance within a range of oil-producing country groupings. The cumulative score of the three factors in any given place indicates this paper's assessment of that grouping's capacity to continue to attract capital and manage transition risk.

First, each factor is weighted in the index based on the author's judgment, which reflects an informal dialogue with both oil and gas industry officials and outside investors in the sector about the relative importance of each factor in capital allocation for upstream oil expenditure. In a scenario of peak demand, risk is likely to be the predominant factor and, therefore, is given a 50 percent weighting. Peak demand and lower prices will reduce industry appetite for risk, and for projects that require higher rates of return or higher oil prices to be successful. Cost will remain a critical factor, and is given a 30 percent weighting, with peak demand and lower prices advantaging lower-cost projects. Cost encompasses not just lifting costs,

36 Examples of government action include the EU Fuel Quality Directive and the California Low-Carbon Fuel Standard. Examples of company and investor actions are numerous, but key cases include the exit of major European supermajors and banks from the Canadian oil sands, as well as various investor campaigns against gas flaring in the Permian Basin and elsewhere.

Oil Market Transition Resilience Index: Production Groupings and Weighted Score

Producer groupings are ranked relative to each other on a scale of one to four for each factor (cost, risk, and low carbon/ESG. Scores for each factor are weighted as a percentage of total attractiveness for new investment, then summed to provide a total score indicating risk to the energy transition, with a lower score indicating a lower level of risk.

	Cost Ranking	Cost Score (Ranking Weighted at 30 Percent)	Risk Ranking	Risk Score (Ranking Weighted at 50 Percent)	Low Carbon/ESG Ranking	Carbon Score (Ranking Weighted at 20 Percent)	Total Weighted Score
Core GCC	1	.3	2	1	1	.2	1.50
North America+	4	1.2	1	.5	2	.4	2.10
Russia	3	.9	3	1.5	3	.6	3
Fragile and Failing	2	.6	4	2	4	.8	3.40

but broader fiscal costs and cost of capital as well. Finally, the 20 percent weight on climate signals that it is significant for industry capital allocators (and growing), but cost and risk still rule.[37]

A clear theme is that while industry has a long and complex history of allocating capital according to well-developed cost and risk methodologies, the focus on climate is growing. A good example of the growing focus on GHG intensity is the 2020 BP World Energy Outlook, which assesses GHG intensity of crude oil production. The BP study concludes that supply for the lowest quartile carbon intensity will increase by 2.7 mbd in its "rapid" scenario, while the highest quartile intensity producers will see production decline by 2 mbd.[38]

While the countries could be grouped according to OPEC/non-OPEC, Organisation for Economic Co-operation and Development (OECD)/non-OECD, international oil company (IOC)/national oil company (NOC), this taxonomy is organized to emphasize geopolitical differences and above-ground risks, such as political systems, security, environmental policy, and fiscal policy as equally important to commercial factors in the ability of oil producers to manage a peak demand scenario. Core GCC excludes Qatar because it is a smaller oil producer, has been at odds with its larger neighbors, and left OPEC in 2018. North America+ is intended to capture higher-cost producers with more complex resources (deepwater, shale, oil sands), even though the countries vary with respect to the role of NOCs vs IOCs. Most of these countries are also more diversified economies than those of other producing regions. Russia is a category unto itself because of its size, geopolitical influence, and political system. Lastly, the fragile and failed states include countries with higher above-ground risk and capital costs. This group includes countries that are vulnerable but not in crisis (Algeria, Kazakhstan, Nigeria, Angola, and Iraq), as well as those confronting geopolitical factors that have significantly disrupted oil investment (Iran, Venezuela, and Libya).[39] The list of country groupings are as follows:

- Core GCC (Saudi Arabia, Kuwait, UAE)
- North America+ (United States, Canada, Mexico, Brazil, Norway)
- Russia
- Fragile and failed states (Iraq, Iran, Libya, Nigeria, Angola, Algeria, Venezuela, and Kazakhstan)

Across each of these producer groupings, country-level indicators for each of the three factors—cost, risk, and

37 It could also be argued that climate change should be included in with other risks. This report argues that climate change will be a factor influencing projects that may otherwise have attractive cost and risk metrics. At this point, this report does not weight the factors within each risk factor.

38 "Global Market for Liquid Fuels Adjusts to Changing Patterns of Demand and Production," bp, accessed on May 13, 2021, https://www.bp.com/en/global/corporate/energy-economics/energy-outlook/demand-by-fuel/oil.html.

39 Carbon Tracker International has produced an excellent report looking at economic vulnerability for petrostates, with a much broader set of 40 developing country producers. See *Beyond Petrostates: The Burning Need to Cut Oil Dependence in the Energy Transition,* Carbon Tracker, February 11, 2021, https://carbontracker.org/reports/petrostates-energy-transition-report/.

Oil Market Transition Resilience Index: Oil Production by Major Producer and Producing Region: Current vs 2040

In million barrels per day (mbd)

Grouping	Country	2019 Baseline	2040 Sustainable Development Scenario	2040 UNEP Production Gap Report Scenario
Core GCC	Saudi Arabia	12	12.5	6
	UAE	3.9	4.5	3
	Kuwait	2.67	3	2
Russia	Russia	10.6	7.5	5
North America+	United States	12.7	9	6
	Canada	4.9	3	2.5
	Norway	2.07	1.2	0.5
	Brazil	3.06	1.5	1
	Mexico	1.74	0.5	0.5
Fragile and Failing	Iraq	4.9	3	1.5
	Iran	3.8	2	0
	Venezuela	0.84	0.5	0
	Libya	1.19	0.6	0
	Kazakhstan	1.72	0.8	0.5
	Algeria	1.01	0.5	0.3
	Nigeria	1.8	1	0
	Angola	1.42	0.7	0
Other		29.5	17	10
Total		99.82	68.8	38.8

carbon emissions—were aggregated to rank each grouping on a scale from one to four, relative to each other, within each factor; the lower the score, the better the group performs within each factor. Each score is underpinned by a variety of indicators, including data that measure national dependence on oil revenue, economic diversification, investment climate, social capital, and the environmental impact of the oil sector. The rankings for each country are multiplied by the weighted value of each factor (cost at 30 percent; risk at 50 percent; and low carbon/ESG at 20 percent), then added together to provide an indicator of new investment risk to each grouping as each manages the oil market transition in the Sustainable Development and Production Gap Report Scenarios. The lowest score equals the most likely to attract continued investment and manage a transition to a peak demand scenario.

Overall, the author believes this initial effort helps assess regional challenges linked to peak demand and potential geopolitical risks and opportunities for policymakers and industry. It also helps begin to operationalize how climate and ESG factors will shape the oil market in the near future.

Using the Oil Transition Risk Index, the table below demonstrates how oil production could be redistributed on the basis of the resilience of each state and its likely attractiveness to investors targeting low-cost, low-risk, and low-carbon oil. The model includes a relative allocation of production in each peak demand scenario, with the countries with the lowest risk, cost, and carbon aggregate scores retaining the largest share of production. Production shares are further allocated on a diminishing basis according to the risk, cost, and carbon scores. On this basis, the further logic of the model is that the countries with higher risk, cost, and carbon intensity will lose

Oil Market Transition Resilience Index: Global Crude Production Market Share: Current vs 2040

Percent Distribution by Producing Region

Grouping	Country	2019	2040 Sustainable Development Scenario	2040 Production Gap Report Scenario
Core GCC	Saudi Arabia	18.60%	29.07%	28.35%
	UAE			
	Kuwait			
Russia	Russia	10.62%	10.90%	15.46%
North America+	United States	24.51%	22.09%	27.06%
	Canada			
	Norway			
	Brazil			
	Mexico			
Fragile and Failing	Iraq	15.52%	13.23%	5.93%
	Iran			
	Venezuela			
	Libya			
	Kazakhstan			
	Algeria			
	Nigeria			
	Angola			
Other		29.55%	24.71%	25.77%

market share, while those with lower risk, cost, and carbon intensity will retain or grow market share.

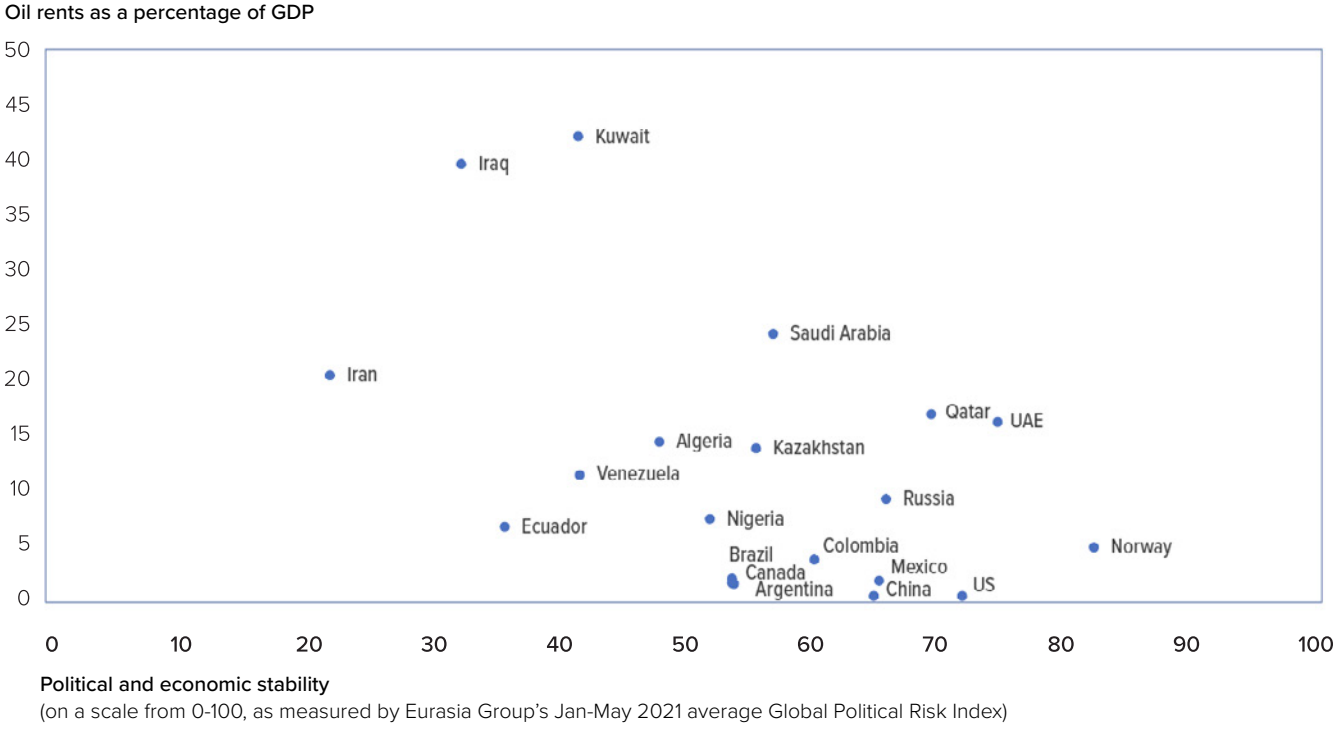
Finally, the ability of oil-producing regions and their capacity to manage peak demand will be guided by their capacity to manage domestic stability and external shocks.

This paper uses the Eurasia Group's Global Political Risk Index (see below), along with the shared geopolitical expertise of the Atlantic Council, to further understand how the above projections of market conditions in more rapid transition scenarios like Sustainable Development and Production Gap Report Scenarios might further impact oil-producing countries.

While many studies have looked at peak oil demand, few have attempted to look at the long-term effects on regional oil producers. The Institute of Energy Economic Japan (IEEJ) did so in its 2018 Energy Outlook.[40] This paper builds upon to the IEEJ report, but varies in three key respects. First, the IEEJ model looked at production by strict geographic grouping. While its study looked at the effects of peak demand on the Middle East overall, this report attempts to distinguish between the core GCC producers and fragile and failed states such as Iraq, Iran, Algeria, and Libya. Second, the IEEJ model allocates future market share of oil production in its peak demand scenario according to cost. While low cost is a key factor, this report argues that the future distribution of oil production will also be shaped by industry and investor perceptions of risk, as well as the climate/ESG characteristics of each producer. Finally, the IEEJ model looks at an 87-mbd scenario for 2050, primarily based on accelerated penetration of zero-emissions vehicles. The author has opted for the

40 Yukari Niwa Yamashita, "IEEJ Outlook 2018: Prospects and Challenges," The Institute of Energy Economics, Japan, November 8, 2017, https://eneken.ieej.or.jp/data/7690.pdf.

Oil dependency and political and economic stability



SOURCE: World Bank, Eurasia Group

more aggressive and disruptive Sustainable Development and Production Gap Report Scenarios, both to assess the market and geopolitical effects of a more rapid peak, and because the Sustainable Development and Production Gap Report Scenarios are closer to the Paris Agreement targets that are increasingly driving investment and policy related to the oil sector.[41]

Given the shared geopolitical expertise between the Atlantic Council and Eurasia Group, this report demonstrates particular interest in how various measures of government performance and capacity will influence the ability of various countries to manage domestic stability as peak oil demand takes shape.[42] This report leverages Eurasia Group's Global Political Risk Index and measurements of political capacity, defined as the ability of a government to manage external shocks. This approach is central to this report's assessment of the major oil-producing regions and their capacity to manage peak demand, particularly the more rapid transition scenarios like the Sustainable Development and Production Gap Report Scenarios.

41 Yamashita, "IEEJ Outlook 2018."

42 *Redrawing the Geopolitical Map, The Global Commission on the Geopolitics of the Energy Transformation*, January 2019, http://geopoliticsofrenewables.org/report/redrawing-the-geopolitical-map.

VI. Regional Analysis

Core GCC

Saudi Arabia, Kuwait, and the UAE are well positioned to manage a peak in oil demand on some fronts, and challenged on others. These three countries represent 17 percent of global crude oil production and have long been a focal point of global energy geopolitics, from World War II to the oil shocks of the 1970s to the Iranian attacks against Aramco facilities at Abqaiq, Saudi Arabia, in September 2019. A core US foreign policy doctrine established in the Jimmy Carter administration was to prevent any foreign power from dominating the oil-rich region.[43] While the United States no longer has much direct dependence on the Gulf for crude imports, stable oil markets remain critical to the global economy, to key US allies, and to US shale producers. Beyond oil, the United States has key interests in GCC stability as a hedge against both Islamic terrorism and aggression from nearby Iran.

The core GCC producers are well positioned to manage geopolitical fallout from both peak demand scenarios evaluated in this report. The pathway is by no means certain, particularly for Saudi Arabia, but structural advantages around strong financial capacity, stable political systems, low lifting costs, the ability to self-finance the energy sector or raise capital at low cost, and a low carbon footprint will help the three GCC producers manage the low-carbon transition. Key risks include a failure of economic diversification programs, a breakdown in the monarchy structures governing all three countries, and instability contagion from neighboring oil producers in Iraq and Iran, which are likely to fare less well in the low-carbon transition.

The core contrast between the major GCC oil producers is between very low production costs for crude oil and materially higher breakeven prices to balance budgets, along with relatively thin non-petroleum revenue streams.[44] Saudi Aramco reported lifting costs of just $2.80 per barrel in 2019 as part of financial disclosures around its international public offering, with neighboring national oil companies in the UAE (Abu Dhabi National Oil Company) and Kuwait (Kuwait Petroleum Corporation) reporting similar numbers.[45]

A key counterpoint pertains to the high degree of social spending, industrial subsidies, and defense budgets, all of which have been built on the back of high oil prices and high volumes of production. The transfer mechanisms between state-owned national oil companies and government fiscal coffers are not always clear.[46] Nonetheless, decades of high prices and high volumes for oil have created extraordinary wealth in all three countries. In recent years, governments in each country have committed to economic diversification efforts that have produced mixed results, particularly in Saudi Arabia and Kuwait. The UAE is further along in its diversification efforts, in part, thanks to the non-petroleum economies in Dubai.

Yet, the World Bank notes that "traditional diversification" is inadequate because it frequently means developing the hydrocarbons value chain to include refining, petrochemicals, and energy-intensive manufacturing. These efforts may reduce direct exposure to upstream crude oil prices, but do not necessarily spur the skill development or capital formation to bolster other sectors of the economy that will be imperative for state success through the energy transition.[47] The World Bank further notes that diversification into refining and petrochemicals has only increased the exposure of the GCC countries to climate-linked policy disruption.[48]

As such, a vital part of the GCC's ability to successfully manage peak oil demand will be its climate and sustainability policies. A December 2019 World Bank update on the GCC economies noted that GCC producers fare well on the "carbon intensity curve, with average lifecycle GHG

43 "Editorial Note" from *Foreign Relations of the United States, 1977–1980, Volume XVIII, Middle East Region; Arabian Peninsula*, Office of the Historian, Foreign Service Institute, United States Department of State, accessed on May 18, 2021, https://history.state.gov/historicaldocuments/frus1977-80v18/d45.

44 Bahrain, Qatar, and Oman are excluded from this study due to relatively smaller oil production.

45 "Aramco's Oil Production Costs Least in the World at $2.8 Per Barrel," *Asharq Al-Awsat*, November 15, 2019, https://aawsat.com/english/home/article/1993111/aramco%E2%80%99s-oil-production-costs-least-world-28-barrel.

46 Ellen R. Wald, "Why the IMF is Wrong about Saudi Arabia Needing $85 Oil," *Forbes*, April 29, 2019, https://www.forbes.com/sites/ellenrwald/2019/04/29/why-the-imf-is-wrong-about-saudi-arabia-needing-85-oil/#725d4b1e54cb.

47 Antonio M. Ollero and Sahar S. Hussain, "Economic Diversification for a Sustainable and Resilient GCC," *Gulf Economic Update*, No. 5 (December 2019), 1-61, http://documents.worldbank.org/curated/en/886531574883246643/pdf/Economic-Diversification-for-a-Sustainable-and-Resilient-GCC.pdf.

48 Ibid.

intensity of below 10 grams of CO_2 equivalent per megajoule, with Saudi Arabia showing the lowest GHG intensity second only globally to Denmark."[49] Climate policy has been a growing priority for all three countries, at least with respect to the upstream sector. Routine flaring has been reduced dramatically as natural gas is no longer a waste product, with all three countries well below the global average of gas flared per barrel of oil produced.[50] In the Sustainable Development and Production Gap Report Scenarios, both investors and consumers will likely be drawn to the lowest GHG barrels, creating a structural advantage for the core GCC producers.

Overall economy carbon intensity in the GCC remains high on a per capita basis in terms of individual consumption spurred by generous subsidies, as well as inefficient commercial and industrial demand. All three governments, but particularly the UAE, are ramping up spending on non-fossil fuel energy, as well as technologies such as CCUS.[51] Unlike other oil-producing regions, the GCC will have relatively less exposure to global ESG investing pressure, although it has become a more important factor in its sovereign bonds, through the Morgan Stanley Capital International Index, and as its national oil companies offer minority equity stakes to global investors.[52] Global finance will become more important as oil revenues decline and the relative growth of ESG—not just on climate, but on matters of human rights and corporate governance—will continue to be a key risk for the GCC countries to manage.[53]

Assessing the Scenarios

In the Sustainable Development Scenario, the author forecasts that the GCC will significantly increase its overall share of crude oil production, and even see a modest increase from current production levels, despite the projected overall one-third drop in global oil demand from current levels. This scenario rests on the ability of the three core GCC producers to continue to leverage their low-cost and low-carbon advantages, while avoiding geopolitical risk internally and externally. Internally, the interconnected risks of failure to successfully navigate transition programs and manage social pressures around modernization could lead to a political crisis that would affect oil production. The core GCC markets are notable for high domestic spending and a corresponding high quality of life for citizens in terms of low-cost energy, food, education, and generous subsidies for employment. Abrupt cuts in these services could drive political instability.[54] The International Monetary Fund (IMF) found in a recent study that "as global oil demand is expected to peak in the next two decades, the associated fiscal imperative could be both larger and more urgent than implied by the GCC countries' existing plans. At the current fiscal stance, the region's financial wealth could be depleted by 2034."[55]

Yet, while fiscal pressures on the GCC countries would be severe in the Sustainable Development Scenario, they would be partially offset because oil production volumes would remain high and prices are assumed to remain moderate at $40 per barrel Brent, based on the continued need to develop higher-cost non-OPEC barrels to keep the market in balance in the 67-mbd scenario for 2040. Externally, the threat would likely be greater, as disruptions and instability in neighboring states like Iraq, Iran, and possibly Bahrain would be elevated.

In the Production Gap Report Scenario, the core GCC group also significantly increases its market share relative to 2019 levels, albeit slightly less than in the Sustainable Development Scenario. The direct impact would be significantly worse in terms of likely lower oil prices and materially lower volumes, dropping from 19 to 11 mbd in this report's hypothetical projection for the Production Gap Report Scenario, as opposed to a slight increase in production in the Sustainable Development Scenario. The Production Gap Report Scenario, therefore, implies that with lower oil prices and lower production volumes, the pressures on diversification efficacy internally, and regional failed state risk externally, would be materially higher. The market's willingness to finance minority equity

49 Mohammed S. Masnadi et al., "Global Carbon Intensity of Crude Oil Production," *Science Magazine*, August 2018, https://www.sciencemagazinedigital.org/sciencemagazine/31_august_2018/MobilePagedArticle.action?articleId=1419937#articleId1419937.

50 "Flaring Intensity: Top 30 Flaring Countries (2014-18)," World Bank, accessed on May 18, 2021, http://pubdocs.worldbank.org/en/765161560185685003/pdf/Flaring-intensity-Top-30-flaring-countries-2014-2018.pdf.

51 *Renewable Energy Market Analysis*: The GCC Region 2019, *International Renewable Energy Agency*, 2018, https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jan/IRENA_Market_Analysis_GCC_2019.pdf.

52 Saurabh Katiyar, "Saudi Arabia Inclusion and Emerging Markets," MSCI, March 28, 2019, https://www.msci.com/www/blog-posts/saudi-arabia-inclusion-and/01297979912; Toby Belsom, "What are the ESG Implications of the Saudi Aramco Debut Bond Issue," *PRI Blog*, April 24, 2019, https://www.unpri.org/pri/pri-blog/what-are-the-esg-implications-of-the-saudi-aramco-debut-bond-issue.

53 François R. Farjallah and Marie Owens Thomsen, "Environment Figures in GCC Investor Plans," *Gulf News*, December 25, 2019, https://gulfnews.com/business/analysis/environment-figures-in-gcc-investor-plans-1.68668336.

54 Tokhir N. Mirzoev et al., *The Future of Oil and Fiscal Sustainability in the GCC Region*, *International Monetary Fund*, February 6, 2020, https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2020/01/31/The-Future-of-Oil-and-Fiscal-Sustainability-in-the-GCC-Region-48934.

55 Ibid.

or debt issuances from GCC national oil companies would likely deteriorate as well.

In both scenarios, the core GCC oil producers would continue to intensify their sales to new demand centers, primarily in Africa, India, and Southeast Asia. This results in the forging of new alliances underpinned by energy security concerns (on both the supply and demand sides), but containing elements beyond simple energy investment, such as those seen between Riyadh and Moscow in late 2017.[56]

While the core GCC states have backstopped OPEC in recent years, the alliance would likely rupture in both scenarios. Led by Saudi Arabia, a new coalition within OPEC largely made up of key low-cost producers (or those with considerable geopolitical added value, such as Russia) would begin to actively manage remaining segments of the oil market. Early evidence of tensions between core GCC countries and the broader OPEC group over market management has taken place through 2020 and into 2021. Core OPEC members Saudi Arabia and UAE have been working closely with Russia to implement large production cuts to rebalance markets following the oil demand shock in April 2020.[57] Smaller OPEC producers—notably Iraq and Nigeria—have pressed for production increases, but, as of this writing in March 2021, compliance remains high.[58] Eventually, in the two scenarios central to this analysis, cooperation between weaker and stronger OPEC states will become even more strained.

North America+

For this study, the author has categorized the larger non-OPEC producers, excluding Russia and Kazakhstan, as "North America+." While this is an imperfect classification, this grouping has several characteristics in common.

- Significantly more diversified economies: oil less than 20 percent of export revenue for the group (excluding Norway, at 37 percent) and less than 21 percent of fiscal revenues (less than 10 percent for the United States and Canada); oil rents less than 5 percent of GDP.
- Highest level of official reserves adequacy: well above levels in core GCC countries, Russia, and failed and fragile states.
- Lowest cost of capital: no country risk premium for the United States, Canada, and Norway; one hundred and eighteen for Mexico and two hundred and ninety-six for Brazil. The latter are higher than core GCC and Russian country risk premiums, but lower than those of all of the failed and fragile states, except Kazakhstan.[59]
- Lower overall political risk, particularly around political violence and risk of nationalization and confiscation. The newly ratified United States Mexico Canada Agreement (USMCA) is a key consideration for Mexico as an offset to recent economic nationalism.
- Significant role for IOCs: direct (Canada, United States) and NOC partnerships (Brazil, Norway). Mexico is an exception, given the reversal of 2014 energy reforms that would have opened up the Mexican upstream to greater IOC participation.[60]
- Smaller non-OPEC producers like the United Kingdom (UK), Guyana, and Colombia could be included in future studies.

Assessing the Scenarios

Peak demand scenarios such as the Sustainable Development and Production Gap Report Scenarios are likely fatal for the economics of new long-cycle projects such as the Canadian oil sands, offshore projects in the Brazilian pre-salt, or Mexican deepwater plays. Producers try to maximize the value of existing oil projects and reserves through brownfield expansions, while focusing new investments in short-cycle plays where there is low political risk and lower production costs, such as US shale.

Overall, lower risks around transition are a key advantage for the North America+ region, offsetting the moderately to significantly higher production costs. Within the North America+ region, private investment will likely favor US, Canadian, and Norwegian oil plays that are in the lower

56 King Salman made the first-ever visit by a Saudi monarch to Moscow in 2017; Summer Said and James Marson, "Energy Alliance Propels Russia-Saudi Cooperation," *Wall Street* Journal, September 21, 2017, https://www.wsj.com/articles/energy-alliance-propels-russia-saudi-cooperation-1505986203.

57 David Sheppard, Anjli Raval, and Henry Foy, "G20 Backs Largest Oil Supply Agreement in History," *Financial Times*, April 10, 2020, https://www.ft.com/content/16ac91d8-42bf-4190-88de-f3d89b2b36f4.

58 Grant Smith and Julian Lee, "OPEC Production Plunges as Saudis Deliver Extra Oil Cutbacks," *Bloomberg*, March 2, 2021, https://www.bloomberg.com/news/articles/2021-03-02/opec-production-plunges-as-saudis-deliver-extra-oil-cutbacks?sref=G4fmO740.

59 Aswath Damodaran, "Country Default Spreads and Risk Premiums," New York University Stern School of Business, January 8, 2021, http://pages.stern.nyu.edu/~adamodar/New_Home_Page/datafile/ctryprem.html.

60 Samantha Gross, "AMLO Reverses Positive Trends in Mexico's Energy Industry," *Order From Chaos*, December 20, 2019, https://www.brookings.edu/blog/order-from-chaos/2019/12/20/amlo-reverses-positive-trends-in-mexicos-energy-industry/.

The ERIELL oil rig at night. Unsplash/WORKSITE Ltd. (@worksite)

political risk jurisdictions, given the industrial base, skilled workforce, and bias of capital markets. These advantages will support producer efforts to manage a transition to lower-cost barrels that are increasingly produced by a series of new technologies, including a combination of robotics, supercomputing, and artificial intelligence.[61]

Technology and innovation will be critical to managing the climate and ESG challenge as well. A suite of technologies, including CCUS, enhanced oil recovery, hydrogen, and increased oilfield efficiency, all show promise in reducing the lifecycle carbon footprint of hydrocarbons.

The countries and companies that develop and support these technologies are likely to extend the life of their hydrocarbon resources while, at the same time, positioning their investment communities and human capital around the new technologies they will need for increased diversification, both inside and outside of the oil economy. On this basis, this paper's model projects the North America+ region to prospectively gain market share in both the Sustainable Development and Production Gap Report Scenarios. This assessment is partially about current GHG performance, but more so about the technical capacity and financial incentives to move to net-zero emissions and become the world's lowest-carbon oil producers. Given the outsized dependence of the region on private investment, the ESG factor is already driving industry behavior in terms of performance improvement, asset highgrading, and technology investment. This is most evident in net-zero emissions strategies announced by European IOCs. Equinor, Norway's national oil company, is a leading indicator of corporate strategy and technology investments to support net-zero initiatives, from increasing renewables programs to divesting from higher-carbon barrels. This does not mean abandoning oil production; rather, Equinor will focus on powering its offshore production in the Norwegian Sea with onshore zero-emissions electricity and moving to zero flaring in its North American shale plays.[62]

61 For example, Schlumberger has initiatives focusing on state-of-the-art software for oil and gas production, such as the Schlumberger Information Solutions (SIS) Norway Technology Center (SNTC): https://www.slb.com/about/rd/technology/sntc.aspx. Also, per Schlumberger's most recent annual report, the use of digital technology is helping the exploration and production (E&P) industry enhance and optimize the drilling process: file:///C:/Users/hnovik/AppData/Local/Packages/Microsoft.MicrosoftEdge_8wekyb3d8bbwe/TempState/Downloads/SchlumbergerLimited2017AR.pdf.

62 "Equinor Aims to Cut Emissions in Norway Towards Near Zero in 2050," Equinor, January 6, 2020, https://www.equinor.com/en/news/2020-01-06-climate-ambitions-norway.html; Nerijus Adomaitis and Terje Solsvik, "Equinor Broadens Scope of Carbon Targets to Match Rivals," *Reuters*, February 6, 2020, https://www.reuters.com/article/us-equinor-results/equinor-broadens-scope-of-carbon-targets-to-match-rivals-idUSKBN2000HB.

Increasingly, such aggressive commitments to decarbonization will be essential to the Canadian oil sands and US shale as well, if those industries are to retain market share in the Sustainable Development and Production Gap Report Scenarios for peak demand. The Canadian oil sands face investor pressure on cost and environmental and GHG performance, but these pressures are well understood by an industry that must adapt or simply disappear. With highly problematic gas flaring, the same pressures are emerging for many shale producers as well. These challenges are by no means easy, but more within the capacity of individual producers to deliver against, and less of an unknown than the types of transition and political risks found in other oil-producing regions.

The author's analysis does suggest that Brazil and Mexico will underperform relative to United States, Canada, and Norway. The two countries have higher political risk and more challenging ease-of-doing- business metrics. The landscape for oil investment has been highly politicized, with cycles of resource nationalism, first in Brazil in the Luiz Inácio Lula da Silva-Dilma Roussef administrations, and then in Mexico more recently under President Andrés Manuel López Obrador.[63] Industry tolerance to ride the cycle of nationalist politics will be significantly reduced in the Sustainable Development and Production Gap Report Scenarios. Moreover, the longer-cycle, exploration-intensive pre-salt and Gulf of Mexico deepwater projects may struggle to attract capital absent aggressive government incentives.[64]

Russia

Russia represents perhaps the biggest wild card in the peak demand scenarios. Given the scale of its oil industry and geopolitical influence, it deserves dedicated analysis. On the positive side, Russia has a favorable cost of capital relative to all the failed and fragile states, healthy official reserves, and moderate production costs. Its national and independent oil companies also have deep technical and financial capacity, and have proven effective at lowering decline rates and optimizing brownfield production. Although they have been strained by sanctions and a lack expertise in Arctic and shale oil development, these shortcomings would be less significant in a world of peak oil demand.[65] Russian official reserves are favorable, representing a higher ratio of reserves to both oil export revenue and fiscal revenue compared to the core GCC group. Russia's oil rents as a percentage of GDP are also lower than those of the core GCC and the entire fragile and failed producers group, representing an overall economic health not enjoyed by those states.

Yet, it would not be accurate to say that Russia's economic diversification is going well. Oil remains nearly half of total export revenues. The economy is still characterized by low productivity, poor innovation, and weak global competitiveness.[66] Further, growing spending and employment in the public sector through the 2000s has increased dependence on oil revenues and increased the political complexity of future austerity related to the sector. Even the legacy of quality educational institutions and scientific training has eroded significantly over the last decade, contributing to gaps in skills and innovation.[67]

Russia is challenging from the GHG and ESG perspectives as well. Mostly because of high levels of methane venting, Russia gets less than half the barrels of oil output per ton of GHG emissions compared to producers in the United States and Canada, as well as in the core GCC group. According to the same IEA data, however, Russia's GHG performance is better than that of all states within the fragile and failed category, with the exception of neighboring Kazakhstan. Under Vladimir Putin, there has been little interest in the Paris Agreement, Group of Twenty (G20) climate efforts, or engagement with ESG investors.[68]

63 Francisco J. Monaldi, "The Cyclical Phenomenon of Resource Nationalism in Latin America," *Oxford Research Encyclopedias,* March 31, 2020, https://oxfordre.com/politics/view/10.1093/acrefore/9780190228637.001.0001/acrefore-9780190228637-e-1523.

64 Michael Dyer, "Brazil and Mexico: Opposite Political Systems in 2018 and the Outlook for the Respective Oil and Gas Industries," IHS Markit, July 12, 2019, https://ihsmarkit.com/research-analysis/brazil-and-mexico-opposite-political-systems-oil-gas.html.

65 James Henderson and Ekaterina Grushevenko, "The Future of Russian Oil Production in the Short, Medium, and Long Term," *Energy Insight*, No. 57 (September 2019), 1-22, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/09/The-Future-of-Russian-Oil-Production-in-the-Short-Medium-and-Long-Term-Insight-57.pdf.

66 Ashleigh Garrison and Kelly Song, "Russia's Achilles Heel: Putin Still Falling Short on Master Plan for Aging Oil Economy," *CNBC*, July 19, 2018, https://www.cnbc.com/2018/07/19/checkmate-putin-falling-short-on-master-plan-for-aging-oil-economy.html.

67 *Diversifying Russia: Harnessing Regional Diversity, European Bank for Reconstruction and Development*, https://www.ebrd.com/downloads/research/economics/publications/specials/diversifying-russia.pdf.

68 S&P Global Ratings, "Environmental, Social, and Governance: Can Russian Companies Meet Growing Investor Demand for ESG?" *S&P Global,* November 12, 2019, https://www.spglobal.com/ratings/en/research/articles/191112-environmental-social-and-governance-can-russian-companies-meet-growing-investor-demand-for-esg-11232607.

Assessing the Scenarios

In the author's projections for 2040 based on the Sustainable Development and Production Gap Report Scenarios, Russia moderately gains market share as production falls off elsewhere. Their forecast for the Sustainable Development Scenario would see Russian oil production drop by just over 25 percent, versus more than 50 percent in the Production Gap Report Scenario. Russian financial reserves, industry capacity, and political stability under Putin would likely be enough to support the oil industry in the Sustainable Development Scenario, likely with an ongoing assist from China. China would likely support the Russian oil sector and gain leverage relative to Russia as other export markets, such as Europe, face some of the most rapid declines in oil demand. However, in a Production Gap Report Scenario, China's oil demand would be dramatically lower, and both its need and interest in a partnership with Russia would be lessened.

The Production Gap Report Scenario, with its rapid decline in oil demand, would increase the likelihood that Russia is even more aggressive on the world stage, in line with recent interventions in Ukraine and Syria.[69] The Kremlin would be unlikely to be able to diversify the economy soon enough and, as a result, faces economic deterioration. Although Putin's ability to rule is notionally extended to 2034, the peak demand scenarios and expected economic stress could ignite a growing opposition movement to his lasting power.

Fragile and Failed

The group of fragile and failed oil-producing states encompasses institutionally weak countries with inadequate state capacity to diversify away from economies dependent on oil revenue. These producers will feel the most acute and enduring pain from peak demand. Regions or countries dependent on oil production for political cohesion will be highly vulnerable to political turmoil. This includes failed states that have already seen deep political unrest and an oil sector collapse, like Libya and Venezuela, as well as fragile states such as Iraq, Nigeria, Angola, Algeria, Kazakhstan, and Iran, where peak demand could deeply exacerbate structural political and economic problems.

The group of producers in this category have relatively low production costs, but are offset by higher country risk and cost of capital. Whereas the three core GCC producers have country risk premiums of just 55 basis points above the benchmark, the eight failed and fragile states have an average 655 basis points above benchmark, according to Moody's data from January 2020.[70] In practical terms, this means future investment will typically demand a higher rate of return to account for above-ground risk. In the peak demand scenarios, markets will be more averse to funding such projects, although there may be private equity and other non-traditional oil and gas players that will target the higher returns. The fragile and failed states also rely on offshore projects and large onshore conventional fields, where industry has been less willing to allocate capital relative to shale.

The prospects for diversification in the group are mixed, but poor overall. On a more promising note, countries like Nigeria and Kazakhstan have more diversified economies today and a smaller share of the oil sector in nominal GDP relative to countries such as Libya, Algeria, and Iraq. But, overall, this group has the highest dependence on oil for GDP, exports, and fiscal revenues, as well as the smallest official financial reserves. Iraq, Venezuela, and Angola have less than one year's official financial reserves to cover export and fiscal revenue from the oil sector. Weak political institutions, poor ease of doing business, and corruption will further undermine transition programs.

The ESG and climate metrics also paint a challenging picture for the group. While the group has mixed data on GHG intensity, it includes some of the highest GHG emitters and the most deeply intransigent social and governance issues. From IEA data on combined flaring, fugitive, and vented GHG emissions from upstream oil, countries like Algeria, Iraq, and Nigeria get the fewest barrels of oil production per ton of direct GHG emissions.

Assessing the Scenarios

Given these challenges, the author's analysis suggests significant loss in overall production and market share in both the Sustainable Development and Production Gap Report Scenarios. Market share would drop from 15.6 percent currently to 13.2 percent in the Sustainable Development Scenario, and all the way to 5.9 percent in the Production Gap Report Scenario. Production volumes would also plunge, setting this region up to be the most negatively affected by peak demand. This report's model projects that average production per country in this category could fall from 2.08 mbd in 2019 to 1.13 mbd in the 2040 Sustainable Development Scenario, and to just 287,000 b/d in the

69 Dmitri Trenin, "Russia's Comeback Isn't Stopping with Syria," *New York Times*, November 12, 2019, https://www.nytimes.com/2019/11/12/opinion/russias-comeback-isnt-stopping-with-syria.html.

70 Damodaran, "Country Default Spreads and Risk Premiums."

Production Gap Report Scenario 2040. The latter is the most radical, as the author projects zero oil production from Iran, Venezuela, Libya, Nigeria, and Angola. Clearly, in the Production Gap Report Scenario, the production gap has to be closed somewhere, and the author believes these countries are among the most likely candidates, as improbable as it may seem from today's perspective. Iran, Venezuela, and Libya are already in virtual collapse, but even improved political stability would not be enough to attract new investment in the Production Gap Report Scenario, given the paucity of demand. Nigeria and Angola are producing at much higher levels, but have high dependency on foreign investment, challenging business environments, high costs and GHG intensity, and limited financial resources to support diversification.

Capital flight and divestment has already been a key theme for this group, from sanctions in Iran and Venezuela, to regulatory uncertainty and corruption in Angola and Nigeria, to political turmoil in Algeria and Iraq. These trends would dramatically worsen in peak demand scenarios, with domestic industry, capital markets, and governments lacking meaningful capacity to maintain investment, most notably in terms of capital to bring on new projects to replace declining reserves. China and Russia could backfill Western capital flight, but the results of past efforts along these lines in Venezuela are a cautionary tale.[71]

Declining economic growth with weaker oil prices and lower volumes will likely lead to population flight, increasing tensions over borders and human displacement. In extreme cases, places where oil production is localized, but competing political or ethnic groups are networked across borders—such as in West Africa, North Africa, Iran, and Iraq—rapid revenue declines may result in "failed state" dynamics, increasing the risk of broader regional conflict.

The countries with substantial low-cost reserves but high political risk will face an inflection point very soon. One option will be to offer favorable fiscal terms to incentivize foreign investment. But, shifting to concessionary fiscal terms would also undermine the ability of those governments to maintain levels of social spending, maintain networks of political patronage, and manage risks to regime stability, providing a short-term aid to revenue declines at the expense of undermining institutions, ultimately increasing risks over the long term. The notion of an energy transition that is both "inevitable" and "forceful, abrupt, and disorderly" does not bode well for countries with weak political capacity and thin prospects for economic diversification.[72] In this context, the need for a "just transition" highlighted both in the Sustainable Development and Production Gap Report Scenarios will be critical, not just for displaced fossil fuel workers in Texas and Alberta, but also for fragile petrostates facing failed economic models and stranded assets. Alternative economic pathways from solar power in Algeria to building out Nigeria's tech sector will be essential focal points for governments within the fragile and failed states group if they want to avoid disruption. Support from outside powers, whether large states, corporations, financial institutions, international governmental organizations, or even foundations and nongovernmental organizations, will be vital to ensure that diversification efforts succeed.

Implications for Consumers

Oil-importing countries, on the other hand, see significant benefit as their oil imports drop, the price of those remaining imports drop, and their economies grow. As producers compete for market share in a buyer's market, the ability of producing countries to use oil exports as a foreign policy tool diminishes, reducing geopolitical vulnerabilities, and in some cases, potentially increasing geopolitical power for importers. The following is a brief review of potential geopolitical implications for the largest net crude oil importer regions: China, Japan, South Korea, India, and the EU.

Of the oil importers who experience a windfall of geopolitical leverage, China is the biggest winner. China imports nearly 10 mbd from a variety of suppliers, including crisis states like Venezuela and Iran, as well as from rivals, such as Russia and the United States. China's long seaborne supply chains, transit chokepoints, and relatively limited pipeline imports create a well-documented security challenge.[73] China's responses—from the government's oil-for-loans initiative in Venezuela, Angola, Brazil, and many other countries, as well as its infrastructure buildout in the Belt and Road Initiative (BRI)—have dominated the country's foreign policy. Nor are such efforts likely to dissipate in the short, or even medium, term. But, in the long term, if Chinese oil demand peaks and declines after 2030, the prospects of a reorientation in its foreign policy grow.[74]

71 MacKenzie Sigalos, "China and Russia Loaned Billions to Venezuela – and Then the Presidency Went Up for Grabs," *CNBC*, February 7, 2019, https://www.cnbc.com/2019/02/07/venezuela-china-and-russia-owed-debts-as-presidential-fight-rages.html.

72 Inevitable Policy Response, "What is the Inevitable Policy Response?" United Nations Principles for Responsible Investment, accessed on May 18, 2021, https://www.unpri.org/inevitable-policy-response/what-is-the-inevitable-policy-response/4787.article.

73 Michal Meidan, *China's Energy Security at 70, Oxford Institute for Energy Studies*, October 2019, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2019/10/Chinas-energy-security-at-70.pdf.

74 Liu Zhihua, "Report: China's Oil Consumption to Peak by 2025," *China Daily*, October 17, 2019, https://www.chinadaily.com.cn/a/201910/17/WS5da81492a310cf3e35571149.html.

Beijing will have outsized gains from reduced oil insecurity and gains from leading the low-carbon technological revolution that brought the world to the peak demand scenarios. This includes leadership in foundational clean energy technologies, including solar panels, batteries, electric vehicles, long- distance transmission, and nuclear.[75] Meanwhile, China's existing access to the metals and minerals necessary to produce these technologies provides them with the leverage to sustain this advantage as the energy transition continues to evolve.[76]

However, this could give rise to a new source of geopolitical tension as countries compete for access to these new energy resources. Perhaps energy security and geopolitical concerns shift away from oil and toward these new critical materials, engaging a new group of actors and dynamics in the fight for energy resources by midcentury.

For Japan and South Korea, the two countries differ from the Chinese oil transition perspective in several respects. The two countries have had slower oil demand growth in recent years, but are even more dependent on imports than China, whereas China still produces about 25 percent of its crude needs domestically. Moreover, as China is actively engaging in energy security strategy through the BRI and its oil-for-loans programs, Japan and South Korea risk being squeezed out. This is true both in terms of China having greater diplomatic and financial resources, including its ability to offer preferred access for oil suppliers to downstream projects in its own large and growing market. China is also a formidable competitor for Japanese and South Korean clean-tech manufacturers, with its large market, low cost of capital, broad subsidies program, and critical mineral resources. Historically, Japan and South Korea have had to depend on the United States for oil security, not just in preserving open sea lanes for oil transit, but in maintaining stability in the Middle East and managing conflicts with key producers such as Russia, Iran, and Venezuela. In the peak demand scenarios, it could be that Japan and South Korea have to cooperate in a similar fashion with China as it reaches ascendancy as the global clean-tech superpower. The Trump administration went to great lengths to keep Japan and South Korea aligned with the United States through its liquefied natural gas and crude oil exports, seen as active programs to limit dependence on China's BRI, as well as oil and gas exports from US adversaries Russia, Iran, and Venezuela.[77]

India would be an unlikely partner for China, but will be another winner in peak demand scenarios. Indian energy security would likely improve, and India would be able to shift its oil imports to low-cost, low-risk, low-carbon suppliers. Fragile and failed states like Iran, Iraq, and Venezuela would be less of a focal point in Indian foreign policy and tensions with Washington.[78] India, too, aspires to be a clean-tech leader, but faces formidable challenges in meetings its Paris Agreement commitments and managing local air and water pollution. The prospects for decarbonizing the Indian electricity sector and linking that with the electrification of transportation through buses, electric scooters, trucks, and passenger vehicles would be compelling, given the role both coal and diesel play in contributing to India's environmental problems. Yet, realistically, India's electricity grid, infrastructure, and financial capacity for energy transition remain behind China's, at least in the short term.[79]

Lastly, for the EU, its oil demand growth is minimal to flat, and its economies are aging and less energy intensive, making it more like South Korea and Japan than China and India. With the UK leaving the European Union, the remaining member states are now even more dependent on imports from Russia, Africa, and the Middle East. Combined with physical proximity, oil and gas import dependence keeps the EU actively engaged in these regions from a crisis management and political stabilization perspective. The EU Green New Deal framework is a massive Brussels-led push to achieve carbon neutrality by 2050 in line with the Paris Agreement, but energy security and reduced import dependence would be an important co-benefit. The EU will do the most to target low-carbon sources of oil, with its proposed border carbon adjustment tax a key signpost. The plan will also notably bolster electric vehicles, as well as hydrogen and advanced biofuels and biogases.[80]

For the purposes of this study, all of these regions are considered "agents of change" for the achievement of the

75 Xizhou Zhou and Isabella Ni, "Renewable Cost Reductions: China at scale," CERAWeek by IHS Markit, March 13, 2019, https://ceraweek.com/news/china-renewables-at-scale.html; Jeffrey Ball, *Grow Green China Inc.: How China's Epic Push for Cleaner Energy Creates Economic Opportunity for the West, Brookings Institution*, May 2019, https://www.brookings.edu/wp-content/uploads/2019/05/FP_20190529_grow_green_china.pdf.

76 Sophia Kalantzakos, *The Geopolitics of Critical Minerals, Instituto Affari Internazionali*, December 27, 2019, https://www.iai.it/sites/default/files/iaip1927.pdf.

77 "US Energy Priorities Abroad: A Conversation with US Secretary of Energy Dan Brouillette," Atlantic Council, February 7, 2020, https://www.atlanticcouncil.org/event/us-energy-priorities-abroad-a-conversation-with-us-secretary-of-energy-dan-brouillette/.

78 Tanvi Madan, *The Brookings Foreign Policy Studies Energy Security Series: India, Brookings Institution*, November 2006, https://www.brookings.edu/wp-content/uploads/2016/06/2006india.pdf; K.P. Nayar, "India Bridging the Gulf with Oil Diplomacy," *The Tribune*, February 21, 2019, https://www.tribuneindia.com/news/archive/comment/india-bridging-the-gulf-with-oil-diplomacy-732296.

79 *India's Shift Towards Low-Carbon Energy, Energy Transitions Commission,* 2020, http://www.energy-transitions.org/content/indias-shift-towards-low-carbon-energy; *India 2020 Energy Policy Review,* International Energy Agency, January 2020, https://www.iea.org/reports/india-2020.

80 Frédéric Simon, "The EU releases its Green Deal. Here are the key points," *Climate Change News*, December 12, 2019, "https://www.climatechangenews.com/2019/12/12/eu-releases-green-deal-key-points/.

peak demand scenarios. The major oil import-dependent states will pursue decarbonization, pollution management, industrial policy, and energy security goals simultaneously, with uneven outcomes, but a shared direction toward lower oil demand.

Implications for Geopolitics and US Policy

The author finds that the question of geopolitical stability and peak demand will be material to US national security. The Sustainable Development and Production Gap Report Scenarios for peak demand will create massive disruption in a number of failed and fragile oil-producing states, and potentially reorient the foreign policy interests of great powers like Russia and China. The remaining question is how peak demand would reshape US engagement with the rest of the world, including as a provider of geopolitical leadership in managing the disruptions that will follow the energy transition.

The United States is currently balanced between its status as the world's largest oil producer and its largest consumer. While this study suggests the United States is well positioned to maintain a dominant position in the oil market, many other less favorable scenarios could just as easily emerge. US policymakers would be wise to devote the same attention to the long-term prospects of the US oil sector during the pending era of peak demand, as they once did during the peak supply era from the 1970s to the rise of shale around 2010. The COVID-19 shock shows that the US status as net exporter—and whatever foreign policy benefits one chooses to assign to such status—is fragile, even if the United States itself is not a fragile petroleum state like Libya or Iraq. It would have been difficult to imagine twenty years ago that a US president would threaten to pull US troops out of Saudi Arabia unless the kingdom agreed to sell less oil, protecting the economic viability of US exports, and not the physical availability of Saudi imports.[81]

The US energy abundance of the late 2010s and the Trump administration have both profoundly changed Washington's geopolitical calculus. At best, this intersection triggers a reevaluation of traditional relationships; at worst, it encourages the United States to withdraw from its role as a global leader. Though the United States has some deeper relationships with countries directly (Saudi Arabia) or indirectly (Israel) impacted by the pandemic economic downturn, regional instability that would previously trigger US action or intervention does not carry the same weight as it once did. Some observers saw the non-response by the Trump administration to the September 2019 Iranian attack on a major Saudi oil facility as a reflection of greater US energy self-sufficiency translating into disengagement in a "regional" dispute between the two Gulf powers.[82] Even as the Biden administration's relationship with Riyadh continues to evolve, the relationship appears to still be, at least in part, guided by the role of both the United States and Saudi Arabia as major oil producers. This was underscored by Energy Secretary Jennifer Granholm's call with Prince Abdulaziz bin Salman about oil prices, and the announcement of Riyadh and Washington's collaboration in the Net Zero Producers Forum, alongside Canada, Norway, and Qatar (all of whom, notably, are members of either the Core GCC or North America+ producer groupings who score well in this analysis).[83]

Geopolitical strategist Peter Zeihan has gone so far as to project that the United States will soon become the "Absent Super Power."[84] While this may be a bit extreme, it is worth noting a statement former US Secretary of the Interior Ryan Zinke made in 2018, "I don't want to see your children have to deploy overseas to have to fight for energy. There's a number of reasons why the United States does fight overseas, but energy shouldn't be one of them."[85] The United States' changing geopolitical calculus amplifies the sentiment of many US voters who see the status quo as one in which the nation sacrifices much and, increasingly, receives little. This is the sentiment that underscored the election of Donald Trump and will continue to shape US politics well into the future. Similar sentiments are driving politics across Europe.

81 "Trump to Saudis: Cut oil supply or lose US military support – sources," *The Jerusalem Post*, April 30, 2020, https://www.jpost.com/international/trump-to-saudis-cut-oil-supply-or-lose-us-military-support-sources-626423

82 Alex Ward, "The Week in US-Saudi Arabia-Iran Tensions, Explained," *Vox*, September 20, 2019, https://www.vox.com/world/2019/9/20/20873672/trump-saudi-arabia-iran-oil-missile-drone.

83 "Joint Statement on Establishing a Net-Zero Producers Forum between the Energy Ministries of Canada, Norway, Qatar, Saudi Arabia, and the United States," United States Department of Energy, April 23, 2021, https://www.energy.gov/articles/joint-statement-establishing-net-zero-producers-forum-between-energy-ministries-canada.

84 Peter Zeihan, The Absent Superpower: The Shale Revolution and a World Without America (Austin: Zeihan on Geopolitics, 2016).

85 Ryan Zinke and Scott McEwen, *American Commander: Serving a Country Worth Fighting For and Training the Brave Soldiers Who Lead the Way*, (Nashville: W Publishing Goup, 2016).

VII. Conclusion

This study set out to answer three major geopolitical questions related to the prospect of a peak in oil demand, including

- the likely redistribution of oil market share between major producers;
- the potential for failed states or material internal political instability in major oil-producing states; and
- the possible winners and losers among oil consumers in a peak oil demand, low-carbon transition.

It is worth highlighting that even though the Sustainable Development and Production Gap Report Scenarios seem radical by today's standards, there will still be meaningful oil production required in both scenarios. The main motivation in taking on this study was a belief that while many studies tried to understand what policy, market, and technology pathways would facilitate deep decarbonization and peak demand, few, if any, looked at the aftermath for the oil market in terms of capital flows, production levels, market impact, and geopolitical impact. This initial taxonomy built around low-cost, low-risk, and low-carbon parameters will hopefully serve as a useful beginning point for further inquiry.

In terms of capital flows, the IEA's Sustainable Development Scenario suggests that overall fossil fuel investment will still be $555 billion annually in 2040, down from $1.017 trillion in 2019, but still a large opportunity. A significant slice of that will be required to sustain 68 mbd of oil production. Of course, the Production Gap Report Scenario will likely have a materially smaller "call on capital," given the forecasted 38 mbd of production in 2040. In both cases, the emphasis will likely shift from greenfield capital to sustaining capital. The IEA's Sustainable Development Scenario forecasts that annual capital spending on renewables and electricity networks would jump from $710 billion in 2019 to $1.334 billion in 2040.[86] Growth-oriented, risk-seeking capital is already shifting in this direction, with fewer dollars available for exploration and mergers and acquisitions in traditional oil and gas. According to industry data, private equity fundraising in oil and gas fell from $74 billion in 2014 to just $11 billion in 2019.[87]

If these trends continue, this report's main conclusion is that the Core GCC, Russia, and North American+ oil-producing regions will hold or grow market share, while the group of fragile and failed oil producers will see a significant decline. There simply will be not enough capital to go around, and the risk profile of the failed and fragile states will be a major barrier to sustaining investment. Of course, it is possible to develop risk scenarios for the other three regions, and a more positive trajectory for the fragile and failed states. For example, certainly Russia or Saudi Arabia could face internal unrest or external conflicts that would destabilize their oil sectors. With sanctions in Russia and the Iran threat facing Saudi Arabia, they are dealing with such risks already. But, overall, high levels of official reserves, strong internal political stability, and low-cost production are key advantages. It is also possible that the oil and gas sector in Canada or the United States could face rising costs, particularly cost of capital and hurdle rates from investors and boards bruised by a decade of weak returns. Both countries could also see a political shift toward an EU-style Green New Deal that could be unfavorable to the oil sector. Nonetheless, the author sees the core advantage of the North American sector as being political stability on top of industry flexibility and innovation.

In particular, the author believes the North American producers will be out front in reducing the GHG intensity and methane intensity of their crude production. The former will be key for the Canadian oil sands and the latter for US shale producers, particularly in the Permian Basin. The author notes that the fragile and failed states also include some of the most GHG intensive, and are overall poor environmental performers in the global oil sector. They have the least efficient methane intensity of the four groups according to analysis of IEA data, as well as the lowest average scores in the Yale Environmental Index.[88] Moreover, the costs associated with reducing flaring and fugitive emissions, as well as addressing other environmental liabilities, are likely to become more, rather than less, challenging to address. Fewer IOCs are likely to commit scarce capital to these markets, and unfavorable ESG metrics will be a barrier for raising capital. It is possible that banks and IOCs will step up their efforts to support decarbonization in markets that lack sufficient domestic and technical capacity to do so. Article 6 of the Paris Agreement could play a key role here as well, if ratified.

86 *World Energy Outlook 2019, International Energy Agency*, November 2019, https://www.iea.org/reports/world-energy-outlook-2019.

87 Kirk Falconer, "Energy PE Fundraising at an Ebb in 2019 as LPs Rethink Allocations," *Buyout Insider*, February 7, 2020, https://www.buyoutsinsider.com/energy-pe-fundraising-at-an-ebb-in-2019-as-lps-rethink-allocations/.

88 *Methane Tracker 2020, International Energy Agency,* March 2020, https://www.iea.org/reports/methane-tracker-2020; Environmental Performance Index, "2020 EPI Results," Yale Center for Environmental Law & Policy, accessed on May 18, 2021, https://epi.yale.edu/epi-results/2020/component/epi.

A final scenario for consideration is whether the redistribution of market share would be more even. It is certainly conceivable that the production declines associated with the two peak demand scenarios evaluated in this report will be more idiosyncratic and bottom up versus strategic and top down, as implied by this report's low-cost, low-risk, low-carbon taxonomy. This raises the interesting question of whether a critical mass is necessary to sustain an oil industry. The report author would hypothesize that the withdrawal of capital would have negative cascading effects. Upstream activity benefits from ecosystems or clusters of activity and capacity for financing, labor, law, and, most importantly, the development of shared engineering and technical solutions for the below-ground geology and reservoir management. This trend advantages areas such as the Permian Basin or the North Sea where the technical, financial, and human capital necessary to profitably exploit oil is very deep. More remote regions will have higher costs with less available capacity and few technical solutions, but the same is true for fragile and failed states that are currently experiencing, or will experience, capital outflows in the upstream sector. Losing scale and capacity makes the prospects for rebuilding the oil sector in Libya or Venezuela very challenging. Iraq rebounded from two decades of war and sanctions to double its oil production between 2010 and 2018. Yet, the market conditions of 2009 were favorable in tracking billions of dollars of upstream capital from abroad to recreate capacity and regrow the sector.[89] In the peak demand scenarios, those market conditions are unlikely to be found again.

The peak demand scenarios could also create further shockwaves.

First, it is possible that the period of post-peak instability would, in turn, lead to short-term spikes in oil prices as geopolitical disruptions mount in fragile oil-producing states unable to adapt effectively to slowing demand at the same time that investment and supply gaps manifest. Failed state dynamics in Venezuela and Libya have been in motion for some time, and would likely be accelerated in a peak demand scenario. Rapid peak demand scenarios could transition fragile states like Nigeria, Algeria, and others into failed states.

Elsewhere, the process of economic diversification is critical to managing a peak demand, though fraught with risk, depending on the speed or severity of demand decline. For example, while these scenarios forecast Russia as managing peak demand well relative to the fragile and failed states, there is plenty of risk for mismanagement of diversification that could challenge internal political and economic stability in Russia.

In the United States, while there could be temptation to retreat to isolationism in a world where oil is relatively more abundant, the United States also has significant interests in understanding and managing the potential for geopolitical disruptions due to peak demand for both US national security and the stability of key allies. Iraq, with its history of US military intervention and strategic geopolitical proximity to Iran, Syria, Saudi Arabia, Turkey, and Israel, is an obvious focal point. The balance of winners and losers amongst oil consumers, some of whom have much to gain from leading a low-carbon, electric vehicle future, such as China, create additional geopolitical and foreign policy challenges worthy of consideration.

89 Robert E. Ebel, "Geopolitics and Energy in Iraq: Where Politics Rules," Center for Strategic and International Studies, August 2010, https://www.csis.org/files/publication/l00730_Ebel_IraqGeopolitics_Web.pdf

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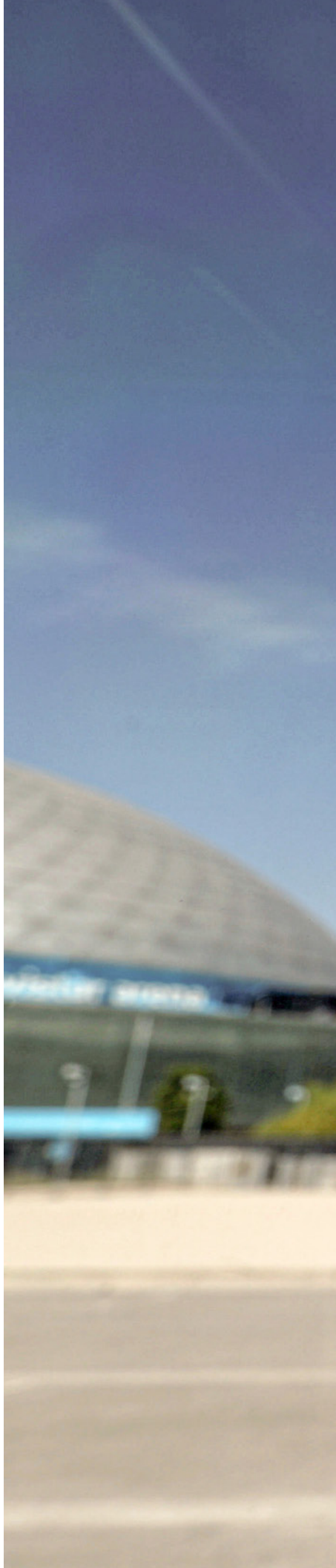
List as of June 1, 2021



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