UPHEAVALS IN GLOBAL ENERGY IN 2020: COVID, CLIMATE CHANGE, & ENERGY TRANSITIONS

A Report from
2020 Aspen - Columbia Global Energy Forum

Jason Bordoff & Vicki Hollub, Co-Chairs
Dave Grossman, Rapporteur

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For all inquiries, please contact:

Energy & Environment Program
The Aspen Institute
2300 N Street, NW | Suite 700
Washington, DC 20037
Phone: 202.736.2933
Fax: 202.467.0790

The Aspen Institute
2300 N Street, NW | Suite 700
Washington, DC 20037

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EXECUTIVE SUMMARY

2020 wasn't an easy year for the energy sector around the world - nor was it for anyone else. The COVID-19 pandemic, the resulting economic contraction, and drops in energy prices have resulted in hard times for the global energy sector. Global energy investments and demand for oil and gas declined during COVID to unprecedented extents. As a result, a consolidation cycle is underway in oil and gas, and there will likely be an underinvestment cycle as well if the economy rebounds reasonably. Demand and price recovery have already begun, but the resurgence of COVID cases and the prospect of a prolonged pandemic bring great uncertainty to projections of the pace of recovery. It is also unclear whether the pandemic will be a catalyst to a clean energy transition. COVID may be accelerating the fall of coal and the rise of renewables globally, but its impact on the transition depends largely on the policies that governments deploy to respond to the pandemic and its economic effects.

Whether we have reached a tipping point toward sustainable energy depends largely on government investment and policies

No country, community, or company tied to fossil fuels will be unaffected by the clean energy transition. Pressure from the public, the financial community, and others on climate action is growing stronger, as are climate impacts around the world. Whether we have reached a tipping point toward sustainable energy depends largely on government investment and policies, regardless of whether or not demand for oil or coal has officially peaked, With the growing pressure to address climate change, such policies may not move in a predictable path, but may instead be more disruptive. The transition may be faster than expected, with significant implications for fossil fuels:

OIL – European and U.S. oil majors are pursuing divergent strategies. Some of the former are making notable climate commitments and speeding up investments in clean energy sources, while U.S. companies are doubling down on oil and gas and the cash flows that the hydrocarbon business will still produce over decades. There has been more investor interest in parts of the business moving toward climate-friendly production, such as enhanced oil recovery and direct air capture, than in the regular oil and gas business.

GAS – Some see natural gas as a bridge fuel to a low-carbon future, but concerns about methane emissions and carbon budgets are raising questions about how long that bridge is. Natural gas can displace dirtier fuels and support renewables deployment, but other technologies may be able to play those roles as well. For natural gas to play even a short-term role in decarbonization, carbon dioxide and methane emissions have to be managed across the value chain, and many companies are adopting targets and taking actions, as regulations in various countries get tougher. Eventually, the gas itself will have to be decarbonized, with approaches such as hydrogen and biomethane, though those face technological, cost, availability, and infrastructure uncertainties.

COAL – Coal has declined rapidly in many developed countries in recent years, due to a combination of market forces and policy, but there are hundreds of coal projects being built or on the drawing board around the world. Beyond stopping new coal construction, there is a need to think about accelerating the retirement of the existing fleet and replacing it with clean energy. Environmental considerations aside, the cost competitiveness of renewables has improved so much and so quickly that the economics of such moves are very favorable. The economics create opportunities for more collaborative coal transitions, through approaches such as securitization of coal assets and investments in a just transition. Poland, which has announced a coal phase-out within the next 20 years, may be a case study for planning a clean energy transition with a focus on just transitions for workers and communities.

Amid growing pressure for a clean energy transition, the dual shock of COVID and low oil prices severely impacted the economies of – and amplified the challenges facing – the Gulf Arab States. To address the large deficits, governments have been cutting spending and delaying energy projects, and investment may not pick up again for years. There are debates within the Gulf States about what direction economic diversification efforts should take now, with some arguing for a focus on lowering the risk profile and improving the resilience of the oil and gas sector and others arguing for high-tech, non-carbon industries. The Gulf Arab States have high capital efficiency and some of the lowest-carbon oil and gas assets in the world, so they might emerge in relatively good position in an energy market that is evolving to have squeezed margins and a bigger focus on carbon emissions. The Gulf States may also be well-placed to capture big parts of the green energy economy, as they are implementing solar and wind electricity projects at the lowest prices ever, and production of renewables-fueled hydrogen is starting to become viable. The outcomes of the November 2020 U.S. elections could have significant implications for the region, especially in regard to crude oil exports, OPEC+ cooperation, and more.

In considering the future of the global energy sector and climate change, India is a country of key importance. The government has a target to quintuple India's renewables capacity by 2030, but achieving it will not be easy, even with solar already being the cheapest electricity in India and solar-plus-storage becoming competitive. It will require a sizable shift in how the Indian power sector is configured, designed, and managed, with significant investments needed in manufacturing, generation, transmission and distribution, storage, and human capacity. State-level distribution utilities will be a major factor in the speed of the transition, though technologies such as solar pumps for rural areas could help restore their financial health. Coal is still king in India in some respects, but it is facing clear headwinds; its role as the biggest cause of urban air pollution has led the government to adopt emissions standards for coal plants, which are leading some to close. The economics and jobs tied to the coal sector, however, could make a clean energy transition into a thorny political issue in India. The role of and future for natural gas in India are similarly unclear. India has a target to more than double the gas in its energy mix, but the dominance of coal, the growth of renewables, and the expense of gas in India make it unclear how much gas demand will grow. Energy infrastructure financing from the U.S. government and private sector, as well as Indian policymakers' decisions regarding India's future economic and investment profile, could play an important role in shaping what India's energy transition looks like and how fast it occurs.

Along with India, China is the country that is most important to the future of energy and the climate. The relationship between the United States and China is experiencing unprecedented turbulence. The Trump Administration dramatically shifted U.S. trade policy, abandoning multilateralism and embracing tariffs to reduce trade deficits. U.S. tariffs on Chinese imports were met by retaliatory tariffs by China, and most tariffs still remain in place. There are serious concerns about Chinese conduct and unfavorable views of China across a broad spectrum of the U.S. political firmament. The status of the bilateral relationship has strained the ability of U.S. companies to increase exports of natural gas to China, as the trade barriers have led buyers in China to conclude that the U.S. supply of natural gas is unreliable. Climate change had been a positive pillar of the U.S.-China relationship during the Obama Administration, but even with a Biden Administration, it is unclear if that aspect can be revived. Beijing may welcome a Biden Administration's commitments on climate change as an opportunity to inject cooperation into an otherwise contentious relationship, but the forces of nationalism are strong in both countries, the United States lacks credibility on the climate front after the Trump Administration, and there could be tensions between the urgency of Americans' concerns about climate change and Americans' concerns about U.S. national security with regard to China and competition on technologies. The United States should pursue the bilateral relationship in parallel with multilateral efforts with allies. Reviving multilateral trade policies more broadly would require convincing the American public that rebuilding post-COVID involves building the manufacturing strength of the country in a way that promotes climate objectives – and that more open trading systems, including with China, are part of that.

The 2020 U.S. elections are clearly hugely consequential in terms of domestic and global energy and climate policy. If Democrats win the White House and Congress, there could be an aggressive climate package as part of a green economic recovery, actions on taxes and spending via budget reconciliation, and broader legislative policies pursued. There appears to be little support for carbon pricing in Congress now – with Democrats more focused on standards, investment, and justice and

Republicans fearing electoral blowback – but carbon pricing in some form might still have a role to play as part of a suite of policies. There is potential for bipartisan action on some climate-related topics, including resilience and adaptation, innovation, and natural climate solutions, as well as on particular technologies, such as carbon capture and storage, but these pieces do not add up to comprehensive climate policy. A Biden Administration would be expected to pursue its clean energy and climate goals through regulations too, including with respect to the production of and emissions from natural gas, though the conservative shift on the Supreme Court could constrain the ability of agencies to regulate emissions. Regardless of the federal election outcomes, there are also numerous opportunities in blue, purple, and red states to keep the climate and clean energy conversation moving forward.

COVID-19, LOW PRICES, & ENERGY MARKETS

The combination of a pandemic and a price drop has led to hard times for the oil and gas industry, and the industry will be changed going forward.

EFFECTS OF THE PANDEMIC

In considering the impact of COVID on the energy sector, it is worth separating out the initial shock from the after-effects. When the virus first hit, there was a clear hierarchy: the pandemic dominated, the economy was hostage to the pandemic, and energy was hostage to the economy. The pandemic was viewed as a transitory economic shock. Several months later, and as more time passes, the elements of that hierarchical picture are starting to separate, and dislocations of capital, labor, and energy are taking on directions of their own.

With respect to energy, even if the economy changes, there have been lasting impacts across all energy markets, including but not limited to oil and gas. For example, the historic collapse in oil prices, driven by the pandemic and the subsequent economic collapse, has hit shale hard. For the past decade, shale has been the dominant feature in the global energy picture, in both gas and oil. It will still be a major force, but it may look different going forward.

Global natural gas demand is forecast to fall 3% year-on-year in 2020 due to COVID – the largest recorded drop ever.

Global natural gas demand is forecast to fall 3% year-on-year in 2020 due to COVID – the largest recorded drop ever. Most declines in gas consumption occurred in mature markets across Europe, North America, and Asia, with particularly sharp drops in the first half of the year, when natural gas prices in some regions reached historic lows. The whole natural gas value chain had to be flexible to adjust to the pandemic's impacts on demand. Pipeline gas exporters bore the brunt of supply-side adjustments, though most liquefied natural gas (LNG) exporting countries also experienced some supply curtailment over the first half of 2020, with falling exports. The United States accounted for the biggest share of downward adjustment in global LNG supply, but the United States was not alone. Without the flexibility of the LNG supply, the adjustment to the 2020 demand shock could have been less orderly and had more damaging effects on the underpinnings of the global gas trade. It was a buyers' market even before the pandemic, given the well-supplied market, but the pandemic demand shock made things even worse for sellers. Total contract activity declined, and shorter contract lengths and smaller quantities became more common. Given that one-third of active contracts are due to expire by 2025, by which time total export capacity is projected to increase by 20%, there will be a large increase in uncontracted capacity. If natural gas prices remain low, there will likely be larger numbers of opportunistic buyers, especially in Asia.

Some price recovery has occurred, and natural gas demand is forecast to increase again in 2021 as electricity demand and industrial activity gradually return (as well as residential heating demand, following a mild 2019-2020 winter). The recovery of global natural gas demand is likely to be supported by fast-growing markets in Asia, Africa, and the Middle East. The resurgence of COVID cases and the prospect of a prolonged pandemic, however, bring great uncertainty to projections of the pace of energy demand recovery in 2021. The dominant factor in everything right now is when the

world will get COVID under control. If it fails to do so for a while, and global economic recovery is postponed for a few more years, there could be a very different world in terms of energy supply and demand.

It is also unclear whether the pandemic will be a catalyst to a clean energy transition. COVID may be accelerating the fall of coal and the rise of renewables globally, but its impact on the transition depends largely on the policies that governments deploy to respond to the pandemic and its economic effects. There are already billions of dollars being committed to green stimulus, as well as pledges on hydrogen, batteries, vehicles, and more. There is talk from China that the next five-year plan will be much more focused on green energy and digital innovation. Governments around the world are increasing clean energy R&D investments. The policies may not be as substantial as the climate crisis demands, but big government planning and spending are coming out of the COVID pandemic that could accelerate a transition going forward.

UNDERINVESTMENT & CONSOLIDATION CYCLES

Global energy investments, including in oil and gas, have declined during COVID to an unprecedented extent. Oil demand is also declining, but absent large governmental policy shifts, it is not clear that global oil demand will continue declining. If the economy rebounds, there will be a rebound in global oil demand too. Electric vehicles (EVs) get lots of media attention, but they are still a tiny percentage of the cars sold in the world, whereas SUVs dominate. Furthermore, in the future, the driver of global oil demand will no longer be road transport but the petrochemical industry because of increasing demand for plastics. There will be an underinvestment cycle in oil and gas if the economy rebounds reasonably, suggesting that price volatility is a possibility in a couple of years. In general, investment gaps are self-correcting; the cure for low prices is low prices. There will not be enough supply, prices will go up, and the investment gap will close. This has been the cycle before, and it is not clear it will be different this time. Still, the investment gap issue is real.

Oil demand is also declining, but absent large governmental policy shifts, it is not clear that global oil demand will continue declining. If the economy rebounds, there will be a rebound in global oil demand too.

At the moment, many oil companies (not all) have virtually no access to equity. Energy companies, for instance, are now a much smaller percentage of the S&P 500. They also have limited access to debt, and cash flow has been constrained by low oil prices. Companies that do have equity can use it for acquisitions of other companies that do not; companies and basins in oil and gas are likely to consolidate, focusing on a smaller footprint of advantaged assets. This reality has implications for the sector and for decarbonization. For example, mid-caps in the energy space, pre-COVID, were looking at investing in digital technologies to lower emissions, but all digital transformation is now focused on efficiencies and cost reduction, so that companies can aim to be the ones doing the consolidation as opposed to being consolidated. There has been a de-emphasis on decarbonization and an increased emphasis on winning in the consolidation cycle.

CLIMATE CHANGE & THE FUTURE OF FOSSIL FUELS

Everything in energy has to be viewed in the context of the urgency of addressing climate change. No country, community, or company tied to fossil fuels will be unaffected by the clean energy transition.

THE CLIMATE IMPERATIVE

Pressure from the public, the financial community, and others on climate action is growing stronger, as are impacts around the world such as wildfires, hurricanes, floods, and droughts. The trends in public concern around climate change are a reflection of how little progress has been made over the past decade or two, the math of the carbon budget, and how fast things have to change. This needs to be the decade of action if there is to be hope of meeting the Paris Agreement goals.

Global carbon dioxide (CO_2) emissions declined in 2020 due to COVID and the resulting economic contraction, but these are not sustainable gains and are absolutely not structural declines. China is illustrative: it was the first country with the pandemic, the first to get it under control, and the first whose economy is bouncing back, as are its emissions. Lower economic growth does not produce a cleaner energy world and is a poor low-emissions strategy. Energy efficiency suffers the most with low energy prices, and clean energy investments suffer too.

Global carbon dioxide (CO_2) emissions declined in 2020 due to COVID and the resulting economic contraction, but these are not sustainable gains and are absolutely not structural declines.

Even for big believers in markets, governments may need to play an outsized role in addressing climate change. Market, technological, and policy forces that led to peak coal demand – and may or may not be leading to peak oil demand – are insufficient. Global coal demand, for instance, peaked in 2014, but global coal consumption since then has only declined by a few percentage points, so not much has really changed. Coal is still the leading source of emissions around the world. Likewise, whether oil demand peaks soon or not, supply, demand, and emissions may not meaningfully change. Peak demand misses the point. Even with tremendous progress in deployment of renewable energy sources, the share of clean energy globally has stayed fairly constant for years. A sustainable path and a tipping point to sustainable energy are out of reach without strong government investment and policy.

Policies have created favorable conditions for coal, oil, and gas, and it is naïve to think those policies will not change with the pressure of addressing climate change. Given the imperative of decarbonization, the desires of the tens of millions of people moving to a more energy-intensive lifestyle in emerging economies, and the needs of the billions of people in energy poverty in the world, a range of policies and technologies will be needed to provide clean energy solutions. The complexity of a zero-carbon transition is immense, but the challenge looks different in emerging markets and developing countries than in the United States; it also looks different in the power sector than in heavy industry. There are roles for renewables, hydrogen, energy efficiency, and more. The costs of nuclear have to come down, and other regulatory and technological challenges have to be addressed. Innovation is also needed across the board, including in advanced durable materials and waste recycling, to adapt to a low-carbon energy transition. Saudi Arabia has been pushing the

concept of "circular economy" within the G20, which, in the climate context, involves: reducing the carbon that has to be managed in the first place through efficiency, fuel substitution, renewables, nuclear, hydrogen, and so forth; reusing carbon to create feedstocks and fuels (e.g., methanol, ethanol, fertilizer, curing concrete); recycling carbon through the natural carbon cycle (including via bioenergy); and removing excess carbon and storing it (e.g., direct air capture, biologic storage, geologic storage). All of these zero-carbon alternatives need to be pursued to make progress on decarbonization. Some kind of carbon pricing could help organize the competition among these potential solutions, but carbon pricing policies have proven to be very difficult to get adopted.

Governments are making ambitious climate commitments, but it is not yet clear what kinds of policies will be put in place to reach those targets; this seems to be a moment of disconnect between ambitions and the reality of policies.

Indeed, policies may not move in a predictable path, such as a steadily rising carbon price. Governments are making ambitious climate commitments, but it is not yet clear what kinds of policies will be put in place to reach those targets; this seems to be a moment of disconnect between ambitions and the reality of policies. There is a lot of pressure building, though, for more disruptive policy changes, such as bans or restrictions on fossil fuel production. Young people around the world are being very vocal about their expectations for change from how things have been done in the past. Rollbacks of regulations on the fossil fuel industry and heavy emitters could yield popular backlash that causes more economic harm to those industries. The transition may be faster than expected, which could lead to stranded assets. There is no reason to think that there will be anything but more volatility in oil and gas going forward given the need to redesign significant parts of the energy sector globally.

OIL

Oil companies, at least in some countries, are under massive pressure from investors and activists with regard to climate change, but the world also still uses a lot of oil and gas. There is a relatively long tail on hydrocarbons, if one looks at the global demand picture, and they will not be replaced overnight. Oil will be needed for years to come, but it is possible that the perception of the industry as being one that has a less bright long-term future in a world serious about climate goals could lead to continued underinvestment, which could lead to continued decline in demand, and so forth in a self-reinforcing cycle. Companies and countries reliant on oil revenues need to seek to find a path to an orderly transition.

There is a divergence in strategies between international and U.S. oil majors. Some European oil majors have made notable climate commitments, such as achieving net-zero by 2050, and are speeding up investments in new clean energy sources. The companies making commitments, though, represent a small fraction of global oil production and an even smaller fraction of global CO_2 emissions. News coverage focuses on the high-profile actors making big announcements, but most emissions lie elsewhere, such as with national oil companies.

In contrast to their European peers, U.S. companies are doubling down on oil and gas. Even if the world was on track for 1.5°C or 2°C, there would still need to be new investment to offset decline rates in the sector. U.S. companies see the best strategy to survive as having the lowest price possible (to weather low-price periods) and continuing to benefit from cash flows that the hydrocarbon business will still produce over decades. The lowest-cost oil generally involves using existing infrastructure. While there are still continued finds of oil and gas resources, including with advanced seismic technologies, they are minor discoveries in the scheme of things. All major areas have been discovered, and exploration has dramatically dropped off over the last four decades in terms of the size of discoveries. The focus therefore has to be on how to get more out of the existing reservoirs. Shale reservoirs, for instance, only produce a fraction of the hydrocarbons in place. Advanced technologies in the industry have yielded big improvements in things like drilling and completions, but there has not been much technology developed on the production side to help recover oil at lower cost. That is the next step where significant technological advancement is needed, to enable the industry to adapt to low prices. The world

does not need more reservoirs; it needs to figure out how to get the rest of the recoverable stuff out of existing reservoirs at low cost and with low emissions.

While many of these investments have an attractive cash flow profile over time, there is a question as to how investors (public and private) are going to value them. Equity market investors like growth, and the oil and gas industry is clearly out of favor. Investors are trying to see where growth will be and so are looking at what companies will do going forward (e.g., become an energy company versus remaining an oil and gas company). European companies are under more pressure currently, partly because of all the policy in Europe, but this trend is inevitably coming to the United States too. COVID has been a real accelerant for what climate change was already putting at risk for investors and oil companies. COVID has crystallized for people the risks of things changing dramatically. For instance, dialogues occurring inside leadership in major oil exporting countries are now reflecting increasing realization that economic pressures might be permanent – not that oil prices could not go up again for a year or two, but that countries may not get a 5-10 year period to collect rents again and refill their sovereign wealth budgets. Combined with billions of barrels of oil in inventory that is not getting used quickly because of the stalled economic recovery, the outlooks for some governments look quite constrained, and some governments – like some companies – are looking at how to adapt.

There has been more investor interest in parts of the business moving toward climate-friendly production, such as enhanced oil recovery (EOR) and direct air capture, than in the regular oil and gas business.

There has been more investor interest in parts of the business moving toward climate-friendly production, such as enhanced oil recovery (EOR) and direct air capture, than in the regular oil and gas business. The last barrel produced in the world should be produced via EOR, through which more CO_2 is injected than is emitted when the produced oil is burned. Companies investing in EOR, carbon capture and storage (CCS), and so forth may well be the survivors as the world moves toward dealing with climate. Pivoting toward climate-friendly products and production, however, will only work if countries and companies can deliver economic results; there will be dollars to invest in things that can generate a return.

NATURAL GAS

Natural gas, which is expected to grow its share of total primary energy demand over the next couple of decades, is seen by some as playing a role in decarbonization. Beyond the power sector, potential growth markets for natural gas could include transportation (including marine, rail, and heavy-duty trucking) and the industrial sector. Natural gas has been deemed a bridge fuel to a low-carbon future, but concerns about methane emissions and carbon budgets are increasing scrutiny and raising questions – especially in OECD countries – about how long that bridge is. To address climate change, there is a need to move off of carbon-intensive fuels, but there is more nuance in the conversation than is sometimes commonly understood.

Natural gas is plentiful and quick-ramping, emits half the carbon emissions of coal generation when combusted, and results in significantly lower levels of local air pollution compared to coal. Natural gas can contribute to emission reductions by displacing dirtier fuels. In the United States, for instance, there has been a significant shift from coal to gas – driven primarily by economics – and there is still more room for coal-to-gas switching, even in developed markets. In Mexico, natural gas was used to offset fuel oil and improve energy access and resilience. Likewise, LNG exports to the developing world have the potential to improve energy access while offsetting coal, fuel oil, and wood use.

Natural gas can also support renewables for a lower-carbon future. The more variable renewables there are on the system, the more need there is for natural gas or long-term and seasonal storage for peaking and baseload, and batteries do not yet appear to be sufficient to meet multi-day storage needs. The concept of natural gas as a partner for renewables,

though, is coming under more challenge around the world. Some places are using demand response, while others are making big bets on hydrogen and offshore wind.

For natural gas to play even a short-term role in decarbonization, companies everywhere will be under pressure to show they are taking the proper steps to manage emissions of all kinds, including CO_2 and methane. Because they have been and will be challenged about the benefits of gas, many companies are improving their performance on leak detection, methane emissions, and quantification and reporting. Individual oil and gas companies have adopted methane intensity targets, tried new detection and measurement technologies, and funded methane mitigation projects. Some companies have committed to eliminating routine flaring by the end of the decade, though the flaring record of U.S. shale producers has not been stellar. Transparency will be a key driver of change. Within the next few years, improved satellite monitoring and ground-based detection systems will make methane emissions very transparent, with data used by regulators, policymakers, investors, and civil society around the world for detection and verification at a much more granular level, thereby enabling changes in policies and markets.

Building natural gas infrastructure locks in CO_2 emissions for the lifetime of the infrastructure, which highlights the need to eventually decarbonize the gas itself with approaches such as hydrogen and biomethane.

Even with such efforts, building natural gas infrastructure locks in CO_2 emissions for the lifetime of the infrastructure, which highlights the need to eventually decarbonize the gas itself with approaches such as hydrogen and biomethane – though there are technological and cost uncertainties in those new types of gases. In California, natural gas infrastructure is extensive, mostly for residential heating and cooking, but there are efforts to use renewable natural gas (RNG) from biogenic sources in the infrastructure, as well as to evaluate how the infrastructure can be used to accommodate higher percentages of hydrogen. Using RNG from certain biogenic sources (e.g., cow manure) to displace oil in the transportation sector can also be hugely carbon negative, displacing dirty fossil fuel while capturing methane emissions. Some studies show the potential for RNG is only enough to meet a small portion of total existing gas demand and thus to displace only a tiny amount of fossil fuels, but other studies may show more. RNG today comes mostly from landfills and dairies, but there is also gasification technology that can generate RNG from woody biomass and other feedstocks, and California recently expanded the definition of RNG to include such feedstocks.

If optimistic cost projections for electrolyzers are realized in the next few years, some economies will target hydrogen as their preferred option for decarbonizing gas. Virtually all hydrogen produced today comes from natural gas, with substantial associated emissions – but at this moment, scaling up use of hydrogen is more important than how the hydrogen is produced. The costs of transforming methane into hydrogen using CCS are currently substantially cheaper than making hydrogen through electrolysis using renewables. The "blue hydrogen" from CCS can help develop the hydrogen industry at scale as "green hydrogen" drops in price and comes online more.

A key question about hydrogen is the extent to which it can utilize existing infrastructure. The percentage that can be blended in without corrosive problems varies by region and pipeline materials, but blending even a low percentage of hydrogen into gas systems will help hydrogen scale up. There are many institutions looking into the relevant material science regarding pipelines, coatings, and so forth. Midstream companies that have well-maintained pipelines that use modern materials could have an edge in blending hydrogen into the pipeline mix. In addition to the material science issues, the percentage that can be blended into the system depends on the most sensitive items connected to the gas system. The corrosiveness concern is also greater in some applications than others. Some utilities, for instance, are pursuing projects to create green hydrogen from excess renewables generation as a form of storage. A green hydrogen electrolysis project at a substation may be more achievable than hydrogen flowing through thousands of miles of distribution lines to homes and businesses.

Some gas companies are focusing on their core competencies and aiming to reduce more and more emissions in the natural gas value chain, while others are embracing a wider transition and are investing more in zero-carbon energy options such as hydrogen and CCS. All of these efforts can support and contribute to decarbonization. The jury is still out, though, on whether the majors will win in the energy transition. There is a lot of capability they do not have in new energy sectors, and there is a lack of clarity on where the returns will be for hydrogen, CCS, and other zero-carbon options.

The future of gas is also very uncertain, at least in Europe, which is adopting suites of policies, programs, and performance standards. Natural gas's role in Europe's power sector will be challenged by renewables on price, capacity, and availability. Its future in heating and industry may be challenged by the strong focus on hydrogen and building renovation in European policies. New European CO_2 and methane performance standards will be key differentiators for all fuels. The European investment community is also starting, for the first time, to have a coordinated effort to engage with and operationalize sustainability in financial transactions. With the European Green Deal, the overall architecture and infrastructure of European gas markets will change – everything from production to consumption of energy. The vision is radical, and transitions are not always linear and predictable.

Natural gas's role in Europe's power sector will be challenged by renewables on price, capacity, and availability. Its future in heating and industry may be challenged by the strong focus on hydrogen and building renovation in European policies.

The future of gas is uncertain beyond Europe as well. Governments are being pressured to include methane targets in their nationally determined contributions under the Paris Agreement and to adopt well-designed regulations at the national or regional scale to tackle methane emission reductions. In addition, the technological and cost improvements in renewables, coupled with the incredibly low cost of financing at the moment, have created opportunities for countries to pursue grid transformations in ways that leapfrog at least some aspects of a natural gas buildout, though some in emerging economies chafe when people in developed countries preach about leapfrogging fuels.

COAL

In many OECD countries, coal has declined rapidly in recent years, due to a combination of market forces (e.g., inexpensive and plentiful natural gas, dramatically reduced costs for wind and solar) and policy (e.g., controls on mercury and particulates, clean energy incentives and standards). This has not been uniformly true across OECD countries, though, and certainly has not been true across the globe. In developing countries, particularly ones lacking sufficient and reliable electricity, there are many existing coal plants and new ones under development, including through the Belt and Road Initiative sponsored by China. There are hundreds of coal projects being built or on the drawing board around the world. New coal-fired power generation can bring mixed blessings to the countries they serve – bringing new electricity that enables job creation, economic opportunity, and poverty reduction, but also bringing air pollution, crippling health impacts, increased water demand, and other harmful considerations.

Stopping new coal construction has been a focus of activists and policy over the past decade. This is important, but it is not enough, as the emissions from running just the existing coal fleets to the end of their economic lives would far exceed 2°C or 1.5°C climate scenarios. There is a need to think about accelerating the retirement of the existing fleet and replacing it with clean energy. The good news is, even if one ignores the environmental considerations, the economics of such moves are very favorable. The cost competitiveness of renewables has improved so much and so quickly that not only is new coal uncompetitive with new clean energy in much of the world, but it is also already cheaper to build new renewables plus storage than to continue operating a sizable portion of the world's existing coal fleet – a portion that will become even more sizable over the next few years. The parts of the world where coal is still competitive are shrinking rapidly, and the net cost to society of engineering a coal-to-clean transition will be negative within a couple of years.

Within just a few years, it will be the case that ordinary customers of energy – in the United States, Europe, China, India, and elsewhere – would pay more for their energy bills if most coal is left on the system than if the coal was immediately replaced with renewables plus storage. Even in places where the economics will not align until later this decade (e.g., some places in Southeast Asia), it takes time to plan transition programs, do the needed grid planning, negotiate with workers, and so forth, and that work needs to get started now to enable smoother skating to where the puck will be.

The economics create opportunities for the debates about coal transitions to become less adversarial and more collaborative. Long-term contracts and noncompetitive tariffs shield much of the coal fleet from competition from clean and cheaper renewables (though that varies by jurisdiction), but incentive-based approaches can take advantage of the economics to accelerate coal plant retirements. For example, coal plants can be refinanced, such as through ratepayer-backed securitization, which can unwind long-term contracts and save everyone money. Instead of having ratepayers locked into long-term contracts to purchase coal-based electricity, securitization lets ratepayers raise low-cost debt, make coal plant investors whole, free up resources to replace coal with clean energy and storage, and save ratepayers money on their bills.

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Retiring uncompetitive coal could save many billions of dollars annually – savings that could be used to support just transitions for workers and communities. It is essential to consider the fate of communities reliant on coal extraction, transportation, and generation, as well as the fate of workers and families that have sometimes worked with coal for generations. Just transition is much more about economic development and workforce policy than environmental policy, and it is critical to get ahead of it. It will involve decades of transition in regions and communities that were literally built around the resource that is being transitioned away from.

Poland may be a case study of the importance of a just transition. Poland has announced a phase-out of coal by 2039 – an unprecedented transition that, over the next couple of decades, will involve building a zero-emission energy system of a size comparable to the existing conventional system that was built over the past 60-70 years. The new system will be based on offshore wind in the Baltic Sea, new nuclear power, and distributed energy systems (reflecting the boom in rooftop solar, as well as other sources such as biogas, batteries in electric vehicles and buses, and heat pumps). The Polish effort is premised on a just transition, focused on particular regions that have rich industrial cultures and manufacturing capacity based on coal, which support millions of people. There have been hard but constructive discussions with the trade unions about the transition and about creating new jobs and opening new niches (including in clean technologies) to replace the existing fossil-dependent sectors.

Europe has deeper experience on these types of just transition issues than the United States, but the evidence is mixed regarding previous policies and approaches. It is important to get the treatment of workers and communities right – particularly because there will be more of them. In the United States, for example, just transition discussions focus on coal workers, but the number of oil and gas workers dwarfs the number of coal workers. The United States has to do a better job looking forward than it has in the past to address economic dislocation from the energy transition.

THE GULF ARAB STATES

This is a dynamic time for companies and countries that rely on oil and gas revenues. For the Gulf Arab States, this is a time of stress, uncertainty, hardships, and debates about what the future looks like for their economies and their energy sectors.

FISCAL DYNAMICS IN THE GULF STATES

The dual shock of COVID and low oil prices amplified the short- and long-term challenges facing Gulf States. Even when there were higher prices, most countries in the Gulf were running deficits, and with the price decline, those deficits have become more acute. The price decline also follows the oil price crisis of 2014-16, which weakened the countries' fiscal price buffers. Therefore, when COVID hit, the fiscal space was already very constrained (which explains the limited fiscal stimulus that Gulf Arab States have implemented so far, especially compared to the United States or China).

The pressure on Gulf economies has been significant. Revenue in Iraq has been halved. Saudi Arabia has deficits and will not have a balanced budget for a few years. Kuwait has a liquidity crisis. Egypt may be the only country in the region that might grow in 2020.

Just as different Gulf States have been affected in different ways by the health and economic crises, their responses have also varied. Countries such as Saudi Arabia have introduced some taxes to raise revenues, though not enough to address the deficits. Governments have relied on international debt markets, which is an increasingly costly approach. Some governments are doubling down on their reserves. The only option not used yet is currency devaluation.

To address the large deficits, governments have also been cutting spending and delaying energy projects. It is not necessarily a bad thing to cancel or delay projects that had low rates of return, but 2020 has been challenging to the region in ways that are already deeper and longer-lasting than previous downturns, with significant impacts on energy investments. Declines in energy investment in the region, as in much of the rest of the world, are being felt this year – without a lag – and investment may not be able to pick up again for years. For the majority of Gulf States, even those well-positioned in the recovery, the lost output will not be recovered before 2022 at best. The only sector that has seen increased investment in the Gulf Arab States is the gas value chain, given growing gas demand both for local consumption and for use as a feedstock for petrochemicals and derivatives.

The combination of measures pursued by the Gulf States could see them muddle through until oil prices recover. Cooperation with other producers through OPEC, while hard to achieve and ensure compliance, therefore assumes greater importance. If oil demand peaks or plateaus, though, OPEC's ability to cut production and increase prices will be affected. If countries see an energy transition coming and shift to trying to get all of their resources out of the ground soon, cooperation could also break down from cheating. Maintaining export volumes would require increasing market share in a shrinking market. Oil would become normalized, more like other commodities, with competition on price. There are harbingers of this already, such as the Russia-Saudi price war. If there is a prolonged period of price competition in the market, lower prices may cause enormous pressure on revenues in the Gulf, but they might be good for the long-term future by spurring greater efforts to diversify economies.

ECONOMIC DIVERSIFICATION & LOW-CARBON ENERGY

The energy market is evolving, with more consolidation, much lower returns, and squeezed margins that are only likely to become lower over time. The Gulf States have to eventually adjust to that lower-price environment. The fact that the Gulf States have largely been unable to cope with the COVID recession and low prices indicates how decades of efforts to diversify their economies have achieved only limited success. Diversification requires deep structural reforms, including with regard to the private sector, labor markets, human capital, subsidies, and taxes, and these are hard to achieve. It is unclear how fast – and whether – such reforms can be implemented. Still, mirroring the divergent approaches taken by U.S. and European oil companies in the face of low prices and the drive for decarbonization, there are debates within the Gulf States about what direction diversification should take now, with some arguing for a focus on being a long-term leader in oil and gas and others arguing for high-tech, non-carbon industries.

Diversification requires deep structural reforms, including with regard to the private sector, labor markets, human capital, subsidies, and taxes, and these are hard to achieve.

Expecting the Gulf Arab States to diversify away from the energy sector, which has been their core competitive advantage, may be unrealistic and suboptimal. The oil sector remains profitable, with higher margins than any new sectors that governments aim to establish. Even in a market with squeezed margins, the Gulf Arab States have some of the characteristics of the few winners that will emerge, including high capital efficiency and direct access to some of the lowest-carbon oil and gas assets in the world. Cost curves will mean something, and the Gulf States should be well-positioned relative to other players in the field. The Gulf Arab States may be better off leveraging their core strengths and assets and enhancing the competitiveness of the sector by lowering production cost, improving production efficiency, decarbonizing production, improving the efficiency of domestic energy use, diversifying the energy mix, shifting the oil portfolio towards petrochemicals, and decarbonizing final petroleum products. Some countries are better positioned to embark on that suite of efforts than others, in terms of the carbon intensity of oil and gas production and the levels of methane emissions and flaring. The returns on such efforts are also lower than the current approach. The efforts, however, lower the risk profile and improve the resilience of the sector, enabling it to compete in any price environment while sustaining demand. These trends in energy markets are already being taken into account in business plans and strategies by at least some national oil companies in the Gulf.

The Gulf States may be well-placed not only to supply the world with relatively low-carbon fossil fuels, but also to capture big parts of the green energy economy. There is a lot of effort going into decarbonization in the Gulf States, and these projects also take advantage of core regional strengths. Oil rents, at least at the beginning, can support a smooth transition to new technologies.

Coming into 2020, a few of the Gulf States were already implementing big renewable electricity projects – solar and wind – at the lowest prices ever, while delivering good returns to investors. Even the lowest-cost producer of oil and gas cannot make fuel available to generate electricity at prices that compete. The turbulence of 2020 has not changed this outlook, and indeed, renewable electricity prices have only come down further. Gulf States can generate renewables for about two-thirds of daily hours through a combination of wind and solar, which means production of renewables-fueled hydrogen – global demand for which is on the rise – starts to become viable. Electrolyzers are expensive at the moment, but deployment at scale with super-cheap renewables will drive the cost down. Since the entire Gulf region benefits from the same characteristics – lots of land, excellent sun and wind, reasonably good credit, a good track record of protecting investments, and sophisticated technology deployment capabilities – more green hydrogen projects are to be expected, as well as other industrial projects on the back of green hydrogen. The Gulf States are thus well-positioned to generate much-needed economic activity by continuing to invest in large renewables capacity to serve their own needs and to produce green hydrogen for export.

In addition to renewables, there has been some nuclear power development in the region. The Barakah nuclear project in the UAE commenced operations in 2020 and was built on time and on budget, but it has not really led to an inflection point for the reacceptance of nuclear power. Since the Fukushima incident in Japan, Gulf States that were looking at nuclear mostly have not returned to it. Nuclear power in the Gulf raises nonproliferation concerns, particularly with respect to Iran. There are also geostrategic considerations, with competition for selling nuclear power into the region, including from Russia and China. Those who care about nonproliferation and nuclear safety should want the United States to be a major player. The United States has done some things to get back into the game of global nuclear exports, in terms of development finance changes, but there is much more to do. The new generation of advanced nuclear technologies is smaller, faster, cheaper, and better, presenting an opportunity to meet the requirements of the Gulf States and complement renewables with dispatchable zero-carbon power, but the United States has to get out of its own way or it will be left out of that market.

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RELATIONSHIPS WITH THE UNITED STATES

Relationships between various countries in the region and the United States may depend on the outcome of the November 2020 U.S. elections. One big question is what happens with U.S. reengagement in the Iran nuclear deal if there is a Biden Administration. It is not clear what kinds of changes in Iranian behavior a Biden Administration will seek, nor is it clear how much Iran and U.S. allies are willing to re-negotiate, but oil sanctions will very likely be chits to be used in negotiations. Biden has made clear that getting back into the Iran nuclear deal or some version of it is a priority, but that does not mean a complete reset. Iran will insist on having a return of crude oil exports, which would mean a lot more barrels coming back on the market, potentially lowering oil prices and causing headaches for Russia and Saudi Arabia.

As for Saudi Arabia, it is hard to overstate the extent to which there will have to be serious mending and resetting of the U.S.-Saudi bilateral relationship under a Biden Administration, in light of the challenges that many Democrats and Republicans see with the Saudis. Saudi Arabia may be weaker on both sides of the U.S. political aisle than it has been in the past.

Another key question will be how the politics of oil prices take shape under a Biden Administration. It will be interesting to see if a Biden Administration would pressure OPEC+ the way President Trump did in April if oil prices drop. The Trump Administration learned that OPEC+ supply management is key to the health of the U.S. shale sector. Biden is more concerned about climate and less concerned about shale, but he is also worried about the health of the U.S. economy.

INDIA

India has burgeoning energy demand and the fastest growing rate of emissions, but it has also seen remarkable declines in the cost of clean energy. It is one of the most important countries in terms of the future of climate change and the global energy sector.

MOVING TO RENEWABLES

India was a non-player in renewables at the beginning of the decade, but by 2017 it was the second-largest solar market, thanks in part to big targets from the government. India, which currently has about 90 GW of renewables, now has a target of 175 GW of renewables by 2022 and 450 GW by 2030. The country is expected to see huge growth in electricity demand, and with the 2030 target, the government is saying that the new growth will be fundamentally different from previous growth that was powered by coal. Solar is already the cheapest electricity in India, and solar-plus-storage is starting to make in-roads to provide electricity competitive with coal. As India goes from its existing 90 GW of renewables to 450 GW in 10 years – a fivefold increase – the renewables capacity added will be equal to India's entire power sector capacity from the start of the country to the present.

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Achieving the huge growth in renewables represented by the 2030 target will not be easy, even with the precipitous cost declines for solar and wind and the beginnings of battery deployment. It will require a sizable, fundamental shift in how the Indian power sector has to be configured, designed, and managed. For example, executing it on the ground will involve land acquisition, hiring and training people, manufacturing equipment, and more. India will need to buy billions of dollars of wind turbines and solar panels in the next few years; if more of that is domestic, it will lead to job creation, but it will also require huge investments to create the manufacturing capacity. In addition to the investment needed in renewable generation capacity, India will require still more to build transmission and distribution capacity. There will also have to be enhanced investment and understanding in how to manage flexibility, including better software and better-trained staff. There are market questions as well, such as whether India should have a real-time market that can absorb and balance renewables. Renewables in India do not suffer from market constraints, but from execution constraints, and it remains to be seen if the ambitious targets can actually be executed on the ground.

Renewables currently account for about 10% of India's grid, but in a decade, that might be 35-40%, and at times much higher. There is not currently an ability to manage the grid like that, so storage and other balancing technologies will also have to grow considerably. There are decisions to be made about the types and durations of storage to pursue, and it is possible that India may require customized battery solutions. With the cost of batteries coming down over time, India will have to decide whether to lock into long-term battery solutions or wait a few years as the technologies evolve and costs continue to decline. Similarly, India could lock into pumped hydro today, which is cheap but would forestall cheaper options later as battery costs decline. This will all require enlightened policymaking. The cost dynamics around storage technologies are shifting very quickly, and it is not clear that policymakers and the market understand that yet.

Political will in India clearly seems to be moving toward renewables, but that will is more evident at the central level. The bigger challenge in India is at the state level. Historically, state-level distribution utilities have been essentially bankrupt, with large portions of power going to farmers who do not pay for their energy usage for pumping water. Most state governments are not in a position today to continuously refinance these organizations. The political dynamics involved in making changes in tariffs and making state electricity boards into vibrant utilities may be the biggest challenge to achieving renewables targets; distribution companies' financial health will be a major driver of the speed of the transition. Until that situation is tackled, the market for renewables will not be through the big state-level utilities but rather through direct deals. Renewables present opportunities for change in distribution companies, though, largely because of the ability of solar in rural areas to provide electricity at far lower costs than when transmitted across long lines from central stations. As more and more solar pumps are deployed, distribution companies have an opportunity to reduce their losses, which could help restore their financial health. Solar pumps are not a silver bullet, but they can be part of much needed power sector reform.

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Stranded assets could also impede the transition, or renewables businesses will have to find a way to go around them. India has already seen a lot of stranded coal assets, and there will be more, potentially accelerated due to trends in the financial industry to incorporate ESG factors. Even some early renewables that have contracts at high prices could become stranded assets, but the organization of the renewables sector, which is essentially led by the private sector, is fundamentally different from the thermal sector, which has been more state-owned. The private sector has bankruptcy as an option, but the government does not, and it is not clear what will happen with all the government-owned utilities and plants.

India's economic growth and emission reductions depend on cleaner options beyond the power sector as well, including for transportation, industrial processes, and other sectors. In the transport sector, EVs, especially two-wheelers, are already cost-competitive with petrol-driven vehicles, and electric buses are cheaper on a lifetime basis than diesel or compressed natural gas buses. In industry, especially the steel industry, there are a lot of heating applications that could be met cleanly with electricity, and it is cheaper to use solar for electricity than coal. For higher-temperature industrial needs and long-distance transport (as well as seasonal grid balancing), hydrogen produced through electrolysis of water using cheap solar electricity may be an answer.

Low-carbon options are thus already becoming economic choices in India in power generation, industry, transport, and elsewhere. Over the long term, this helps move India toward a cleaner future. India's clean energy transition is at a critical juncture, though. The targets have gotten more ambitious and the challenges more pronounced. The energy transition could also be affected by macroeconomic forces, as COVID dealt a serious blow to India's economy, which has begun rebounding; COVID hit the poor particularly hard in terms of both health impacts and lost livelihoods. Actions taken in the short term have to align India in moving toward its long-term goals. In the wake of the COVID pandemic, India's emphasis has been on revitalizing economic growth, job creation, and entrepreneurship support. This is evident in the nature of the economic stimulus packages, which have focused on provision of credit, guarantees, and other such mechanisms to the areas creating the most jobs and economic growth, such as agriculture and small and mid-sized enterprises. If credit availability could be matched by green equity availability, then there would be a better chance of nudging the present towards the future. This is a key time to see if India stays on track for an energy transition or falls by the wayside.

TRANSITIONING FROM COAL

The transition from coal to renewables is a major one for a country like India that is so dependent on coal-fired power plants. Countries such as India are faced with the challenge of providing accessible, affordable energy to large numbers of people, and coal provides that cheaply. The country is desperate for growth, and coal is in some respects king in India. The vast majority of coal used in India is used in the power sector, and an even larger majority of the electricity in the country currently comes from coal.

There are clear forces currently operating, however, that will make coal less important in the years to come in India. Most importantly, while coal is the key source of power, it is also the biggest cause of urban air pollution, from its use both in power plants and in a huge number of industrial establishments across the country that need affordable energy. COVID-related lockdowns brought people in India cleaner air, which they do not want to lose. The large concerns about air pollution are leading the government to adopt standards for improving emissions from coal power plants, including sulfur dioxide, nitrogen oxides, particulate matter, mercury, and water discharges. Noncompliance is already leading to the closure of some old plants, and new, ultra-critical plants with better emissions are replacing older ones. In addition, there is a massive power surplus in India – which is ironic, as there is still not affordable energy in many homes and areas – and fewer new coal plants are being commissioned; the central electricity agency has talked about a future with ramped-up renewables and forced curtailment of generation from coal plants. Coal will not be wished away, but it is facing clear headwinds.

The economics and jobs tied to the coal sector, however, could make a clean energy transition into a thorny political issue in India. There are massive numbers of people with livelihoods connected to coal, so there are serious employment implications from mining through transportation to combustion. This is why some are pushing to clean up rather than shut down coal, but either way, more discussion is needed in the country to address the transition for coal workers and regions. There is a need for skill development and certification that creates jobs. Notably, the transition will occur over 20-30 years, which is roughly the professional lifetime of a coal miner. It is possible that if the government plans well, the last miner will retire on the day the last coal mine is closed, which is also the day the last coal plant is closed. There could be a phased transition from coal to renewables.

Natural gas could be a bridge fuel for India, especially with local air pollution concerns, but India is a price-sensitive market, so the market for natural gas may depend on India tightening clean air regulatory enforcement, which may or may not be a top priority post-COVID.

ROLE OF NATURAL GAS

The role of and future for natural gas in India are unclear. India has a target to more than double the gas in its energy mix, which could make India as large a market for LNG as China over the next decade. Some U.S. companies are excited about the potential to export gas to India. Even with a huge contraction in India's economy due to COVID, exports of LNG to India still grew substantially. There has been infrastructure investment in city pipelines to use gas for home heating. LNG is also being used in transportation, displacing oil, and there are commitments for thousands of filling stations for heavy trucking, representing millions of tons per year of LNG demand. Natural gas could be a bridge fuel for India, especially with local air pollution concerns, but India is a price-sensitive market, so the market for natural gas may depend on India tightening clean air regulatory enforcement, which may or may not be a top priority post-COVID. The right regulatory changes and fiscal instruments could bring more gas into India and make it more competitive.

While gas demand will grow in India, it is not clear how much it will grow, how much the country actually wants it, or whether it makes sense for investors to

direct their funding towards it. Gas in India is expensive, and India does not have good access to gas, so ramping to meet renewables loads in the medium term will likely be met by coal or storage, not gas. Coal is so big and cheap in India that it takes priority, and renewables are the focus from an environmental perspective, so there may not be the needed pressure on policy changes (e.g., pricing, fiscal terms, pipeline access, market development) to make gas growth a reality. Even for growth outside the power sector (e.g., industry, heating, transport), upgrading infrastructure presents a problem. Investment in gas infrastructure will need time to be recovered, and it is not clear there will be enough time before the economy moves to zero-carbon. As long as there is not clarity on how long there is to recover investments in infrastructure, there will be risks facing investors.

U.S.-INDIA RELATIONSHIP

The U.S.-India energy partnership has existed for decades, with energy collaboration seeing higher prioritization over the past 12 years or so. That will continue to be the case regardless of the outcome of the November 2020 U.S. elections. Energy is seen as a strategically important area for the partnership and as a growing opportunity for U.S.-India trade. Still, how big the energy opportunities are in India and what they look like depend heavily on the outcomes of the U.S. elections and the economic choices that India makes moving forward.

India will continue to have a diverse focus on energy, moving aggressively on renewables but also looking at transition fuels. There is a lot of sunk cost in India's coal sector, leading to presumptions that India will continue to rely on coal as it transitions. Energy infrastructure financing from the U.S. government and private sector, though, could play an important role in what comes next, how fast the transition occurs, and what it will look like. Under the Trump Administration, there has been a strong focus on fossil fuels, as well as private-sector investment and collaboration on renewables that has not been government-driven. If there is a Biden Administration, there will be more focus on clean technologies such as renewables.

Energy infrastructure financing from the U.S. government and private sector, though, could play an important role in what comes next, how fast the transition occurs, and what it will look like.

U.S. financing for energy infrastructure in India will be really important, whether on renewables, gas, coal, or other areas the national governments want to prioritize. The clean energy transition will be capital-intensive, which privileges countries and groups that are wealthy and have cheap, available capital; less wealthy countries are challenged in terms of both availability and distribution of capital. India has taken steps to bring in foreign investment, but it has also taken steps to focus on domestic industry and protect domestic markets. There is apprehension about whether foreign investment and foreign players will have the same opportunities and access to India's market as domestic industry. These are challenges that U.S. companies are navigating as they look to India. As tensions in the U.S.-China relationship rise, companies are questioning whether to diversify and de-risk, and India could benefit significantly from that if companies have confidence in regulatory stability, a level playing field, and market access. These are decisions Indian policymakers will be grappling with regarding India's future economic and investment profile.

TRADE & THE U.S.-CHINA RELATIONSHIP

Along with India, China is the country that is most important to the future of energy and greenhouse gas emissions. China is the world's largest energy producer and consumer and the largest greenhouse gas emitter by far. It consumes more coal than the rest of the world combined. It has more EVs than the rest of the world combined. The dynamics, chemistry, and content of the U.S.-China bilateral relationship are absolutely key to the future of energy and global climate action.

TRADE TENSIONS

The relationship between the United States and China is experiencing unprecedented turbulence and escalation of tensions, greatly magnified by trade disputes and COVID. The tensions will likely persist regardless of the outcomes of the November 2020 U.S. elections.

Since World War II, the U.S. government has been a major force in using diplomacy to help build an open trading system. There was a consensus that opening global markets and fostering the free flow of goods, services, ideas, and capital would benefit all nations. The resulting expansion of global trade and investment contributed trillions to GDP and lifted millions out of poverty. Trade has led global GDP to expand, but the distribution of the gains from global trade has led some portion of the population to feel it has suffered, and portions of the U.S. population – across parties – likewise feel negatively toward trade.

The start of the Trump Administration led to a dramatic shift in U.S. trade policy. The Trump Administration does not partake in multilateralism, and it supports managed trade over free trade, with tariffs as its preferred tool to reduce trade deficits. The Trump Administration, for instance, backed away from the Trans-Pacific Partnership (TPP) trade agreement, preferring a bilateral instead of a multilateral approach, which opened up a lot of opportunities for China with fewer checks and balances. The United States also acted alone (rather than joining with others) to raise tariffs on Chinese imports in response to China's violations of commitments that it made when joining the World Trade Organization, and China retaliated. These actions have hurt both economies. The United States and China signed a Phase 1 trade deal, which was seen as a truce in the tariff war, in which China agreed to improve intellectual property protection, open its financial services sector, and increase purchases of U.S. farm, energy, and manufacturing products and services. The data, however, shows that China is far behind on these commitments, and most tariffs remain in place.

The bilateral relationship has deteriorated still further, including due to Chinese actions in Hong Kong, Taiwan, and the South China Sea, repression of Muslim Uighurs, and various differences regarding technologies. The conventional wisdom in DC on China has changed a lot in recent years, with a recognition of a series of prior mistakes but perhaps now an overcorrection toward greater confrontation. Anti-China perspectives have become more bipartisan; across a broad spectrum of the U.S. political firmament, there is serious concern about Chinese conduct. Most Americans now hold an unfavorable view of China, and both political parties are taking tough stances on China. If President Trump wins the 2020 elections, the relationship is not expected to improve, and tariffs on Chinese goods would likely increase. If Biden wins, he has said he would build a united front with partners to challenge China's abusive behavior, but there is unlikely to be any rapid change. Existing tariffs are likely to remain. Mostly, Biden is expected to work with allies more to constrain China.

The best that can be hoped for is that both the United States and China try to find solutions to their differences. Thus far, Chinese leadership has responded commensurately with U.S. actions, matching tariffs with tariffs, journalist expulsions with journalist expulsions, consulate closings with consulate closings. Chinese reaction if there is a Biden Administration will depend on the first steps taken by the United States and whether there is willingness to use diplomacy to find a way out of the deep hole the relationship is currently in.

NATURAL GAS TRADE

The status of the bilateral relationship puts a strain on the ability of U.S. companies to capture the opportunity to increase exports of natural gas to China.

China is a major importer of natural gas, and even through COVID, China's LNG consumption grew. China also imports natural gas via pipeline from Russia and other countries. Like India, China is trying to increase the amount of natural gas as a percentage of its total energy mix as part of a diversification strategy. The United States, meanwhile, is exporting a small but significant amount of its natural gas production, and more LNG export terminals have been brought online over the past several years, opening billions of dollars of international trade opportunities. Providing more U.S. LNG supply to China could discourage a deeper China-Russia relationship; indeed, more LNG cargoes have already led China to back down some of the pipeline gas from Russia.

Natural gas could be an opportunity to build bridges between the two economies, and the Phase 1 agreement was encouraging for natural gas.

Natural gas could be an opportunity to build bridges between the two economies, and the Phase 1 agreement was encouraging for natural gas. The Phase 1 agreement was a break in the armor, signaling continued trade in energy. That gave the green light to Chinese companies to continue negotiations on agreements; Chinese companies will not do so without the guidance of the Chinese government. Chinese companies will not even come to the table for discussions if they are being discouraged by the central planning process. Many steps backward have occurred since the Phase 1 signing, however, and the trade barriers have impacted buyers in China, who have concluded that the U.S. supply of natural gas is unreliable. The company-to-company relationships were not the problem, and there was never a question about performance or facility operations. The perception is based at the public policy level, rooted in concerns about trade barriers, so the perception may be curable.

PROSPECTS FOR CLIMATE COOPERATION

The tensions in the U.S.-China relationship have implications for global energy and climate action. If President Trump wins the 2020 elections, nothing will change on the climate front, but if Biden wins, he will want to act on climate. The global climate challenge cannot be effectively addressed without China.

It is unknown if the U.S.-China climate relationship that was created under the Obama Administration can be revived. During the Obama Administration, climate change played a central role in the U.S.-China relationship and was vital to getting the Paris Agreement done. The relationship had plenty of stresses then too (though not as bad as now), but climate change was seen as a potentially positive pillar in it. After the Copenhagen conference in 2009, China seemed to make a calculation that it should bargain hard and protect its core interests but that it should not be seen as obstructionist and ultimately should cut a deal. It is not clear that such a sentiment exists now to anchor negotiations on climate progress.

The climate landscape has changed as well. The goal under the Obama Administration was to negotiate a global agreement, which is difficult but concrete. The issues now are about transformation of the global economy at speed

and scale, which are a bit more amorphous. The sense of what needs to be done has also changed, shifting from a 2°C consensus to more of a 1.5°C consensus. The imperative has intensified.

China appears to be responding to that imperative. Xi Jinping made a commitment at the UN for China to be net-zero before 2060. This is very important, as China usually meets its goals, and it came from the president directly. The near-term implications for Chinese conduct, though, are very unclear, and statements from China and emissions numbers from China are not necessarily pointing in the same direction. China is planning or building dozens of gigawatts of new coal plants domestically, as well as dozens more globally through Belt and Road. A lot of the domestic coal-build decisions are made at the provincial level, not nationally, though when Beijing wants to seriously dictate something, it can. The internal debates in China are real regarding fossil versus zero-carbon, both domestically and globally through Belt and Road, but the coming five-year plan (early in 2021) will resolve much of the debate, likely in the direction of clean energy. China's leaders know how much China emits, and they know it is enough to have disastrous repercussions. If Chinese emissions do not drop sharply until the 2030s, the world will bust through temperature goals and carbon budgets. It will be key to see what the five-year plan goals are and to what extent they are followed or circumvented in provinces.

If Chinese emissions do not drop sharply until the 2030s, the world will bust through temperature goals and carbon budgets.

Encouragement from the United States (and Europe) could help. If Biden is elected, Beijing may welcome that, given his commitments on climate change, though a Biden Administration would need to make clear that climate is a top priority through its personnel, communications, and initial domestic policy steps. There is no naiveté that the problems in the relationship will magically be solved with a new president, but there is recognition of the potential for climate collaboration to be the basis for injecting cooperation into an otherwise contentious relationship between DC and Beijing that is the worst it has been since the Nixon era. The need for some kind of positive element in the relationship is greater now than ever.

The question is whether existing tensions make it too difficult to blend areas of strategic competition with areas of collaboration on global issues such as climate change. If climate is to be a big priority in a Biden Administration, it will have to involve some cooperation with China; it is hard to see progress made on climate globally without the United States and China working together. Cooperation will be hard, though. The forces of nationalism are strong in both countries (regardless of the U.S. election outcomes). President Trump's actions validated Chinese fears about U.S. goals, and China's view is that the United States is on the decline while China is on the rise. The Chinese will see less upside in reaching out and making a climate deal than they did before, and the United States now lacks credibility on the climate front after the Trump Administration. The United States gets more benefit from joining with China than vice versa.

There could also be tensions between the urgency of Americans' concerns about climate change and the urgency of Americans' concerns (especially in Congress) about U.S. national security with regard to China and competition on technologies. When it comes to Mission Innovation or collaboration with China on clean energy, those could be conflicting concerns. Clean energy could be both a cooperative and a competitive space.

A Biden Administration should try to revive the U.S.-China climate relationship, understanding that the relationship and the climate battle are in a different place, but it should not appear to be chasing China. The United States should pursue the bilateral relationship in parallel with multilateral efforts with allies, including the EU and others. A comprehensive China strategy, which has been lacking under the Trump Administration, could have areas of collaboration – such as climate, global pandemics, international terrorism, and international poverty – that could be moved forward with diplomacy, especially if done in collaboration with other like-minded nations.

A Biden Administration would have to approach the international community with a mix of leadership and humility. The United States has been a scofflaw for the past few years; the rest of the world is eager for the United States to come back, but it is also wary. The United States should activate the High Ambition Coalition from Paris to put pressure on all

players, including China. Border carbon adjustments could also be part of bilateral and multilateral discussions. Adaptation, resilience, and green finance could be further areas for collaboration, including work on serious international financial reform with the International Monetary Fund and international development banks so that all finance that goes out is climate-aligned. Progress on those areas can provide a pathway to deal more effectively with thornier technology and trade issues.

GLOBAL TRADE & CLIMATE CHANGE

It is not clear if there are avenues to revive multilateral trade policies that incorporate strong climate solutions again, even if there is a new Administration. For example, it is not clear that the United States would be embraced back into the TPP. There were tough negotiations on it for years, with other countries putting things on the table that were politically tough for them; when the United States dropped out, some of those things dropped out too. The United States may not be satisfied with the slimmed down agreement that remains, and other countries may not be willing to make such commitments again.

Free trade is also out of favor, and the trends toward nationalism and isolationism around the world are worrying. The well on free trade has been poisoned not only by President Trump's rhetoric and actions, but also by changed perceptions among the U.S. population. New trade agreements with strong climate, energy, and labor elements would require persuading the American population and other countries that reduction of trade barriers is a positive thing. Such persuasion will require strong leadership, lots of logic, and vocal support from the business community. It will be necessary to capture the imagination of the American public and explain that rebuilding post-COVID involves building the manufacturing strength of the country in a way that promotes climate objectives – and that more open trading systems, including with China, are part of that. Reduction of trade barriers is positive for both economic growth and the climate fight.

It is also essential to tell the world and the U.S. population not just to open markets and grow GDP, but that they will get a part of that growth. The U.S. economy is changing because of the rapid advances in technology. The U.S. economy now has twice the output with half the workers as a couple of decades ago, and that trend will continue (and will likely accelerate). Those workers need to be trained for the economy of tomorrow. Addressing climate change requires enhancing America's human infrastructure.

U.S. ENERGY POLICY AFTER THE 2020 ELECTIONS

The 2020 U.S. elections are the most important ever in terms of domestic and global energy and climate policy. The issues have never been as prominent, and there have never been such vastly different policy directions at stake.

DIVERGENT CLIMATE POLICY PATHS

If President Trump wins the 2020 election, energy policy will basically be the same, but more so. The federal government will continue to prioritize fossil fuels and downplay climate change. Under the Trump Administration, some states took a lot of actions on energy and climate, which would continue and likely accelerate under a second term, though courts might block some. California's ability to lead under the Clean Air Act would also be eliminated. Some actions in red states would continue – including utilities taking on net-zero goals and states promoting or exploring technologies such as CCS and hydrogen – but Republican elected officials in red states would be unlikely to take much political action prioritizing climate change.

If Biden wins the White House and Democrats take the Senate (and retain control of the House) in the 2020 elections, there will be big pressure for action on climate change. The United States under a Biden Administration will act strongly on climate change regardless of what China, India, or others do.

Some argue that the most important thing politically for the Democrats to do is to focus on job growth and economic recovery (in addition to the pandemic), while others argue for bigger structural reforms. This debate is unresolved within the Democratic Party, but an aggressive climate package as part of a green recovery could unite those factions. Biden has framed climate change as core to economic policy, and that is where the opportunity lies.

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If the Democrats control the White House and both houses of Congress, the first opportunity for action could be budget reconciliation, under which a lot can be done on taxing and spending on existing programs. There will also be pressure to change the rules on filibusters, though such changes are far from certain; if the filibuster is eliminated, more policy options could be explored, such as a clean energy standard.

There appears to be little support for a carbon price among Democrats on the Hill, much less among Republicans; the idea's stock has dropped in Congress over the past few years, though there are still a few members of Congress pursuing it. Among Democratic constituencies, there has been a major shift in climate policy in recent years, with greater prioritization now of standards, investment, and justice. There is a focus on making sure that people in specific communities – especially the ones that have borne the brunt of pollution from industrialization – see benefits from climate action in the near term. On the Republican side, the pro-carbon-tax advocacy community has not demonstrated that it will have the resources or ability to go up against the electoral onslaught that will face the first serious Republican policymaker to put forward a carbon tax. Sector-based standards have a better chance, even among conservatives, if they are structured right. The fact that carbon prices are more supported internationally (e.g., the EU has one, and China has made announcements about carbon markets) is unlikely to spur much action on carbon pricing in the United States, though

it could spur the EU and the United States to seek alignment on carbon border adjustments. Carbon pricing in some form might still have a role to play, however. For instance, carbon pricing can serve as a backstop for other policies and potentially as a source of investment – like California's cap-and-trade system currently does. Linkages between sectoral tradable performance standards could be another approach; the House climate bill, for example, has a clean energy standard and a low-carbon fuel standard, and carbon pricing advocates could explore enabling trading between those two sectoral standards.

Outside of Congress, a Biden Administration would also be expected to pursue its clean energy and climate goals through regulations. The conservative shift on the Supreme Court, however, means that, even with a Biden Administration, there could be big constraints on the ability of agencies to regulate emissions. The Court could eliminate or undermine a lot of the foundations for agency action on climate change, which means existing regulations could go away, and new ones could be harder to adopt in a way that will withstand the Court's scrutiny.

There is a focus on making sure that people in specific communities – especially the ones that have borne the brunt of pollution from industrialization – see benefits from climate action in the near term

State actions would continue under a Biden Administration as well, including on hydrogen and offshore wind.

NATURAL GAS POLICY

Natural gas is perhaps the best example of how the climate debate, the Democratic Party, and Biden have shifted since the Obama Administration. The Obama Administration largely promoted natural gas, but many no longer see it as a bridge fuel. This new status for gas and the enhanced focus on climate change will be reflected in numerous ways, including methane regulations, financial market regulations, environmental justice considerations, and other regulations that could affect gas markets. There has been media attention about Biden's proposed ban on new federal leasing for oil and gas, but even if adopted, that would account for a relatively small percentage of U.S. production, and the industry already has more of a supply glut than it can handle. A more consequential proposal that is getting less attention is eliminating the exemption hydraulic fracturing has under the Safe Drinking Water Act; having to get a Class 2 injection well permit would increase the per-well cost significantly.

The new views on gas could permeate into foreign policy as well; the desire to push LNG exports, for instance, may be lower in a Biden Administration than under Obama. If the United States moves away from increasing its natural gas production and exporting LNG to the globe, others (e.g., Russia) will fill that void. There are massive global implications from a U.S. pivot on domestic energy policy, and people working on climate and energy in the United States need to understand the connections between U.S. oil and gas policy, foreign policy, national security, geopolitics, climate change, and the pace of the zero-carbon transition.

OPPORTUNITIES FOR BIPARTISANSHIP

Some things will likely be the same in Congress regardless of the election outcome. There is increasing bipartisan pressure from voters (especially young voters), investors, major corporations, and others to take climate change more seriously. This has already manifested in a thaw in Republican positioning on climate change in this Congress. There may be continuing rethinking from Republicans on climate change, looking ahead to the 2022 congressional elections and the 2024 presidential race. There is therefore potential for bipartisan action.

There will be increasing willingness to pursue bipartisan climate action on a few topics, including resilience and adaptation, innovation policy (from R&D to perhaps permanent incentives to commercialize technologies), natural climate solutions, and some version of regulatory reform (e.g., regarding National Environmental Policy Act processes) to get to decisions on projects faster.

Republican leadership in the Senate and the House, including on key committees, will remain with people who have significant fossil fuel interests. The Senate Energy and Natural Resources Committee, for instance, will be headed up by a Republican from Wyoming and a Democrat from West Virginia. That means table stakes for any potential bipartisan solutions on climate have to include some role for natural gas as a bridge fuel, efforts to strand existing fossil fuel infrastructure as little as possible, and strong support for CCS (e.g., a permanent 45Q tax credit). There will be increasing willingness to pursue bipartisan climate action on a few topics, including resilience and adaptation, innovation policy (from R&D to perhaps permanent incentives to commercialize technologies), natural climate solutions, and some version of regulatory reform (e.g., regarding National Environmental Policy Act processes) to get to decisions on projects faster. There are also some Republicans actively looking at clean energy stimulus options. These are not equivalent to comprehensive climate policy, and they fail to directly confront emissions from the main emitting sectors such as power and transportation, but they are still significant avenues of potential bipartisan progress. However, if Democrats take control of the Senate and remove the filibuster by the time efforts turn to climate legislation, Republicans would likely move back to a defensive posture.

There are also all kinds of opportunities in blue, purple, and red states to keep the climate and clean energy conversation moving forward regardless of the federal election outcomes. Purple state legislatures, for instance, are talking about clean energy standards in bipartisan ways.

APPENDICES: PARTICIPANTS LIST

Lisa Alexander, Senior Vice President, Corporate Affairs & Chief Sustainability Officer, Sempra Energy
Fatema Alnuaimi, Chief Executive Officer, ADNOC LNG
Brian Anderson, Director, National Energy Technology Laboratory
Paul Bauman, Senior Advisor, Rodel Foundation
Morgan Bazilian, Professor, Colorado School of Mines
Leila Benali, Chief Economist, Arab Petroleum Investments Corporation (APICORP)
Suman Bery, Board Member, Shakti Sustainable Energy Foundation
Leslie Biddle, Partner, Serengeti Asset Management
Fatih Birol, Executive Director, International Energy Agency
Nisha Biswal, President, U.S.-India Business Council
Erin Blanton, Senior Research Scholar, Center on Global Energy Policy, Columbia University SIPA
Paul Bodnar, Managing Director, Rocky Mountain Institute
Jason Bordoff, Founding Director, Center on Global Energy Policy, Columbia University SIPA (Co-Chair)
William Budinger, Founder, Former Chairman & CEO, Rodel, Inc.
Jean-Christophe Caffet, Chief Economist, Total
Mauricio Cárdenas, Senior Research Scholar, Center on Global Energy Policy, Columbia University SIPA
Christi Craddick, Chairman, Railroad Commission of Texas
Trisha Curtis, President & Chief Executive Officer, PetroNerds
Ankit Desai, Principal, AND Ventures
Renwick DeVille, Senior Advisor, Golden Pass LNG
Lauren Diekman, Senior Director for Energy, Environment, Infrastructure, U.S.-India Business Council
Paul Doucette, General Manager, Policy & Stakeholder Engagement, Baker Hughes
Erica Downs, Senior Research Scholar, Center on Global Energy Policy, Columbia University SIPA
Maria Jelescu Dreyfus, Founder & Chief Executive Officer, Ardinall Investment Management
Tom Earl, Chief Commercial Officer, Venture Global LNG
Jonathan Elkind, Senior Research Scholar, Center on Global Energy Policy, Columbia University SIPA
Bassam Fattouh, Director, Oxford Institute for Energy, University of London
Paula Gant, Senior Vice President, Strategy & Innovation, GTI
Meg Gentle, President & Chief Executive Officer, Tellurian Inc.
Greg Gershuny, Executive Director, Energy & Environment Program, The Aspen Institute
Jamshyd Godrej, Chairman & Managing Director, Godrej & Boyce Mfg. Co. Ltd.
Jonathan Goldberg, Chief Executive Officer, Carbon Direct
Christy Goldfuss, Senior Vice President, Energy & Environment Policy, Center for American Progress

Kate Gordon, Director, Governor's Office of Planning & Research, State of California

Dave Grossman, Principal, Green Light Consulting (Rapporteur)

Matt Harris, Founding Partner, Global Infrastructure Partners

Carla Hills, Chief Executive Officer & Chairman, Hills & Company International Consultants

Vicki Hollub, President & Chief Executive Officer, Occidental Petroleum Corporation (Co-Chair)

Sally Jewell, Global Board Member, The Nature Conservancy

Peter Kagan, Managing Director, Warburg Pincus

Poppy Kalesi, Director, Global Energy, Environmental Defense Fund

Adam Karson, Senior Economist, Global Macroeconomics, Chevron

Richard Kauffman, Senior Research Scholar, Center on Global Energy Policy, Columbia University SIPA

Castlen Kennedy, Vice President, Corporate Communications & Public Affairs, Apache Corporation

Michal Kurtyka, Minister of Climate, Poland

Cheryl LaFleur, Distinguished Visiting Fellow, Center for Global Energy Policy at Columbia University SIPA

Mary Landrieu, Senior Policy Advisor, Van Ness Feldman

Michael Leahy, Policy Manager, Energy Transitions, Chevron

Jan Mares, Senior Advisor, Resources for the Future

Ajay Mathur, Director General, The Energy & Resources Institute

Denis McDonough, Senior Advisor, Markle Foundation

Robert McNally, President, Rapidan Energy Group

Robin Mills, Non-Resident Fellow, Center on Global Energy Policy, Columbia University SIPA

Vijay Modi, Professor of Mechanical Engineering, Columbia University

Arjun Murti, Member of Advisory Board, Center on Global Energy Policy, Columbia University SIPA

Amy Myers Jaffe, Managing Director, Climate Lab, Fletcher School, Tufts University

Sunita Narain, Director General, Centre for Science & Environment

Richard Newell, President & Chief Executive Officer, Resources for the Future

Pierre Noël, Global Research Scholar, Center on Global Energy Policy, Columbia University SIPA

Meghan O'Sullivan, Professor; Director of the Geopolitics of Energy Project, Harvard University's Kennedy School of Government

Paddy Padmanathan, President & Chief Executive Officer, ACWA Power

Daniel Poneman, President & Chief Executive Officer, Centrus Energy Corp.

Rich Powell, Executive Director, ClearPath

Alice Reynolds, Senior Advisor for Energy, Office of Governor Gavin Newsom

Seth Roberts, Global Strategy & Market Analysis, Saudi Aramco

Kevin Rudd, Former Prime Minister; President, Australia; Asia Society Policy Institute

Christof Ruehl, Senior Research Scholar, Center on Global Energy Policy, Columbia University SIPA

Keisuke Sadamori, Director, Energy Markets & Security, International Energy Agency

David Sandalow, Inaugural Fellow, Center on Global Energy Policy, Columbia University SIPA

Sarah Sandberg, Senior Director, Investor Relations & Corporate Affairs, DCP Midstream

Jérôme Schmitt, Chairman, Oil & Gas Climate Initiative Executive Committee

Tisha Schuller, Founding Principal, Adamantine Energy

Adam Sieminski, President, KAPSARC

Monika Simões, Founder & Managing Director, Energy Dialogues LLC

Sumant Sinha, Chairman & Managing Director, ReNew Power Pvt Ltd

Varun Sivaram, Senior Research Scholar, Center on Global Energy Policy, Columbia University SIPA

Christopher Smith, Senior Vice President, Policy, Government & Public Affairs, Cheniere Energy

Todd Stern, Non-resident Senior Fellow, Brookings Institution

Robert Tudor, Chairman, Tudor, Pickering, Holt & Co.

Clint Vince, Chair, US Energy Practice & Co-Chair, Global Energy Sector, Dentons US LLP

Kassia Yanosek, Partner, McKinsey & Company

THE ASPEN INSTITUTE

Timothy Mason, Assistant Director for Energy & Climate Change Mitigation Policy, Energy & Environment Program, The Aspen Institute

Kate Harrison, Program Associate, Energy & Environment Program, The Aspen Institute

APPENDICES: AGENDA

MONDAY, OCTOBER 12

10:00 – 10:15 AM ET **Welcome Opening Remarks**
Greg Gershuny, Aspen Institute Energy and Environment Program

Opening Remarks from Co-Chairs
Jason Bordoff, Center on Global Energy Policy
Vicki Hollub, Occidental Petroleum

10:15 – 11:45 AM ET **SESSION ONE: Global Energy Markets in a Time of Coronavirus**

The year 2020 will be remembered forever as the year when Covid-19 (coronavirus) dominated the world stage, amplifying the effects of the oil price war initiated by Saudi Arabia and Russia. How will markets respond in 2021 as supply and demand re-balance after 2020's crash in global oil prices, as well as uncertainty about economic recovery? How profound will be the financial reckoning in the US shale patch? What will 2021 bring for OPEC? Will the OPEC+ collaboration persist?

Moderator: Christof Ruehl, Center on Global Energy Policy

Discussants:
Fatih Birol, International Energy Agency
Amy Myers Jaffe, Tufts University
Adam Sieminski, KAPSARC

12:00 – 1:30 PM ET **SESSION TWO: Challenging Times for the Gulf Arab States**

Oil and gas producers in the Gulf and elsewhere have experienced volatility in 2020 as a result of the drop in oil prices in the first quarter of the year and then demand reduction due to the pandemic. The resulting revenue losses created short-term challenges for some of the Gulf Arab States, as well as complications for macro-economic restructuring. At the same time, national companies and foreign firms continue investing in new energy ventures and technologies – independent power generators, renewables projects, nuclear power, carbon capture, and hydrogen production. As the Gulf states seek to manage oil price volatility, what new energy options are emerging? What impact will oil price war have on macro-economic trends and geopolitical relations?

Moderator: Pierre Noel, Center on Global Energy Policy

Discussants:
Leila Benali, APICORP
Bassam Fattouh, Oxford Institute for Energy Studies
Paddy Padmanathan, ACWA Power
Daniel Poneman, Centrus Energy Corporation

1:30 – 2:15 PM ET **Networking Reception**

TUESDAY, OCTOBER 13

10:00 – 11:15 AM ET **SESSION THREE: India – Still Open for Business?**

India has consistently been one of the world's fastest-growing economies. It has made dramatic strides forward in reducing energy poverty, increasing energy supply, and growing clean energy capacity in particular, even as its coal-fired power production also grew. In the past year, however, auctions for new renewables capacity have been undersubscribed; chronic indebtedness in utility distribution companies (discoms) has ballooned, and the government of Prime Minister Narendra Modi has been beset by both the pandemic and socio-political controversy and protests. Has India lost its momentum? Where is India's energy development heading? Is India still open for business?

Moderator: Varun Sivaram, Center on Global Energy Policy

Discussants:
Nisha Biswal, USIBC
Jamshyd Godrej, Godrej & Boyce Mfg. Co. Ltd
Ajay Mathur, TERI
Sumant Sinha, ReNew Power

11:30 – 12:45 PM ET **SESSION FOUR: US-China energy relations**

China now plays a critical role on the international energy stage – dominating consumption of coal, leading the world in oil imports and greenhouse gas emissions, and exporting vast quantities of energy-producing and consuming technology. China is a force to be reckoned with, and in regard to climate solutions it is a force without whose participation success is impossible. Meanwhile, policy and political tensions between China and the United States have emerged as a major dynamic in the world of geopolitics. China hawks in the United States call for a decoupling of the U.S. and Chinese economies. What lies ahead for energy relations between the United States and China? Can the two powers find areas of cooperation against a backdrop of extensive accumulated frictions on security, human rights, trade, intellectual property, and other fronts?

Moderator: David Sandalow, Center on Global Energy Policy

Discussants:
Kevin Rudd, Former Prime Minister of Australia & Asia Society Policy Inst (by recorded video)
Meg Gentle, Tellurian
Carla Hills, former US Trade Representative
Todd Stern, former Obama Special Envoy for Climate Change

1:00 – 2:30 PM ET **SESSION FIVE: The Future for Gas – IEA's Global Gas Security Review 2020**

(Note that this is a PUBLIC EVENT and any comments or questions made are on the record for this session only)

Natural gas has been seen by many as playing a strategic role in the clean energy transition – a means to reduce both local air pollution and coal-associated carbon emissions, a means of quick-ramping dispatchable power, a plentiful, economically-attractive fuel. Concerns about methane emissions and the overall carbon budget have called into question the future for gas. Will demand for gas recover and grow around the globe or only in certain emerging economies? Will natural gas be supplanted by renewable gases from biomethane or hydrogen (blue or green)? The International Energy Agency will present key findings as it releases its gas market report for 2020.

Presenter: Keisuke Sadamori, International Energy Agency

Moderator: Erin Blanton, Center on Global Energy Policy

Discussants:
Lisa Alexander, Sempra Energy
Poppy Kalesi, Environmental Defense Fund
Jerome Schmitt, Oil and Gas Climate Initiative

WEDNESDAY, OCTOBER 14

10:00 – 11:15 AM ET **SESSION SIX: Imagining a Post-Coal Power Sector**

Coal is experiencing contradictory fates in different parts of the world. In most OECD countries, coal is being phased out, whether as a result of policy or market forces or a combination of the two. Many public and private investors are electing not to finance coal projects. In the developing world, however, coal remains central to power generation, despite its deleterious air quality and climate implications. Significant state-sponsorship persists, largely through China's Belt and Road initiative. Millions of workers depend on coal mining, transportation, or power generating jobs. Can we imagine a global power sector after coal? How can we get there, and how soon? How will local and regional employment impacts be managed during the transition (consistent with "just transition" policy objectives)?

Moderator: Jonathan Elkind, Center on Global Energy Policy

Discussants:
Leslie Biddle, President, Serengeti Asset Management
Paul Bodnar, Rocky Mountain Institute
Michal Kurtyka, Minister of Climate of Poland
Sunita Narain, Centre for Science & Environment, New Delhi

11:30 – 1:00 PM ET **SESSION SEVEN: US Energy Policy after 2020 Elections**

The November 2020 elections have the potential for significant impact on U.S. policy for energy and climate, depending on results in the presidential, Congressional, and gubernatorial races. Will the United States continue its current emphasis of supply-side oriented federal policies that stress "energy dominance and de-emphasize the energy transition? Or will November usher in a renewed attention to climate? Will the U.S. Congress re-discover the ability to pass bipartisan legislation on important energy and climate issues? Will states and cities continue to be hotbeds of policy experimentation, and if so with which priorities?

Moderator: Jason Bordoff, Center on Global Energy Policy

Presenter: Denis McDonough, former White House Chief of Staff to US President Barack Obama

Discussants:
Christy Goldfuss, Center for American Progress
Bob McNally, Rapidan Energy
Rich Powell, ClearPath

1:00 – 1:30 pm ET **WRAP UP**

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