

Morgan Lewis

CLIMATE CHANGE
2021 YEAR IN REVIEW



The global impact of our planet's changing climate garnered significant attention in 2021. The United States rejoined the Paris Agreement at the beginning of the year, and in November, during the United Nations Climate Change Conference (COP26), world leaders made aggressive national carbon emission reduction commitments. The industry responded with plans to meet national goals through increased investment in renewable energy resources (such as offshore wind and solar), new energy technologies that facilitate the commercialization of carbon capture and sequestration, and green hydrogen projects, as well as projects designed to electrify the transportation sector.

In the United States, President Biden made addressing climate change a key policy priority on Day One of the new administration, focusing not only on carbon emission reductions but also on environmental justice in the development of new clean-energy projects. The administration has set about implementing its agenda through an "all of government" approach that enlists the support of administrative agencies that are releasing their own plans to address climate change.

Throughout 2021, Morgan Lewis lawyers studied and reported on global climate policy developments. Attached is a summary of thought-leadership pieces authored by our team related to climate-change actions.

With the financial commitments to a clean-energy economy in the Infrastructure Bill, the United States stands ready to make significant advancements to combat climate change in 2022. The Morgan Lewis team will continue to follow these developments and report on global climate policy and industry trends in the coming year.

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RACE AROUND THE WORLD TO ACHIEVE NET ZERO ENERGY CONSUMPTION

Since the 2015 Paris Agreement, countries around the globe have been analyzing their energy and development strategies and planning to meet their commitments. While some countries have made progress by, among other things, implementing new technology and examining different energy sources in an effort to achieve their commitments, other countries have been slower to implement any change. On the heels of the COP26, representatives from nearly 200 countries pledged to work together to combat the effects of climate change by phasing out the use of coal and subsidiaries for fossil fuels and accelerating targets to reach net zero carbon emissions.

EUROPEAN UNION

Under the EU Green New Deal, Europe announced its goal of becoming the first climate-neutral continent by 2050 through deep decarbonization of all sectors of the economy and greater reductions in greenhouse gas (GHG) emission by 2030 while promoting job growth and green technology.

In July 2020, the European Commission (EC) adopted two key strategies to help support the goal of a fully decarbonized, more efficient, and interconnected energy system: the European Union's Energy System Integration Strategy and the Hydrogen Strategy for a Climate Neutral Europe Strategy. Each strategy is set out as an EC Communication, which is meant to serve as an EU-wide roadmap. The Energy System Integration Strategy provides a holistic approach to the framework for green energy transition, with coordinated planning and operation of Europe's energy system as a whole, across multiple energy carriers, infrastructures, and consumption sectors. Within this integrated system, the use of hydrogen could be one of the key ways to support the decarbonization of many industries through investment, regulation, and new research and innovation. Although nonbinding, the EC uses its Communications as instruments to identify key issues in policy areas and to set out the direction of future policies.

It's hoped that these strategies will help provide a unified framework of the various regulations, directives, domestic initiatives, and legal and regulatory regimes that currently make up much of Europe's renewable energy policies. There has been no single unified approach to date, with each sector siloed in approaches between member states. So, it will remain to be seen how the execution of the European Union's very ambitious goals will play out. In the near future, we can expect that energy policies and regulations will continue to substantially evolve, and developers, funders, and investors in renewable energy, in particular, will need to keep pace with this shifting terrain.

JAPAN

Japan is currently dependent on imported fossil fuels, largely from the Middle East, with a single-digit energy self-sufficiency rate. It declined to sign the COP26 coal pledge, as it searches for a cleaner way to burn coal. So, the goal for the country's energy plan is as much to increase renewable energy sources as it is to increase energy production in the country in general.

Japan has long focused on hydrogen as a potential energy source. Composed of representatives from industry, academia, and government, Japan formed a Hydrogen and Fuel Cells Strategy Council in 2013 that helped create the country's basic hydrogen strategy, which includes 10 elements largely looking at innovation, expansion, and education. As part of its Basic Hydrogen Strategy, Japan has supported international collaborations at both the governmental and private-sector levels to promote hydrogen energy; it hosted the first global hydrogen ministerial meeting in October 2018. The Japanese government is focused on developing an international hydrogen supply chain, which is still importing energy but is largely working with other countries outside the Middle East. Japan is also working on the domestic production of hydrogen, drawing on recent success at the Fukushima Hydrogen Energy Research Field, which is the largest hydrogen-producing facility in the world using renewable energy.

Many of the country's major companies are invested in the growth of renewable energy, and specifically hydrogen, to meet their own customer environmental, social, and governance (ESG) goals. But they are finding that lack of detail in the government's green growth initiatives and lack of access to renewable energy sources are making it difficult to meet those goals. Private-sector ESG concerns and carbon-neutral goals of other developed countries will likely result

in pressure on the Japanese government to hasten change. A lack of current concrete plans for a transition to a hydrogen society may make international investment opportunities in Japan a moving target, but there are opportunities for nimble investors.

CHINA

China is the world's largest energy producer and consumer. The country relies heavily on coal and imports of gas and oil. Since 2011, the country has burned more coal than all other countries combined. China did not attend the COP26 conference but did say it would reduce its use of coal for electricity by 1.8% over the next five years. The country's transition plan to renewable energy relies on comprehensive reforms extending from energy supply to energy consumption.

On the supply side, China has been vigorously promoting the clean and efficient utilization of fossil energy and increasing the proportion of nonfossil energy. On the consumption side, Chinese authorities claim that they are determined to prioritize energy preservation and tighten control of total energy consumption. China is aiming to achieve carbon neutrality before 2060 by upgrading energy technologies through innovation, maintaining energy security, and opening the energy sector further to the world.

To help its economy recover from COVID-19, China is approving a number of economic stimulus plans that are attracting the attention of international investors. But these plans to recover from economic losses borne from the pandemic may be off the green infrastructure track, e.g., the continued use of coal power plants. To help combat that, the Chinese government is lifting some restrictions on foreign investment into some sectors. On the hydrogen front, China is encouraging foreign companies to invest in sectors along the full hydrogen value chain: from production, storage, transport, and liquification of hydrogen to the manufacturing of hydrogen production equipment, to hydrogen batteries, and to the operation of hydrogen filling stations. While there has been a steady expansion of international oil companies and multinational companies, there is still heavy regulation and scrutiny over foreign investment into China.

MIDDLE EAST AND RUSSIA

While Russia and many countries of the Middle East, as well as other oil-producing countries, have had a hot-and-cold relationship with the global climate-change discussions, the events of 2020 may have provided additional stimuli for them to begin, in earnest, the active drive toward the road to net zero. In 2020 we all witnessed the historical drop in global oil demand as a result of the COVID-19 pandemic, on the back of what was already a weakened market.

And, of course, in addition to the drop in demand, there was the corresponding drop in revenue for the oil producers. This loss in revenue has been especially felt in the exporter countries, in particular the countries of the Middle East, which have a significant portion of their state budgets dependent on oil revenues for their fiscal break-even. The threat of a long-term low-demand period, or even a plateau of demand, seems to have gotten their attention, with export countries recognizing that, if not carefully managed, this low-demand trend could create destabilization in their overall economies. These countries appear to be identifying the need to replace or supplement the reduced oil revenues, as well as the geopolitical currency that oil has historically given countries such as Saudi Arabia and Russia.

Over the last year and a half, there has been a heightened movement across this region with the further development of programs and the more focused implementation of various "national visions," "strategies," and "roadmaps." We are seeing a noticeable shift in the players involved in such plans, with greater involvement and even leadership coming from senior members of government, influential ministries, and leading companies (both national and private sector) that are moving from the position that these plans are only relevant to environmental authorities and organizations.

The various visions, strategies, and roadmaps being developed indicate that there are multiple and varying paths to a common goal. In this region, a few of the focus areas include the following:

- Energy efficiency: Traditional energy surplus has allowed many of these countries to disregard the low-hanging fruit of efficiency and consider developing ways to reduce emissions to remain competitive and seek the best possible returns.

- Gas and gasification: Gas will play a large role, capitalizing on rising demand as the world transitions from oil and coal to cleaner energy, as well as a focus on liquified natural gas (LNG) expansion with green or carbon-neutral LNG opportunities being explored to increase the value of the cargo.
- Carbon capture use and storage (CCUS): CCUS technology is being explored across the region to reduce the carbon footprint of the product, as well as for its use as a tool for enhanced oil recovery for the region's mature formations.
- Offsets and carbon credits: Again, the implementation and use of offsets and credits are currently focused heavily on making the product carbon neutral to increase value and demand.
- Renewables: The role of renewables in these regions will greatly depend on location. Russia already has a large geothermal and hydro component to its power supply, but it has not had substantial investment in other renewable-sector projects. However, we are seeing continued interest in wind projects and a smattering of solar projects, with smaller localized, off-grid, or within-the-fence projects traditionally having more success in the short term. The Middle East is better placed for success in renewables due to its location and potential for solar energy; the region is putting more resources toward the large-scale development of renewable projects.
- Hydrogen: Maybe the million-dollar question for this region is whether the commercialization of mass production and transportation of hydrogen will create a demand for a cross-border market growth, particularly with respect to the prospects of blue hydrogen, in addition to green hydrogen (for the Middle East) and yellow hydrogen (for Russia).

LATIN AMERICA

Across Latin America, countries are in very different stages of their renewable energy efforts and overall energy needs, creating divergent paths to achieving net zero energy consumption. Virtually all Latin American countries have signed the Paris Agreement, so there is an overall commitment to combating climate change.

In Brazil, the power matrix is already more than 80% renewable, with a high reliance on hydropower, but recurring droughts have caused significant power outages, pushing forward considerable developments in wind and solar power plants. Brazil also had a very significant ethanol production in the 1980s during which many cars ran exclusively on ethanol. While that has lost some traction today, there are basically no cars in Brazil that run exclusively on gasoline, given the high ethanol content (25% to 27%) in gasoline sold at Brazilian pumps. In addition, diesel sold in Brazil must have a minimum biodiesel content of 12%.

Chile is generally ahead of most other Latin American countries in the path to net zero goals, with significant developments in the adoption of renewables (hydroelectric, solar photovoltaic, wind, biomass, and geothermal) currently accounting for around 50% of its energy matrix. Separately, in 2019, the Chilean government released a decarbonization plan with a heavy reliance on solar power that set the goal of a complete phaseout of coal by 2040.

In Mexico, natural gas is already replacing oil and coal, with wind power gaining favor over hydropower. In an effort to boost energy production in Mexico, an energy-reform initiative led by Mexico's prior federal administration aimed to attract foreign investment in energy. Despite the success of the reform, changes in policy carried out by the current Mexican administration have adversely affected private investment. And in both Central America and the Caribbean, where many countries are heavily dependent on oil and diesel—in certain cases relying on those resources for more than 80% of their power—governments are fostering cleaner alternatives including LNG imports and the development of renewable resources such as solar, wind, and geothermal.

AFRICA

Africa is composed of 54 countries, so it's hard to paint its energy picture with broad strokes. But there are well-established opportunities for renewable energy sources in the northern and southern ends of the continent. Both Morocco and South Africa have a proven track record of successful renewable energy development and a regulatory framework. For example, there is a Maghreb–Europe gas pipeline that links a field in Algeria through Morocco to Spain, and Morocco and Germany have signed an agreement to produce green hydrogen in Morocco.

Other regions are in earlier stages of energy development and face challenges unique to their locations. In Sub-Saharan Africa, geography is a large determinant in the success of energy programs. Countries that are farther away from key demand centers lack the infrastructure to transport energy. There are also large areas for improvement for

a regulatory framework and incentives that work to stimulate development. The Africa-Europe Green Energy Initiative seeks to take joint action to increase energy efficiency and the adoption of renewable energy sources. The initiative has set aside 30 billion euros for investment in Sub-Saharan Africa.

Since much of Africa has limited GHG emissions, there isn't as compelling an environmental argument for hydrocarbon substitution. And many countries are hydrocarbon producers, so there is some pressure to aim for coexistence rather than replacement in the short-to-medium term.

UNITED STATES

US President Joe Biden made good on his campaign promise to focus on climate change, taking significant steps since his first day in office to advance the energy and climate initiatives of his administration. Some of those key actions included the notice of the United States' intention to rejoin the Paris Agreement, cancellation of the federal permit for the Keystone XL Pipeline Project, and directives by President Biden to certain federal agencies to take a whole-of-government approach to national policy on climate-related issues. These initial executive orders indicate that climate consideration is an essential element of US foreign policy and national security.

As part of the COP26, the United States was among more than 20 countries that agreed to stop financing most new oil and gas projects, and Costa Rica and Denmark officially launched the Beyond Oil and Gas Alliance, which aims to transition away from oil and gas. The Biden-Harris administration had already paused issuing new oil and natural gas leases on public lands or in offshore waters until a comprehensive review and reconsideration of federal oil and gas permitting and leasing practices could be completed. This review will include consideration of potential climate and other effects associated with oil and gas activities on public lands or in offshore waters, and whether royalties associated with coal, oil, and gas resources extracted from public lands and offshore waters should be adjusted to account for corresponding climate costs. This action may not have an immediate impact on oil and gas companies, as drilling on public land can and will continue with the moratorium on new leasing. However, it may have the longer-term effect of shifting oil and gas production overseas.

The administration has also demonstrated a commitment to innovation and scientific development by launching a climate-innovation working group, with a new \$100 million funding opportunity from the US Department of Energy to spur the creation of new energy technologies. The working group is expected to examine whether the much-hyped possibility of a hydrogen solution will be viable for the long-term success of US net zero carbon energy goals.

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BIDEN-HARRIS ADMINISTRATION'S "ALL OF GOVERNMENT" APPROACH TO ADDRESSING CLIMATE CHANGE AND ENVIRONMENTAL JUSTICE

The Biden-Harris administration has set its sights on an ambitious environmental policy agenda, focusing on climate change and environmental justice as key initiatives, and intends to implement its agenda through an "all of government" approach. The all-of-government strategy, first deployed in the United Kingdom in the late 1990s, employs a coordinated, multidepartment, multiagency approach to address particularly complex problems.

The administration's Executive Order on Tackling the Climate Crisis at Home and Abroad established three working groups at the core of the all-of-government strategy. They bring together cabinet members and people in other key positions across numerous federal agencies and departments to address climate change, environmental justice, and related economic revitalization issues.

- **National Climate Task Force:** The task force will lead the all-of-government approach and implement federal actions aimed at—among other things—reducing climate pollution, delivering environmental justice, protecting public health, and stimulating job growth. The executive order permits the members of the task force to prioritize action on climate change in their policymaking, budget processes, and procurement efforts and their engagement with state, local, tribal, and territorial governments.
- **Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization:** The working group is charged with coordinating the identification and delivery of federal resources to revitalize communities whose economies are focused on coal, oil, gas, and power plants. Coordination with state, local, and tribal officials; unions; environmental justice organizations; community groups; and other stakeholders will enable the group to assess opportunities to protect the interests of coal and power plant workers.
- **White House Environmental Justice Interagency Council:** The executive order provides for a variety of specific actions to be taken, including adding new agency offices, screening tools, and directives to strengthen and coordinate enforcement. The council has been established to develop strategies to address current and historic environmental injustice and identify clear performance metrics to ensure accountability.

ALL-OF-GOVERNMENT APPROACH TO CLIMATE CHANGE

The EPA's Central Role

The US Environmental Protection Agency (EPA) will maintain a central role on climate-change-related efforts, beginning with "clearing the deck" of Trump-era policies that conflict with the Biden-Harris administration's goals. The EPA has quickly reinstated the agency's climate-change webpage and reconfigured the Clean Air Scientific Advisory Committee. The EPA also received an early assist from the US Court of Appeals for the DC Circuit, which struck down the EPA's Affordable Clean Energy rule under the Trump administration. At the EPA's request, the DC Circuit withheld a portion of its order that would have reinstated the Clean Power Plan, leaving the EPA with a blank slate upon which to craft its own policy for regulating GHG emissions from power plants. Also helpful to the EPA was the DC Circuit's separate vacatur of another rule that made it more difficult to regulate additional source categories under Section 111 of the Clean Air Act.

EPA is expected to implement a number of additional measures to combat climate change. It has already taken several such steps, including proposing new standards for methane emissions from oil and gas operations and implementing a phasedown of production and use of hydrofluorocarbons in the US. It is also likely that EPA could move to further regulate greenhouse gas emissions from power plants, particularly now that plans for Congress to pass a clean electricity standard appear to have been abandoned. Such a program of stationary source regulation could take a form similar to the Clean Power Plan, which regulated stationary sources under Section 111 of the Clean Air Act, or EPA could seek to use different authorities under the Act.

Enlisting the Rest of the Executive Branch

President Biden's executive orders make clear that the EPA will not be acting alone, as the orders direct a broad range of agencies to take actions to address climate change:

- Department of the Interior (DOI): DOI will have a very significant role in implementing the administration's climate change agenda because it has authority over energy project leasing on federal lands. President Biden's executive order instructed DOI to pause new oil and gas leases pending further review while facilitating development of renewable energy sources. DOI implemented that pause, but it has been enjoined by a decision of the district court in *Louisiana v. Biden*, which is currently being appealed to the Fifth Circuit.
- Department of Agriculture: The department's ability to provide financial assistance for GHG-reducing practices enables it to play a significant role in the administration's climate-change strategy. It could tweak existing programs such as the Environmental Quality Incentives Program or Conservation Reserve Program to emphasize climate goals, or even implement new climate-change-specific policies.
- Department of Energy: The president's executive order and proposed budget demonstrate a clear emphasis on developing clean energy technologies, which could include anything from wind and solar to biofuels, battery storage, carbon sequestration, or even direct removal of carbon from the atmosphere.
- Department of Defense (DOD): As a major energy user, the DOD can make a significant impact on climate change through its procurement process by shifting toward biofuels, electric vehicles, or other low-carbon energy sources wherever possible. The agency will also have a role in developing climate-resilience policy due to its need to adapt to a changed climate and weather events around the world.

ALL-OF-GOVERNMENT APPROACH TO ENVIRONMENTAL JUSTICE

The Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis outlined several additional key provisions related to environmental justice and the implementation of the all-of-government approach. The order directed all executive departments and agencies to review and address actions taken during the last four years that conflict with the Biden-Harris administration's environmental justice goals. In carrying out this review, heads of agencies are directed to seek input from the public and stakeholders, including environmental justice organizations.

The Interagency Working Group on the Social Cost of Greenhouse Gases was established to provide recommendations on the current methodologies for calculating the social costs of carbon, nitrous oxide, and methane to ensure that the methodologies take account of "climate risk, environmental justice, and intergenerational equity." The chair of the Council of Economic Advisers, director of Office of Management and Budget, and director of the Office of Science and Technology Policy will co-chair the group, which will be composed of officers representing 11 agencies and departments.

Section 222 of the Executive Order on Tackling the Climate Crisis at Home and Abroad outlined specific directives for the EPA and Department of Justice (DOJ).

- EPA: The order directs the EPA to "strengthen enforcement of environmental violations with disproportionate impacts on underserved communities." The agency is also charged with creating a notification program providing real-time data to the public on environmental pollution in frontline and fence-line communities that experience the most significant exposure to pollution and environmental contaminants.
- DOJ: The DOJ is tasked with ensuring that there is "comprehensive attention" given to environmental justice throughout the department. The administration has suggested that the department create an Office of Environmental Justice that would coordinate the DOJ's environmental justice activities nationwide.

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US OFFSHORE WIND IS UNDER SAIL, BUT CHALLENGES REMAIN

The electric system across the United States is under stress from environmental and policy challenges, but a historically untapped resource is primed to make significant inroads over the coming years. For the last decade, electric generation from wind production has been growing all over the continental United States. According to the US Energy Information Administration, the total amount of electricity produced by wind generation domestically has increased from 6 billion kWh in 2000 to 338 billion kWh in 2020. As of last year, wind generation was more than 8% of the total utility-scale generation operating in the United States.

Yet, despite that growth and the corresponding reduction in carbon emissions, one source of wind power—offshore wind production (the generation of electricity from wind turbines stationed in the ocean)—is almost entirely missing. Even with its thousands of miles of coastline, the United States only has about 30 MW of offshore wind production from a single operating utility-scale wind farm. This pales in comparison to other parts of the world, particularly Europe, which has more than 25 GW of grid-connected offshore wind capacity from more than 100 offshore wind farms.

But, as the Biden administration, state governments, and utilities prioritize addressing climate change by further reducing carbon emissions, the United States has looked to the European example; if current plans hold, the United States may soon rival Europe in its use of offshore wind.

Through a mixture of legislation and executive actions, several Atlantic states plus Oregon have set ambitious targets for offshore wind totaling 41.5 GW. And many of these states have at least one offshore wind project with a power-purchase agreement in place or that has been approved to receive offshore wind renewable energy credits—called ORECs—under state renewable programs.

The federal government is also moving forward at an unprecedented pace with the necessary environmental reviews for several projects on the East Coast, with a goal of starting the reviews for 10 projects this year and the holding of auctions for numerous lease areas, including up to eight lease areas in the New York Bight. And, while most of the development interest has been concentrated between Massachusetts and Virginia, the US Bureau of Ocean Energy Management has also recently proposed an auction for a wind-lease area off North Carolina.

There is also significant interest in developing offshore wind projects in the Great Lakes region and the West Coast. In the Great Lakes region, the 20.7 MW Icebreaker Wind project near Cleveland continues to move forward with plans to begin construction next year. The hope is that this project will be the first of many in the region.

On the Pacific Coast, the Bureau of Ocean Energy Management (BOEM) designated five "call areas" for potential development—three off the California Coast and two off the coast of Oahu. Development of these Pacific sites, and many sites in the Great Lakes Region, will require floating turbines because of the water depths in those areas.

Adding to the optimism about offshore wind is the recent final approval of the Vineyard Wind project off Massachusetts. This project will consist of 62 13-MW turbines with a generating capacity of 800 MW. And the developers of the project—Avangrid and Copenhagen Infrastructure Partners—secured financing from nine banks totaling \$2.3 billion to construct the project. With the final approval and financing in place, construction of an onshore substation is ready to begin, with construction of the offshore facilities to follow.

Even more recently, in November 2021, BOEM approved the 12-turbine 130 MW South Fork wind project off the coast off the eastern end of Long Island that is now expected to begin construction in early 2022 and be operating by late 2023.

Several states are also positioning themselves to become hubs for offshore wind development. States are redeveloping port facilities to accommodate the large components of offshore turbines, and some are planning to construct large fabrication facilities at or near the ports for turbine towers, nacelles (the housing containing the

generator and gears), and other large components. The US maritime industry is also taking notice, and the keel has already been laid on the first Jones Act-compliant turbine installation vessel in Brownsville, Texas. Several more Jones Act installation vessels, along with vessels needed to transport workers and components from port to the installation site, are in the planning stages.

Whether the commitments, goals, and purchase agreements result in installed turbines remains an open question. The environmental permitting process has remained challenging for offshore wind developers, with reviews by BOEM taking years to complete. And even when BOEM permitted the first project in line, Vineyard Wind off the coast of Martha's Vineyard, to proceed, several lawsuits were filed in opposition of BOEM's approach under federal environmental laws.

There is significant tension between offshore developers, the fishing industry, and some residents who oppose the projects. In addition, the ability to interconnect to the onshore electric grid remains a work in progress and will require significant upgrades to the electric system largely financed by the offshore wind developers. Those upgrades, too, require extensive regulatory proceedings with uncertainty as to the ultimate cost and in-service date of the needed infrastructure improvements.

Nevertheless, there is significant reason for optimism. As President Biden calls for more action to address climate change by slashing GHG emission, he is prioritizing offshore wind development as a critical component of the United States' quest to meet its recent commitments. His administration has taken aggressive actions to designate new areas for offshore wind leases and has announced plans to complete review by 2025 of 16 Construction and Operation Plans, which are the final BOEM environmental approvals. Also underway are efforts to improve the domestic supply chain for turbines, vessels, and port infrastructure necessary to build a significant and self-sustaining offshore wind industry.

As Secretary of Energy Jennifer Granholm has explained in supporting the Biden administration's offshore wind development goals, "DOE is going to marshal every resource we have to get as many American companies, using as many sheets of American steel, employing as many American workers as possible in offshore wind energy—driving economic growth from coast to coast." If these goals are realized, in a few years, more and more of the nation's electricity will flow onshore with the ocean wind.

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NUCLEAR ENERGY, THE KEY TO ACHIEVING CLIMATE-CHANGE GOALS?

Despite the global attention being paid to combatting climate change, nuclear energy is often ignored in the discussion about how to reduce carbon emissions. But as a reliable, low-carbon energy source, nuclear power is poised to play a very real part in achieving net zero emissions in the United States. Morgan Lewis lawyers discuss some of the key advantages of including nuclear power in the future US energy portfolio.

- Nuclear power is carbon free.
- Although the current generation of operating nuclear plants in the United States required a large amount of upfront capital for construction, smaller, advanced nuclear reactors will require only a fraction of those capital-construction costs.
- Nuclear companies are pursuing nuclear storage innovations that will allow them to make their baseload generating facilities more able to adjust to fluctuations in power demand.
- Nuclear energy is a promising source of power for data centers and bitcoin mining, which are highly energy-intensive and big carbon emitters. Data centers are users of local electric grids in the United States and maintain very large backup generators to prevent any down time during an electricity interruption. Nuclear energy could provide an emissions-free form of the steady, reliable energy needed by these data centers.
- Existing and advanced nuclear power is well suited for hydrogen production because large amounts of electricity are required for electrolysis (splitting water to generate hydrogen), which nuclear power can provide without interruption. Nuclear plants are sited near large bodies of water to supply the amount of water needed for large-scale hydrogen production. Because of the large generating capacity of nuclear plants, they may be able to produce hydrogen more cheaply than that produced from electricity generated by renewables alone.

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TRANSPORTATION INDUSTRY LOOKS TO HIT NET ZERO EMISSIONS

Governments around the world have recently been committing to the greening of the transportation industry with a variety of net zero emission targets, funding proposals, and potential penalties and taxes.

The COP26 in November created the Zero Emission Vehicle Transition Council to bring together governments representing more than half the global car market to increase international collaboration to accelerate the transition to net zero. In the United States, President Biden signed the \$1.2 trillion Infrastructure Investment and Jobs Act on November 15, which allocates \$550 billion in new federal spending over the next five years to improve US infrastructure, including critical investments in the energy sector. The investments will cover power grids, electric vehicles and charging stations, renewable energy, nuclear power, hydropower, and cybersecurity, with the goals to strengthen the energy industry, support emission-free power generation, and bolster emerging technologies. And, in the United Kingdom, the government set its net zero strategy, aiming for a 2035 deadline of being powered entirely by clean electricity, "subject to security of supply," extending a 2050 net zero emissions target for the shipping and aviation industries.

The transportation industry's sheer size means it faces intense scrutiny and plays an enormous role in efforts to reduce emissions to address climate change. Following is a breakdown of some of the high-level efforts being made by the aviation, shipping, and auto industries.

- Aviation contributes 11% of transportation-related emissions in the United States, according to the White House. To address that, the Biden-Harris administration has set the target of 2050 for the aviation industry to reach net zero emissions as part of its Climate Action Plan. In the United Kingdom, emissions from international shipping and aviation contribute 3% and 7% to the UK total, respectively. The United Kingdom in 2020 became the first country to have its national aviation body commit to reaching net zero emissions by 2050. But the government took that a step further in June 2021 and set a target of 2040 to reach net zero emissions for domestic flights.
- The Aviation Working Group, a nonprofit legal entity composed of major aviation companies and regulators, has been lobbying the European Union to create a single international system for the classification of green aircraft financing and leasing to avoid conflicting national or regional standards to eliminate any conflicts in different regions where the airlines fly.
- For almost two decades, the International Maritime Organization's (IMO's) Maritime Environment Protection Committee has explored the issue of GHG emissions in the shipping sector, which generates 2.5% to 3.5% of global GHG emissions. In 2018, the IMO adopted an initial strategy to, by 2050, reduce GHG emissions from ships by 50% from 2008 levels. While that is modest in relation to other transportation sectors, it is still a challenge for this industry.
- Of the 146 new ships ordered in 2020, only 17% were ordered with cleaner fuel engines. The shipping industry is working on finding more environmentally friendly fuels, scrubbing fuel to reduce emissions, and retrofitting ocean ships. Hydrogen-fueled ships are viewed by some as a drawing-board submission but have not been put in place. Others are exploring nuclear power as an alternative. Each option, however, comes with challenges.
- President Biden signed an executive order this summer setting a goal of 50% of all new passenger cars and light trucks to be zero-emission vehicles by 2030 and building on the EPA's proposed tailpipe-emission standards that are set to begin with 2023 car models.
- The recently passed US infrastructure bill earmarks \$7.5 billion to build a national network of EV charging stations to accelerate the adoption of electric vehicles. Along with the funds, the bill establishes a 25-member electric vehicle working group, which will be led by the secretaries of Transportation and Energy, to provide

federal guidance and strategy for the development, adoption, and integration of electric vehicles into the US transportation and energy systems.

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