



Energy

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Overview of the current energy mix, and the place in the market of different energy sources

Oil and gas

The U.S. mainly relies on petroleum and natural gas fossil fuels for two-thirds of its primary energy needs. The transportation sector accounts for the majority of liquid petroleum consumption, and the electricity, residential and industrial sectors are the major consumers of natural gas. In September 2018, the U.S. reclaimed the title of number one oil producer in the world, last held in 1973.

In 2017, the U.S. produced about 15.4 million barrels of petroleum per day (MMb/d), and consumed about 19.9 MMb/d, resulting in net imports averaging about 3.7 MMb/d from countries such as Canada (40%), Saudi Arabia (9%), Mexico (7%), Venezuela (7%), and Iraq (6%). Imports of petroleum in 2017 represented approximately 19% of total petroleum consumption, which was the lowest percentage of imports since 1967. The U.S. Energy Information Administration (EIA) predicts that the U.S. will become a net exporter of petroleum by 2022. According to the International Energy Agency, the U.S. will account for 80% of the increase in global oil supply through 2025, primarily as a result of the onshore oil production boom in the U.S. led by hydraulic fracturing and other tight formation operations.

Power markets

Electricity in the U.S. is generated from three major categories of primary energy sources: fossil fuels (coal, natural gas, and petroleum); nuclear energy; and renewable energy sources. Fossil fuels remain the largest sources of electricity generation (63%), followed by nuclear energy (20%), and renewables (17%). Natural gas has overtaken coal to become the largest single source for electricity generation at about 32%, with coal falling to about 30%. This decline in domestic consumption of coal has occurred despite endorsement of the industry by the Trump administration. Although coal production in 2017 increased by about 6% over the previous year, coal consumption in the U.S. peaked in 2007 and has declined since, primarily due to a move towards natural gas and renewables in electricity generation. The U.S. is a net exporter of coal, with exports increasing slightly in 2017 consistent with the uptick in production and decline in domestic consumption.

Natural gas is serving as a bridge from fossil fuels to a renewable future, by reducing U.S. carbon emissions from older coal-fired plants and filling in the gaps where renewables fall short. In 2017, natural gas production was at its second-highest level on record as a result of more efficient and cost-effective drilling and production techniques used in onshore shale operations. This led to a decline in natural gas prices and increased use by the power sector.

Renewables and energy storage

Wind and solar prices have dropped significantly in the last decade such that these renewables are now undercutting the cost of natural gas in certain regions of the U.S. While the cost of natural gas-generated power is tied to the volatile commodity price of natural gas, the price of renewable energy is tied to its technology costs, which have steadily decreased in recent years. A recent report by Lazard found that the cost of producing one megawatt-hour of electricity from utility-scale photovoltaic solar is around \$50, whereas the same megawatt-hour may cost \$60 if generated from natural gas, \$102 from coal, and \$148 from nuclear.

The last few years have seen a strong commitment by many states and the private sector to embrace renewables. Many large U.S. companies have joined the RE100 group pledge to source 100% of their global electricity consumption from renewable sources by a specific deadline. Target, a major U.S. retailer, reported 147 megawatts of solar installed in 300 of its stores and recently announced that it had purchased enough Renewable Energy Credits in 2017 to power 100% of its global operations. Google also reached 100% renewable energy sourcing in 2017, and Apple recently announced that its global facilities are powered with 100% clean energy.

Battery electric storage is a major development on the power side that has accompanied the growth of renewable generation. According to the EIA, as of 2018 the U.S. had 708 megawatts of battery storage capacity, two-thirds of which was installed in the last three years. Much of the current installation is concentrated in California and the region known as “PJM,” being all or parts of 13 Mid-Atlantic and Midwestern states plus the District of Columbia. Federal Energy Regulatory Commission (FERC) Order 841 promises to expand adoption in other transmission systems. Following last year’s hurricane devastation, Sunnova, Puerto Rico’s largest rooftop solar power provider, is now adding a battery system with each new home installation. Storage is increasingly recognised as conferring multiple benefits, including resiliency to grid outages and lower peak power costs.

Changes in the energy situation in the last 12 months which are likely to have an impact on future direction or policy

Tariffs

Following the September 2017 decision by the International Trade Commission (ITC) that imported solar panels are injuring domestic manufacturing, President Trump approved tariffs on imported solar cells and modules. Analysts predicted that the solar tariffs would slow the shift to renewable energy in the U.S., since approximately 80% of solar panel products are imported. Indeed, since the imposition of tariffs, more than \$2.5 billion in large solar installation projects have been cancelled or postponed. Many solar companies are presently petitioning for an exemption from the tariffs, arguing that they have unique technology or products.

In addition to the solar tariffs, in March 2018 President Trump announced a 25% tariff on imported steel and a 10% tariff on imported aluminium from select countries, including certain traditional allies of the U.S. such as Canada, Mexico, and the European Union. In August 2018, President Trump singled Turkey out for double tariffs, setting rates on steel and aluminium imported from Turkey at 50% and 20%, respectively. The impacts on the oil and gas industry may be significant, as these industries rely heavily on imported steel for drilling, pipelines, export facilities, refineries, and petrochemical operations. According to recent studies, 77% of steel used in U.S. pipelines is imported. It is not clear whether domestic steel and aluminium production can ramp up production to supply the industry

without interruption. Complicating matters is that certain pipelines require a type of steel not manufactured in the U.S. Therefore, the tariffs may result in a delay of pipeline manufacturing and construction, thus hindering transportation. This could have serious implications for high-producing areas that currently have restricted pipeline capacity, like the Permian Basin in Texas and New Mexico.

Steel and aluminium also play a key role in renewable energy production and transmission. The solar and wind industries use a significant amount of steel and aluminium for wiring, transformers, turbines, battery system housing, transmission lines, and towers. Solar and wind assets are usually located in remote locations, and therefore require steel to construct transmission towers and lines to bring the power to consumers.

The global tensions created by the imposition tariffs also threaten U.S. exports. In August 2018, China proposed to counter U.S. solar and steel tariffs by introducing a 25% levy on liquefied natural gas (LNG). With the U.S. set to become the world's largest exporter of LNG as early as 2019, and China being the world's second biggest LNG importer in 2017, the prospect of Chinese LNG tariffs is troubling to the U.S. natural gas sector. Similarly, China announced a 25% duty on U.S. produced coal. China had more than tripled the amount of its U.S. coal imports in 2017 from 2016 levels, and had been looking to increase its purchases in future years. The U.S. coal industry is particularly dependent on foreign exports to remain profitable, so this development is concerning to an already stressed industry.

Permian Basin

The Permian Basin, which lies in the western part of Texas and southeastern part of New Mexico, has been experiencing one of the biggest oil booms in the history of U.S. oil. Over the last two years, the number of drilling rigs in the Permian Basin has more than tripled. In April 2018, an average of 449 rigs served the area, which represented 44% of all rigs drilling that month in the U.S. and 22% of all rigs drilling in the world. According to the EIA, more than half of the emergent growth in crude oil production in the U.S. will come from the Permian Basin.

Recently, the Permian Basin has experienced a surge of investors purchasing or leasing oil and gas assets. In the summer of 2018, the Bureau of Land Management (BLM) auctioned leases in the Permian Basin and grossed nearly \$1 billion for 142 parcels, setting a new onshore lease record. Despite transportation bottlenecks due to a lack of sufficient pipelines and other infrastructure, private companies are continuing to pay record prices to secure assets in the region. Some operators have even resorted to transporting the oil via trucks, which has resulted in an inflated cost on producers known as the "basin differential".

Pipeline companies have billion-dollar plans to build new pipelines in the coming years to keep the oil and gas flowing out of the Permian Basin, with some scheduled to come online in late 2019. However, the newly imposed steel tariffs could increase the cost of pipeline projects, and potentially result in significant delays if the type of steel needed is not manufactured domestically.

Clean energy mandates

Despite the solar and steel tariffs and the current administration's strong endorsement of coal, many states across the U.S. continue to pursue clean energy goals. In September 2018, California enacted a law that set a 100% clean electricity goal for the state by 2045. The law sets forth the most ambitious carbon neutrality commitment of any major economic power in the world. California is now the second state in the U.S. to mandate a carbon-free grid, following Hawaii.

In addition to California's ambitious clean energy goal, in May 2018 the California Energy Commission (CEC) adopted new building standards that require builders of new homes in California to include solar photovoltaic systems starting in 2020. California is now the only state in the U.S. that mandates builders of new homes to either make homes available with solar panels or build a shared solar power system serving a group of new homes. The CEC has estimated that the new building standards will save homeowners around \$19,000 in energy and maintenance costs over 30 years. Other states such as Hawaii and Arizona are considering enacting their own solar mandates, and New Jersey, Massachusetts and Washington, D.C. are considering legislation to require new buildings to be solar-ready.

Developments in government policy/strategy/approach

Opening federal lands to energy development

Debate has lasted decades on how to balance the use and the protection of federal lands. The administration under President Trump has endeavoured to increase energy exploration and development on federal lands, including an expanded offshore leasing programme, opening the Arctic National Wildlife Refuge (ANWR) to oil development, and shrinking several national monuments to potentially make way for energy development.

In early 2018, the Bureau of Ocean Energy Management (BOEM) released a draft National Outer Continental Shelf Oil and Gas Leasing Program for the years 2019–2024. The draft programme, if finalised, will replace the programme implemented by the prior Obama administration and currently in place for the years 2017–2022. When first announced in January 2018, the proposed 2019–2024 programme aimed to make over 90% of the total Outer Continental Shelf (OCS) acreage available for oil and gas leasing. However, almost immediately after announcing the plan, several state governors, lawmakers and residents objected to the nearly wholesale opening of offshore regions adjacent to their coastal states. In response, the Secretary of Interior made a series of public pronouncements indicating that certain sale areas – such as those lying off the coast of Florida – would be removed from the agency's programme, and other areas – such as the entire West Coast and nearly all the Eastern Seaboard – would be “marked down” from the original plan. In the 60 days after releasing the draft programme to the public, BOEM received over two million comments from interested parties. The comment period closed in early March 2018, and BOEM is expected to release its second draft of the programme in the fall of 2018, with a goal to finalise the programme in early 2019. In anticipation of the final plan, BOEM has moved forward with advance planning of certain lease sales proposed under the 2019–2024 programme, like the Beaufort Sea sale, which is scheduled to go forward in 2019 after finalisation of the leasing programme.

States have also begun to anticipate finalisation of the plan and have moved to block its effectiveness. In late August 2018, California state lawmakers passed a bill intended to prevent any new fossil fuel infrastructure originating from federal offshore leases from passing through the state's jurisdiction, which extends to three miles offshore. This measure follows the lead of New Jersey, whose governor signed a ban in April 2018 prohibiting oil and gas exploration in state waters. The governor of New York has also expressed support for a similar ban in his state.

In addition to offshore leasing, the Trump administration and Congress advanced policies and legislation in late 2017 and 2018 to open the ANWR to oil exploration. The ANWR has long been a point of energy debate in Congress, with proponents of development arguing that the eight-million-hectare (19 million acres) wildlife refuge is a source of potentially

significant domestic oil reserves. However, a legislative ban on oil and gas development in the ANWR had been in place since 1980, until Congress lifted the ban in December 2017 as part of its tax-reform package. In April 2018, the Department of Interior (DOI) began the environmental review process necessary for setting up an oil and gas leasing programme in the refuge's 600,000-hectare (1.5 million acres) coastal plain. Although the process is now under way to lease portions of the ANWR for oil and gas development, analysts caution that actual production is likely years away when taking into account the time needed to acquire leases, conduct exploration, and develop necessary infrastructure in the remote region.

The Trump administration has also taken steps to open up onshore federal lands in the lower 48 states that have previously been off limits to energy development due to national monument status granted by previous administrations. In late 2017, President Trump ordered the significant reduction of two national monuments – Bears Ears and Grand Staircase-Escalante – located in Utah, and is reportedly considering shrinking or eliminating at least another 25 monuments around the country. Bears Ears and Grand Staircase-Escalante contain reserves of coal, oil and uranium that could be available for lease now that national monument status has been removed from large portions of the federal lands. At least one company has staked a mining claim on land that was formerly part of the Grand Staircase-Escalante National Monument, although the claim is being called invalid by groups opposing the Trump administration's decision to reduce the monument.

Offshore wind development

Despite a history of fits-and-starts in the U.S., offshore wind is finally gaining a foothold with new projects planned in federal waters off the coasts of New York, North Carolina, and New Jersey. The U.S. Department of Energy (DOE) reports that 28 offshore wind projects are in the planning stages, mainly located off the U.S. Eastern seaboard, but also along the West Coast, near Hawaii, and in the Great Lakes. Analysts anticipate significant growth in the industry over the next decade, and the Trump administration has expressed support for this form of renewable energy. The Interior Secretary endorsed offshore wind in BOEM's proposed budget for 2018, and publicly supported the leasing of federal waters to wind developers off the coast of North Carolina. In addition, DOE created a consortium in late 2017 to support the development of offshore wind technology, with federal funds going towards research and development aimed at decreasing the cost of turbines and improving efficiency. Congress has also been supportive of the wind industry generally by preserving its tax credits in the most recent tax reform bill passed in December 2017.

State governments are likewise getting in on the act with lawmakers in New York, New Jersey, Massachusetts, Delaware, Maryland, Rhode Island, Hawaii, and California all moving to support offshore wind projects in their jurisdictions in various ways. Some of the measures taken include setting aggressive renewable energy targets or mandates that will be partly achieved through anticipated offshore wind development; authorising subsidies for offshore wind projects; and passing laws that require utilities to enter into long-term contracts with offshore wind projects. However, goals to build large wind farms off the coast of California hit a snag in late 2017 and early 2018 when the U.S. Navy released maps objecting to wind projects in large sections of the state's coastline from the central coast down through southern California. State regulators and stakeholders continue to meet with the Navy to determine if there is a way to resolve the apparent conflicts identified by the Department of Defense.

Developments in legislation or regulation

Multiple legislative actions and court and agency challenges are under way that could have a major bearing on efforts by state governments to provide benefits to low-carbon power sources, which potentially conflict with FERC's governance of wholesale power markets.

States continue to expand renewable portfolio standards (RPS) that permit sales of power by wind, solar and other renewable generators at prices higher than those recoverable by gas- and coal-fired sources. As noted above, Hawaii is already on board for 100% renewable power by 2045, and California recently enacted SB100, moving California to 100% renewable and "zero-carbon resources" electricity by that same date.

The legality of zero-emission credit subsidies (ZEC) of nuclear power plants and other generators that receive state subsidies has been in question since the Supreme Court's decision in *Hughes v. Talen Energy Marketing* (U.S. 2016), a case dealing with power plant construction incentives. Illinois and New York federal courts recently sustained ZEC and RPS programs against challenges that such state actions were pre-empted by the Federal Power Act. New Jersey also recently conferred ZEC benefits on nuclear sources, not limited to plants in the state.

The wholesale power market conflict is playing out most notably in connection with FERC's June 2018 decision in *Calpine v. PJM Interconnection*. FERC and independent power producers have argued vehemently that states' "out of market" subsidies for certain types of generating units have created an unlevel playing field in RTO capacity auctions, forcing retirement of generating units that would otherwise be economical to operate. PJM proposed alternative reforms designed to eliminate this defect in its market rules. But FERC rejected both proposals by a 3-2 vote, and PJM's existing rules as "unjust and unreasonable". (Whether this finding affects auctions already held for 2019–2022 or requires refunds for capacity payments collected as a result of previous auction is uncertain.) Moreover, the commissioners in the majority staked out several general requirements for the RTOs to ponder – and for the states, industry and others to challenge.

First, FERC required PJM to impose minimum bid requirements on nearly every generator receiving out-of-market subsidies that bids into the PJM capacity auction. This is a major expansion of PJM's current Minimum Offer Price Rule (MOPR), which applies to only a handful of generating units. In an unexpected reversal of previous FERC policy, the term "subsidy" is defined to include any renewable energy resource that receives state support. Nuclear plants that receive ZEC payments, and coal-fired generators that are subsidised, would also be subject to the Rule.

FERC expects minimum bids to be set high enough so that in most instances, generators subject to the Rule will not clear the auction. This could deprive nuclear generators and other low-carbon resources of a key source of revenues, undercutting ZEC programmes and making it more difficult to finance renewables that previously had been able to receive capacity payments. FERC acknowledges that electricity users in some states will be exposed to double payments, funding state subsidies through state tax payments but still paying a share of PJM's capacity payments passed through to them as ratepayers.

Simultaneously, however, in a major departure from FERC's prior hostility to state subsidies, FERC allowed states to provide any subsidy they choose to generators within their borders as long as both the generator and a corresponding amount of load are excluded from the auction. This option, dubbed the Fixed Resource Requirement Alternative (FRR Alternative) has the potential to significantly alter the landscape in FERC-regulated

wholesale markets. Critics fear that, if the FRR Alternative is widely used, the total number of megawatts of capacity procured in the auction will be reduced considerably, turning it into a residual market and giving a significant competitive advantage to generators that receive state subsidies.

Almost no one appears happy with FERC's June decision. The dissenting commissioners complained that FERC has overstepped its role by creating the FRR Alternative, undermining state efforts to subsidise renewable energy resources by preventing wind and solar generators participating in state RPS programmes from obtaining capacity payments in the auction. States made the latter objection as well, stressing that power sources without greenhouse gas emissions do not create externalities that other sources produce. Gas-fired generators also objected to the withdrawal of load from the PJM auction, fearing that it will create a shallow market, with subsidised generators locking in a preferred right-to-sell capacity to an increasing percentage of the state's load.

FERC asked for public comments before a further ruling is made prior to the 2019 capacity auctions. This controversy is sure to continue before the agency, as well as in other forums.

Judicial decisions, court judgments, results of public enquiries

Climate change litigation

Lawsuits filed by various groups and governments regarding climate change and its effects continued to dominate headlines in the U.S. this year. To date, at least 14 local governments and one state have filed lawsuits against major energy producers seeking damages for climate change-related impacts such as rising sea levels and health consequences. In general, the lawsuits make a public nuisance claim against the companies, with some also alleging negligence and civil conspiracy. The governments seek billions of dollars to help pay for infrastructure – such as sea walls – which they say are necessary to protect their jurisdictions, and also to cover health care costs and environmental damages brought on by an increase in greenhouse gases and global warming trends.

A major allegation running through the lawsuits is that companies committed representations by dismissing the consequences of climate change while promoting fossil fuels. This line of attack is behind an ongoing investigation led by the attorneys general from New York and Massachusetts into ExxonMobil's corporate shareholder disclosures, which has resulted in the production of numerous documents on the subject that are then cited in the nuisance cases.

Despite the barrage of lawsuits, energy companies have been successful in having many of these cases dismissed. Many federal judges presiding over the matters have found that the questions at issue relate to policy matters properly decided by the legislative and executive branches of government, rather than by the courts.

Energy companies have not been the only target of climate change lawsuits in the U.S.; the federal government and many state governments have also been sued for failing to prevent and appropriately address the impacts of climate change. These lawsuits, filed by young people across the country and supported by a group called Our Children's Trust, rely on the public trust doctrine, which is the principle that the government holds natural resources in trust for the public. To date, one federal lawsuit and nine similar state cases have been filed from Alaska to Florida. The federal case, pending in federal district court in Oregon, is set to go to trial as soon as October 2018. The plaintiffs in that matter are demanding extensive changes in federal climate policy and government programmes they allege encourage fossil fuel development.

Coal ash

Coal ash, generated in large quantities by coal-fired power plants, is one of the largest industrial waste streams in the U.S. The waste has been classified by the Environmental Protection Agency (EPA) as non-hazardous for purpose of waste disposal rules, although it can contain arsenic, lead and mercury. In August 2018, a federal appeals court threw out EPA regulations that allowed coal-fired power plants to continue using existing unlined and clay-lined coal ash disposal ponds. The court found that the regulations failed to adequately protect the public from the threat of water contamination posed by these types of surface impoundments. If the decision stands, it could impose a significant cost on coal energy producers that may be required to retrofit or else close hundreds of impoundments, which can average 50 acres in size and 20 feet deep. At the very least, the decision creates uncertainty for the industry, which is already under financial pressure due to a changing energy mix brought on by an increase in natural gas and renewables.

Major events or developments

Nuclear

The nuclear industry suffered additional setbacks in 2018, including the announced retirement of three nuclear generating facilities in Ohio and Pennsylvania. After failing to secure a subsidy from the state of Ohio, and following denial of a requested emergency order from the DOE to keep the plants operating, the plants' operator announced in April 2018 that the facilities would close before the end of their operational lives. The closure plan calls for the three plants to shutter by October 2021, although the operator continues to search for a solution with state officials to keep the plants operating.

This development is in line with a trend seen over the last several years whereby coal and nuclear plants have been less able to compete with power generated by natural gas and renewables. Proponents of the industry point to its reliability and carbon-free power generation capabilities. However, such benefits have not succeeded in insulating the industry from market forces that value cost above other factors. The high costs associated with constructing and maintaining nuclear facilities has been detrimental to approvals and financing, and will likely continue to hamper the industry without significant technological advances, modular production, or government intervention.

In addition to high costs, the nuclear industry has also had to contend with a decades-long debate about where to store spent fuel and dispose of nuclear waste generated by power plants and the military. President Trump and the DOE have recently made a push to revive a long-dormant plan to store nuclear waste in Yucca Mountain, located in Nevada. Selected by Congress in 1987 to be the nation's permanent nuclear waste repository, licensing of the Yucca Mountain facility has never been finalised due to opposition by political leaders from Nevada and residents concerned about impacts to groundwater and safety. Approximately 80,000 metric tons of spent nuclear fuel are presently being stored at nuclear power facilities across the country, and finding a permanent disposal solution would represent a key victory for the industry. In June 2018, the House voted to resume the licensing process for Yucca Mountain. Although the bill stalled in the Senate, the administration's attempts to restart the licensing hearings are expected to resume following the midterm elections in November 2018.

Cybersecurity

Cybersecurity continues to be a key concern with respect to resilience and reliability of the energy grid, not least because more than 80% of the U.S.'s energy infrastructure is owned

by the private sector. In 2018, several natural gas pipeline operators were the victims of hackers, resulting in service disruptions and breakdowns in electronic communications with customers. In March 2018, the Federal Bureau of Investigation (FBI) and Department of Homeland Security (DHS) issued an alert stating that multiple crucial infrastructures in the U.S., including energy and nuclear facilities, had been targeted by Russian government hackers. Millions in federal funding has been allocated to the newly-established Office of Cybersecurity, Energy Security and Emergency Response (CESER), which will bolster the DOE's efforts in energy security.

Vulnerability of the energy sector will continue to grow as the energy industry becomes more automated and internet dependent. A potential defence against hackers may be the use of blockchain technology with distributed encrypted ledgers. In 2017, DOE began working with other entities to develop blockchain cybersecurity technology to secure distributed energy resources at the grid's edge. Utilities have already begun upgrading their systems to provide for greater grid intelligence and communication with customer devices. Blockchain may revolutionise the energy industry by enabling peer-to-peer energy trading rather than centrally controlled production, transmission and distribution.

Proposals for changes in laws or regulations

Affordable Clean Energy Rule

After much anticipation, the EPA proposed a new rule in August 2018 to curb greenhouse gases (GHG) from power plants called the Affordable Clean Energy (ACE) Rule. The proposed rule replaces the prior Obama administration's controversial Clean Power Plan (CPP), which was a cornerstone regulation of that administration's attempt to address climate change. ACE establishes emission guidelines for states to use to limit GHG emissions from power plants located in their jurisdictions, although unlike the CPP, it provides no numerical targets for states to achieve. ACE aims to reduce GHG emissions from power plants in four main ways: (1) by defining the "best system of emission reduction" for existing power plants as on-site, heat-rate efficiency improvements; (2) by providing states with a list of "candidate technologies" they can use to establish standards of performance and incorporate in their state plans; (3) by updating the New Source Review (NSR) permitting programme to encourage efficiency improvements at existing power plants; and (4) by giving states additional time and flexibility to develop their state plans.

Although EPA estimates that ACE will reduce carbon emissions from current levels, critics of the rule argue that the reductions are not sufficient to stem climate change and are far less than what would have been achieved under the CPP. The CPP had been mired in litigation, which had resulted in a suspension of the rule and uncertain implementation schedule. EPA notes that implementation of ACE, when compared to a no-action baseline, will result in a reduction of carbon dioxide emissions by 14–27 million tons annually.

Just as with the CPP, states are expected to sue to prevent implementation of ACE and will likely argue that EPA's proposal fails to comply with its obligation to regulate carbon emissions. However, market forces and state clean energy mandates continue to push carbon emissions downward, even in the absence of comprehensive federal regulation. If these market forces and actions by states and cities across the country continue, they are predicted to result in a 28% reduction of carbon dioxide emissions by 2030 even without incremental federal regulation.

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