Averting Climate Catastrophe:

Fossil Fuels Must End While Renewables Take Over

FOOD & WATER WATCH

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Food & Water Watch mobilizes regular people to build political power to move bold and uncompromised solutions to the most pressing food, water, and climate problems of our time. We work to protect people's health, communities, and democracy from the growing destructive power of the most powerful economic interests.

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We Must Stop Pretending Renewables Will Automatically Displace Fossil Fuels

Only curbing fossil fuels will let renewables deliver on their potential.

Leaders of the United States are at a make-or-break crossroads. As the climate rapidly deteriorates and the impacts multiply from climate-amplified disasters — such as fires, drought, hurricanes and floods — we have a waning chance to avert the worst-case scenarios of climate chaos. It will require bold action and directly taking on the fossil fuel industry.

The science behind climate change is undeniable, and with each passing day more policy makers agree that action is required. The only real debate that remains is how to address this challenge.

There is a growing consensus that we must drastically increase the production of renewable energy, and policy makers — including President Biden — have embraced broad goals for a large percentage of electricity to come from renewable energy by 2030.[1] However, these goals will fall short in addressing the climate emergency if increases in renewable energy are not coupled with immediate action to curb the production and use of fossil fuels.[2]

The policy decisions of the past decade drove a boom in hydraulic fracturing ("fracking"), resulting in a massive buildout of fracked gas power plants, pipelines and petrochemical facilities. Fossil fuel corporations plan to build even more. Natural gas currently accounts for more than three times as much electricity production as renewable energy.[3] Alarmingly, the U.S. Energy Information Administration (EIA) projects that the United States will consume more fracked gas in 2050 than 2020.[4] This is a recipe for disaster.

We do not have a decade or even a few years to test the idea that simply by building up renewable energy, the market will phase out the production of fossil fuels. History shows that even when renewable energy has increased, it has not significantly impacted fossil fuel production. For example, only 34 percent of the fracked gas is burned to produce electricity — meaning that most fracked gas is not even supporting our electric grid.[5] To address our climate crisis, we need to thwart climate change's main driver: fossil fuels.

President Biden and many elected leaders use catchy soundbites about moving off of fossil fuels, but the policies that they embrace (including false solutions such as carbon capture, "blue" hydrogen and offsets) will lock us in to dependence on fossil fuels for decades. Despite Biden's promises to tackle climate change, and the iron-clad science that says we must stop approving new fossil projects, the administration has greenlit even more of them.[6]

Hundreds of leading scientists stated in an October 2021 letter to President Biden that "the reality of our situation is now so dire that only a rapid phase-out of fossil fuel extraction and combustion can fend off the worst consequences of the climate crisis."[7] Their urgency was mirrored in the 2021 report from the United Nations' Intergovernmental Panel on Climate Change. Following the report's release, the UN Secretary-General said:

> *This report must sound a death knell for coal and fossil fuels, before they destroy our planet. There must be no new coal plants built after 2021.... Countries should also end all new fossil fuel exploration and production, and shift fossil fuel subsidies into renewable energy.*[8]

We still have time to fix our future, but the hour is getting late. We are already experiencing significant climate impacts, but we can and must act now to avoid truly catastrophic consequences. We are at a crossroads that will either haunt our future or redeem it. Policy makers can keep catering to the fossil fuel industry and condemn us to runaway climate chaos, or we can boldly reverse course, act for the benefit of humanity and take the necessary steps to end fossil fuels. As a society, the choice is ours.

Renewables and Fossil Fuels Have Grown Together

Renewable energy is not a silver bullet for eliminating fossil fuels.

Renewable energy is ready to take center stage

The need for urgent climate action becomes more pressing daily, and fortunately renewable energy options are cheaper than ever. Across their lifetimes, solar and wind energy projects cost $36.50 and $40 per megawatt-hour, respectively, in 2020, down from $248 and $123.50 per megawatt hour just over a decade

earlier.[9] These levelized costs are far cheaper than generating electricity from new nuclear or coal power plants and are often cheaper than natural gas plants.[10] Over the past decade, cost reductions and public policy have more than quadrupled the share of electricity generated by wind and solar.[11]

Moreover, advances in storage and reliability technologies have torpedoed the fossil fuel industry's claim that 100 percent renewable energy is not possible because "the wind doesn't always blow and the sun doesn't always shine." Scientific advances now mean that off-the-shelf, commercially available technology could support a power grid without any fossil fuels.[12]

Renewable energy's potential has been demonstrated at scale in the real world. In 2019, a literature review of 180 scholarly papers covering the challenges associated with 100 percent (or near 100 percent) renewable systems concluded that most systems studied are technically and economically feasible.[13] Moreover, when combining renewable technologies with storage, modeling shows that "enough renewable baseload potential exists across the U.S. to meet the current electricity demand ten times over."[14]

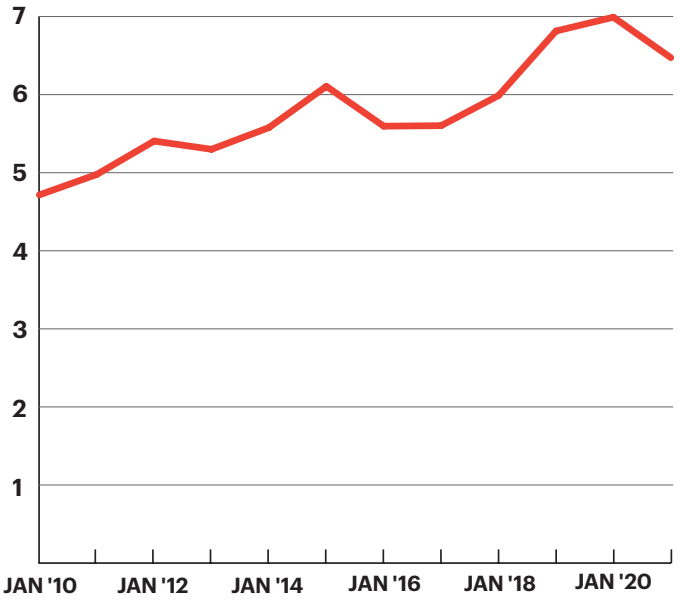
Fossil fuel investment and production still boom

While the trends and viability of renewable energy provide reason for hope, without immediate climate action, the powerful and tenacious fossil fuel industry will doom any hope for climate stability. Despite remarkable progress in renewable electricity, the United States continues to produce and consume large quantities of fossil fuels.

Amid the coronavirus pandemic, U.S. fossil fuel production fell somewhat beginning February 2020 from an all-time high in January 2020 (see Figure 1). But according to EIA projections, fossil fuel production is poised to resume its rise through 2022.[15] Although coal production has fallen by about half during the fracking boom, the increased production of oil and natural gas has more than offset any greenhouse gas reductions that occurred during coal's decline.[16] If these trends continue, the long-term outlook for the climate is dire. The EIA's latest long-term projections predict that the U.S. will consume more oil and natural gas in 2050 than in 2020.[17]

FIG. 1: Monthly Fossil Fuel Production 2010-2020

Coal, oil and gas combined; in quadrillion BTUs



How Has U.S. Fossil Fuel Production Grown So Quickly?

The massive expansion in U.S. fossil fuel production has been enabled primarily by the environmentally destructive practice of shale gas development through hydraulic fracturing ("fracking"). Proponents of fracking misleadingly claim that fracked gas is a "bridge fuel" to move us from traditional fossil fuels such as oil and coal to renewable energy like wind and solar. But this bridge has led only to more fossil fuel dependence, locking us in to decades of worsening climate chaos.

Communities plagued by fracking have experienced well-documented and severe environmental impacts.[18] These harms fall disproportionately on frontline communities that are more likely to be rural, lower income and/or communities of color.[19] In addition to known environmental and public health consequences, fracked gas production is associated with significant leaks of methane.

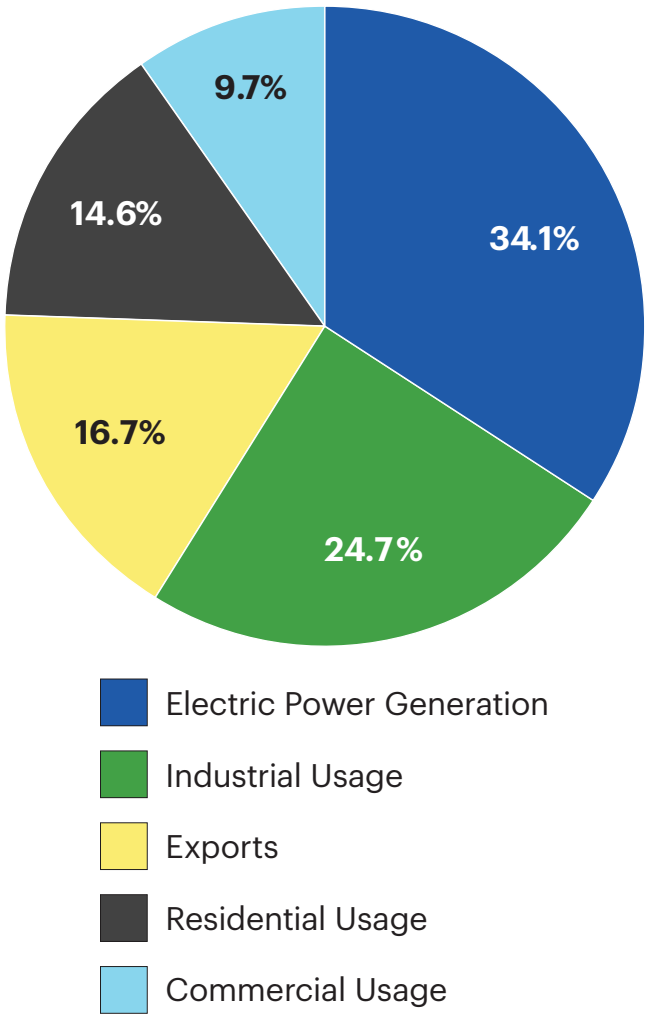
Fracked gas production grew more than five-fold between 2010 and 2019, reaching 75.28 billion cubic feet per day in May 2021, or around 82 percent of all gas produced in the United States.[20] The climate consequences of this natural gas glut are staggering. Natural gas produced in the country is responsible for emissions equivalent to 10.7 million metric tons of carbon dioxide each day; to match these daily emissions, the average American would need to drive a car non-stop for 2.3 million years.[21]

Progress in fossil fuel technology could doom our climate

Without supply constraints such as banning natural gas and oil production, there is no guarantee that fossil fuel use will end or even slow. Unfettered technological progress is likely to unlock an ever-growing supply of fossil fuels at lower prices.[18]

Total resources unlockable by technological improvements vastly outnumber these proved reserves (a metric used in mining that describes the amount of hydrocarbon resources that can be obtained from a site with a reasonable level of certainty). For example, if the production of oil shale (an oil-rich sand similar to bitumen tar sands, not to be confused with shale oil) became economical, it would at least triple proved reserves, and technology to extract methane hydrates (crystalized methane deep in the ocean) could more than double current gas reserves.[19]

FIG. 2: Annual Natural Gas Usage by Type
2021



New environmentally destructive extraction methods could continue to unlock new sources of oil and gas. Currently, technological progress is finding new hydrocarbons faster than consumption is depleting existing sources. Proved reserves of oil and natural gas in the United States more than doubled between 2005 and 2018 despite high rates of extraction. In 2018, proved reserves totaled 504 trillion cubic feet of gas and 47 billion barrels oil.[20] If extracted and burned, these reserves would release the equivalent of 78.7 billion metric tons of CO_2.[21] These reserves alone contain 15 years' worth of U.S. energy-related greenhouse gas emissions.[22]

Emphasizing Renewables Alone Will Not Displace Fracking

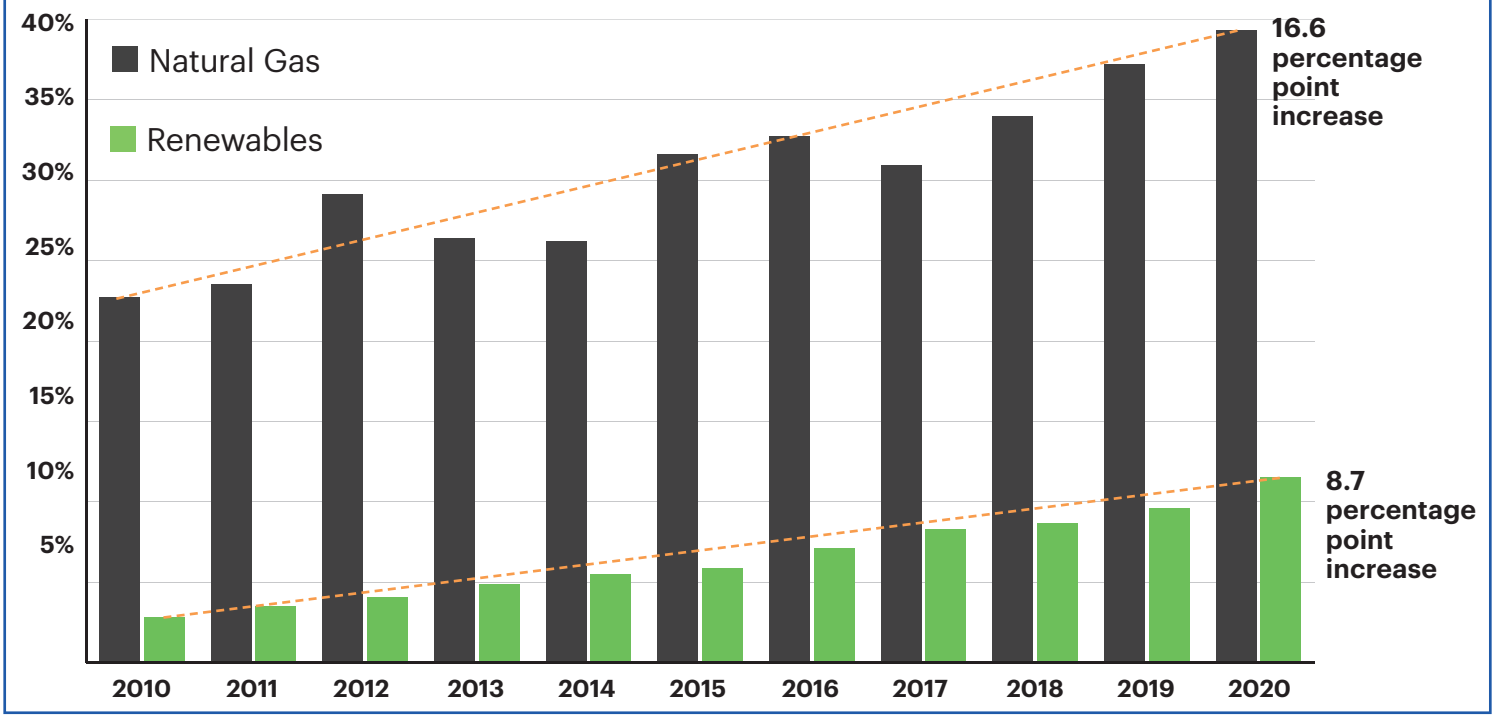
Waning consumer demand for fracked gas means frackers turn to exports, industrial uses.

A single-minded focus on the promotion of renewable electricity, without addressing fossil fuel use in other sectors, will fail to adequately address climate change. Only 34 percent of the natural gas produced in the United States is burned at power plants. Buildings and industrial users each account for about 25 percent of natural gas use, and the remaining 17 percent of natural gas is exported (see Figure 2).[23]

Even in the context of electricity, the promotion of renewables has done little to check the rise of new natural gas power plants supplying the grid. Since 2010, the contribution of renewable energy to the grid has risen from 2.8 percent to 11.5 percent (see Figure 3 on page 5). At this rate, the United States would only reach 100 percent renewable electricity by 2130.[24]

However, the main trend in the electricity sector has been a substantial shift to natural gas. Natural gas grew from supplying 22.7 percent of electricity in 2010 to supplying 39.3 percent in 2020.[25] This was the result of building more than 1,100 new natural gas generators with combined nameplate capacity greater than 100,000 megawatts (about 9 percent of all power plant capacity, or enough to power around 100 million homes if running at maximum).[26] These new gas plants are intentionally designed with lifespans of 40 to 50 years.[27] Without new policy, natural gas plants are likely to represent 40 percent of the new electric generation built through 2050, with even more gas plants opening through mid-century.[28]

FIG. 3: Annual Shares of U.S. Energy Supply: Natural Gas vs. Renewables



Buildings continue to use dangerous and outdated natural gas appliances

Natural gas is used for air and water heating in 9.7 percent of commercial buildings and 14.6 percent of residential buildings in the United States.[29] This use (for air and water heating) could be displaced by readily available electric alternatives, as technologies that enable full electrification eliminate the need for natural gas in buildings.[30] However, current trends indicate that without policy changes, natural gas use in buildings is unlikely to end. Natural gas appliances emit dangerous pollutants such as particulate matter, nitrous oxides, carbon monoxide and formaldehyde, which are linked to respiratory illness and cardiovascular disease. Operating a gas-powered stove and oven for an hour can raise indoor pollution to levels that exceed national air quality standards.[31]

Long-term climate goals cannot be reached without electrification.[32] Despite this, the current pace of electrification in buildings is nowhere near fast enough. Buildings have slow turnover, and owners are often reluctant to invest in retrofits. Full electrification would likely require stringent standards for new buildings combined with rolling retrofit requirements for existing buildings.[33] Deep reductions in buildings' energy use are unlikely without the mandated retrofitting of the existing building stock.[34] While constructing new buildings without natural gas should be the easier task, natural gas companies have fought tooth and nail against modest measures to limit the supply of natural gas to newly constructed buildings.[35]

Fracking's petrochemical and plastics push

The slow-changing buildings industry, while providing a stable outlet for entrenched natural gas companies, is not large enough on its own to support the continued fracking boom. The two sectors that are best positioned to enable the ongoing rise in natural gas production are exports and industrial users.[36]

The use of natural gas in the industrial sector is booming. Bulk chemicals (the production of organic and inorganic chemicals, resins and agricultural chemicals) account for half of this new industrial demand, including as feedstock (for hydrogen, methanol and nitrogenous fertilizer) as well as for heating purposes. Refineries as well as producers of paper and bulk chemicals also use natural gas for process heating and electricity generation, often at combined heat and power (CHP) plants.[37]

In February 2021, the main industry group representing petrochemical companies noted nearly 350 petrochemical projects that were planned, under construction or completed were made possible as a result of fracking.[38] The EIA anticipates that the use of natural gas as a feedstock and a heating source in the industrial sector will grow substantially over the next decade.[39]

What is Fracking's Link to Plastic?

Fracking has unlocked a glut of ethane, a key petrochemical building block for plastics. In January 2020, the United States produced twice as much ethane as a decade earlier, sending growing quantities of ethane to domestic petrochemical plants and exporting it overseas.[44] Ethane production is set to grow faster than other fossil fuels, buoyed by the fleet of new U.S. petrochemical plants.[45] This additional petrochemical manufacturing will compound the local pollution generated by existing large facilities, disproportionately affecting marginalized communities.[46]

The petrochemical boom is ramping up plastics production, generating not only industry profits but also mountains of plastic waste. More than half of the new raw plastic resins produced in the United States are slated to be shipped overseas to be turned into plastic products.[47] The majority of the packaging manufactured by the plastics industry involves materials that are immediately thrown away.[48] Globally, on average, a person discards 110 pounds of plastic annually.[49] Of the 18.3 trillion pounds of plastics produced since 1950, only around 9 percent have been recycled — meaning that more than 16 trillion pounds have been tossed into landfills, littered in the environment or incinerated.[50] In addition to the environmental impacts of plastic waste, plastic production was responsible for 4 percent of global emissions in 2015.[51]

Exporting natural gas: A booming industry

U.S. energy production hit record highs in 2018 and 2019.[40] Because of the pandemic, among other things, consumption of natural gas is set to decline slightly through 2022.[41] However, after a brief decline, U.S. production of natural gas is accelerating,[42] mostly because of the amount being sent to other countries. The EIA projected that natural gas exports would rise from 14.4 billion cubic feet per day in 2020 to 18.3 billion cubic feet per day by the end of 2021 (equal to nearly 20 percent of total U.S. natural gas production). This new export volume would more than compensate for a slight dip in the domestic use of natural gas for electricity, keeping producers flush.[43]

Of this increase in exports, 80 percent will be filled by fracked gas from newly drilled wells — gas that otherwise would have remained underground.[44] Some natural gas is exported by pipeline or truck to Mexico and Canada, and the rest is shipped by tanker from export terminals to reach overseas markets.[45] The gas moving via tankers first gets converted into liquefied natural gas (LNG), and its transport is highly dangerous.

U.S. LNG exports rose to record levels by the end of 2020, averaging 9.8 billion cubic feet per day in December.[46] Existing LNG export capacity supports exporting as much as 10.1 billion cubic feet per day, but facilities that are currently approved and under construction would expand that capacity to 42.1 billion cubic feet per day, nearly half of all natural gas produced in the United States.[47] If built, this export capacity could completely offset the total elimination of natural gas from the electric power sector, enabling producers to export all of the gas that they otherwise would have sold to power plants.[48]

Why is LNG So Dangerous?

Natural gas is almost impossible to ship in its gaseous state. Super-cooling natural gas converts it to a liquid that takes up 600 times less volume, making it possible to load the liquefied natural gas (LNG) onto tankers. When unloaded, the LNG is heated to return it to a gas.[58]

When LNG is stored in tanks, the vastly different air and storage temperatures lead to pressure buildup and require venting to release or "boil-off-gas."[59] At some facilities, super-cold LNG is stored in tanks with only a single inner shell capable of withstanding the extreme temperature of the gas.[60] Observed leak rates are as high as 10 percent, which more than offsets any climate advantage of natural gas relative to coal combustion.[61]

The tankers and storage facilities also pose significant risks of potentially catastrophic explosions. In 2014, a pipeline explosion at a Washington state LNG terminal sent shrapnel flying into a 14.6 million gallon storage tank, causing it to leak.[62] The accident injured five workers, forced the evacuation of 1,000 residents within a two-mile radius and caused $72 million in property damage.[63] In 2004, an LNG explosion at the terminal in Skikda, Algeria killed 30 people and flattened port infrastructure.[64]

LNG advocates love to argue that the export of LNG is necessary to displace coal plants abroad; however, the United States also continues to export coal.[49] The switch to natural gas power in the country has actually pushed some of the domestic coal supply overseas, where international consumers burn it.[50] Every 10 percent drop in U.S. natural gas prices is associated with a 3.3 percent increase in coal exports.[51] As fracking boomed from 2007 to 2013, U.S. coal exports doubled, despite the economic recession.[52] However, continued coal exports depend on expanding the capacity at west coast terminals or adding rail capacity to Canada — hotly contested projects that are vulnerable to public opposition.[53]

These rising fossil fuel exports could be the final nail in the coffin for climate stability. Under so-called "baseline" scenarios — in which no additional mitigation of fossil fuel emissions occurs —the world is on track to hit 4.3 degrees Celsius of warming this century.[54]

So far, modest reductions in the consumption of coal and oil in member countries of the Organisation for Economic Co-operation and Development (OECD) have been largely offset by an increase in natural gas consumption domestically and by a dramatic rise in fossil fuel use in non-OECD countries.[55] Exports would help enable a nearly unlimited supply of fossil fuels, meaning that any policies to mitigate climate change proposed by countries such as the United States, if implemented, would still put the world on track for 3.2 degrees Celsius of warming by 2100.[56]

Corporations and Democrats Continue Trump's Energy Agenda

The "all of the above" approach prevents us from curbing the climate crisis.

U.S. state governments have seized on the momentum for climate action by championing the buildout of renewable energy. However, they have avoided confrontation with entrenched fossil fuel interests and refuse to commit to hard limits on supply. Experience shows that building more renewable energy projects is not enough to guarantee deep reductions in emissions — even within the electricity sector. The "energy dominance" doctrine of the Trump administration took the stance that welcoming renewable energy as part of an "all of the above" approach poses no direct threat to fossil fuels.[57]

While the Biden administration has been more vocally supportive of renewables — promising billions in new spending on technology and development — it has not committed to hard limits on fossil fuel extraction.[58] The administration has made clear that it sees fossil fuels as a key part of the future energy mix.[59] When pushed, Biden even says, "I'm all for natural gas."[60]

Facing pressure from oil and gas interests, some Democrats have embraced carbon capture as a way to keep the oil and gas industry afloat while "complying" with climate goals. However, carbon capture is a favored misdirection tactic, posing as a climate solution. Recent drafts of federal climate legislation have even included carbon capture in a list of "clean" energy sources, elevating it to the same status as real renewable energy such as wind and solar.[61] Carbon capture and storage is unproven, prohibitively expensive and, after accounting for the entire emissions lifecycle, incapable of producing deep emissions reductions. Carbon capture can even enable increased oil production by injecting the captured carbon into oil reservoirs.[62]

Despite the impressive-sounding goals of electricity corporations, the planned time frames for fossil fuel retirements are too slow to meet these goals. Some utility companies are adhering to their climate pledges by divesting from their coal fleets rather than dismantling them, leaving these plants in service under new owners.[63] Others corporations are choosing to buy credits, certificates or offsets from renewable energy producers while leaving dirty portions of their supply chain intact.[64] Meanwhile, sectors such as technology and airlines have embraced a similar approach to climate pledges, but company insiders have questioned whether these measures have any impact on overall emissions.[65]

Virginia's renewables seem to be token gestures, while fossil fuels keep trucking

Plans to build additional renewable energy plants and transition to a more renewable grid in Virginia have been shadowed by new investments in fracked gas infrastructure and a reluctance to phase out existing fossil fuels. Amid growing pressure from climate activists, in 2018 Governor Ralph Northam touted plans by the state's biggest utility to build 3,000 megawatts of renewable energy.[66] Meanwhile, from 2010 to 2020, the state added 6,500 megawatts of new natural gas capacity.[67] Despite posturing in support of renewable energy, Northam's administration supported a number of multi-billion-dollar pipelines to bring natural gas into Virginia.[68] Governor Youngkin's election in 2021 only intensifies the threat

of further fossil fuel development in the state, through commitments to weaken climate and environmental protections, dismantle citizen review boards for fossil fuel infrastructure projects, and greenlight fracked gas projects in the name of grid reliability.[69]

Northam's administration even won praise nationally for its "landmark" climate bill.[70] While the state's climate bill, the Virginia Clean Economy Act (VCEA), is intended to phase out fossil-fueled power plants, the law takes decades to fully take hold and is riddled with loopholes.[71] A legislative effort to clean up those loopholes in 2022 didn't make it out of Committee, signaling the shifting reality regarding climate policy under Governor Youngkin. [72]It is unclear whether the VCEA will have any meaningful impact on the decision making of utilities in the state. Despite the new law, developers have pushed ahead with the environmentally destructive Mountain Valley Pipeline, a 300-mile long project which would carry fracked gas through Virginia.[73]

Virginia's added renewable energy projects appear to provide cover for the business-as-usual operation of fossil fuel power plants in the state. Even as a raft of positive press statements have touted the "transformative" nature of the VCEA, long-term resource plans submitted to Virginia's utility regulator by Dominion Energy tell a starkly different story, including plans to operate natural gas plants long after the targets set by the VCEA.[74]

Dominion's plans show that the company intends to retire much of its coal power fleet regardless of the VCEA. This is because many of Dominion's coal operations have a negative net present value. Conversely, where environmental ambitions compete with profitability, profits appear to win out. Dominion's plans do not retire any natural gas capacity until 2035 at the earliest, and include 970 megawatts of new gas capacity to be built in the early 2020s.[75] Dominion claims that these gas plants are "placeholders," but the company gives no indication as to what might be built in their place.[76] Additionally,

Do We Really Have to Keep Fossil Fuels Around For Reliability?

For utility executives, keeping fossil fuel plants around even while building renewable energy projects makes good business sense, because utilities are often allowed to choose fossil fuel plants over renewable plants to supply electricity when both are available.[99] The most common justification for this practice is the supposed reliability advantages of fossil fuels over renewables. Threats of rolling blackouts and sudden outages are a popular and effective fear tactic in defense of keeping fossil fuels on the grid.[100] These claims continue even though they are based on outdated understandings of how electricity is produced.[101]

Hidden in the complexities of electricity markets, regulators often use the spectre of reliability to thumb the scale for fossil fuels, and utilities point to it as a justification for a slow transition away from fossil fuels. Utilities even use the pretense of reliability to operate inefficient plants.[102] These claims transcend classic concerns about weather variability, touting the supposedly unique ability of traditional turbines to perform "ancillary services" such as frequency regulation.[103] This technical mirage distracts from the fact that other countries have run their entire grids on variable sources of renewable energy (such as wind and solar) for days at a time.[104]

These reliability justifications are not only propping up coal. Energy regulators in California have discussed the need to also prop up unprofitable natural gas plants on supposed reliability grounds.[105] In the state, three needlessly expensive gas plants operating under "reliability must-run" contracts were recently replaced with battery storage at a cost savings, but the process required regulatory intervention and public commission approval.[106]

The Federal Energy Regulatory Commission (FERC) notes that energy storage technologies are capable of providing ancillary services (frequency regulation, voltage support, spinning reserves), often with faster start-up and ramp times than traditional generators, enabling them to provide these services without already running.[107] Academic research also finds that a variety of storage technologies are able to perform ancillary functions, such as backup power, frequency regulation and starts without electricity.[108]

Battery prices have fallen by nearly 90 percent in the past decade, making them capable of competing with fossil fuels on price alone.[109] After switching from gas generators to a battery storage alternative for multiple ancillary services, the Australian Energy Market Operator (AEMO) observed that the battery system provided a more rapid response and higher-quality service.[110] In just two years, the battery system slashed grid regulation costs by over 90 percent, saving consumers more than $76 million.[111]

Dominion's plans make little reference to the company's highly profitable coal units at the Mount Storm power plant in West Virginia.[77]

Between now and 2035, Dominion's plan features only 150 megawatts of additional retirements compared to how much the company would have retired if the VCEA had not passed. The biggest change from the "no VCEA" plan is that the VCEA plan retires three 50 megawatt biomass power plants.[78] Dominion notes that uncertainty exists regarding the units it plans to retire, stating that, aside from a few units, "inclusion of a unit retirement in this 2020 Plan should be considered as tentative only."[79] These power plants may operate less frequently, but without firm commitments to actually close the plants, lower emissions are not guaranteed.

California's renewables are overshadowed by our oil addiction

Nationally, California is the go-to example of environmental and climate action, both positively and pejoratively.[80] There is some merit to these claims — the state produces the most solar power in the country and ranks near the top in renewable energy production as a percentage of generation.[81] However, California is also the largest net importer of electricity, drawing partially on out-of-state coal power plants.[82] The market-oriented bias of climate policy in California has left the state vulnerable to regulatory evasion tactics such as resource shuffling (the process of transferring dirty resources out-of-state and importing from dirty sources outside of the regulatory jurisdiction).[83]

Despite California's environmental reputation, the fossil fuel industry has a large and entrenched presence. Yes, the state is a leader in renewables, but it is also the seventh largest oil producer in the country.[84] In refining capacity, California ranks third behind Texas and Louisiana, with a huge apparatus set up to refine primarily imported oil.[85]

Much of California's oil is produced using particularly water-intensive and environmentally destructive extraction measures such as cyclic steam injection, matrix acidizing and hydraulic fracturing (fracking).[86] On average, oil produced in California is among the dirtiest sources in the world, resulting in higher lifecycle carbon emissions per barrel than other sources.[87]

Oil production also has a huge water footprint in California. Food & Water Watch found that from 2018 to June 2021, the oil and gas industry used over 3 billion gallons of freshwater for drilling operations that could otherwise have supplied domestic systems.[88] The freshwater sucked up by the oil and gas industry since 2018 could have provided everyone in the city of Pasadena with the recommended amount of daily water for an entire year, or everyone in the city of Ventura for 16 months.[89]

Industry-backed decision makers and state agencies have enabled widespread drilling.[90] Governor Newsom's offer of a vague plan to end fossil fuel extraction by 2045 offers no guarantee that these fuels would stay in the ground.[91] Instead of banning fracking now, Newsom plans to continue issuing fracking permits until 2024.[92] These long time frames will doom climate policies, as fossil fuel producers can accelerate their production schedules to extract the reserves before the deadline.[93] When producers anticipate an end to permitting, they stockpile and accumulate permits before the deadline hits, sometimes in quantities big enough to neutralize the policy.[94]

Cozy State Regulators Will Not Choose Renewables Over Fossil Fuels Unless They Have To

Loopholes help fossil fuels compete against renewables.

Curtailment in California

Building new renewable energy sources is often not enough to switch off fossil fuel power plants that were built before clean energy came online. In theory, electricity producers should choose power from renewable sources, which have no fuel costs (rather than paying to burn coal or natural gas).[95] But in practice, renewable power plants are sometimes disconnected while utilities continue to burn coal and natural gas.[96]

This practice of reducing the amount of power supplied from renewables below the amount they are capable of producing is called curtailment. It is often done by disconnecting or reducing at the electrical converter level for solar and changing the blade angle for wind.[97] A review of curtailment in four key solar-producing countries found that in 2018, 6.5 million megawatt-hours of solar was curtailed.[98] That electricity could have powered all the households of a city around the size of Phoenix for a year.[99]

California leads the nation in solar installation, but the state has largely failed to kick its dependence on natural

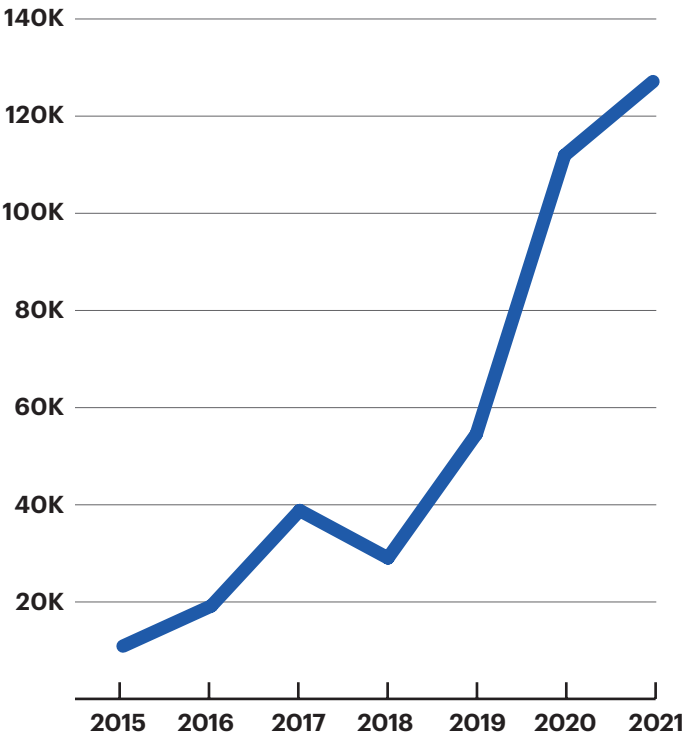
gas.[100] California uses more natural gas than any state other than Texas.[101] Instead of building energy storage, California imports out-of-state power and turns to gas generation to fill gaps in solar generation.[102] These imports hide the fossil fuel footprint of California's electricity. Since 2015, natural gas-fired generation has declined by 29 percent in California, but it stayed the same overall in the western U.S. as out-of-state generators picked up the slack.[103]

Increased solar deployment in California has coincided with increased curtailment.[104] From 2014 to 2019, curtailments nearly doubled each year.[105] California curtails 2 to 3 percent of its renewable energy production.[106] The group that oversees the electricity market and grid, the California Independent System Operator (CAISO), has curtailed more than 5 million megawatt-hours of wind and solar electricity since 2015 (Figure 4).[107] That is enough electricity to cover the needs of 740,000 Californian households for a year.[108]

Fossil fuels use loopholes to stave off renewables

Negative prices, or a surcharge to produce electricity, are a key mechanism to encourage curtailment in California. CAISO enables negative prices by adjusting the price floor to levels that will push out renewable generation.[109]

FIG. 4: Monthly Wind and Solar Curtailment in California (12-month Average)
IN MEGAWATT HOURS (MWh)



In 2017, wholesale prices of power in California hit negative levels.[110] But these negative prices are not leading to cheap energy for consumers — Californians pay electricity rates that are among the highest in the nation.[111]

Negative pricing occurs when plants that are expensive to restart or shutdown continue to operate in anticipation of future demand.[112] Pro-renewable policies can drive prices negative, but when fossil-fueled operators continue to run, this pushes prices to the point where renewables — which cost almost nothing to operate — lose money by selling electricity.[113] CAISO has directly attempted to protect gas generators from negative prices by curtailing renewable energy.[114] California also offers capacity payments for idling gas plants, creating a means for them to stay afloat amid negative wholesale prices.[115] These flexibility payments are effectively a handout to gas generators.[116]

Negative prices reflect an uneven playing field that can favor fossil fuels over renewable energy. CAISO market rules in 2017 allowed natural gas generators to forgo curtailment by appealing to contract stipulations that do not match their technical capacities — in other words, allowing gas plants to pretend to be less flexible than they are.[117] FERC even allowed CAISO to contract directly with fossil-fueled power plants that would otherwise be unable to compete with renewable energy.[118]

Transmission congestion is often cited as a rational for renewable curtailment in California.[119] However, transmission capacity often goes unused while renewables are curtailed.[120] Contracts signed by the big three California utilities restrict the use of transmission capacity to back up renewables.[121] This leads to situations where California continues to import energy while curtailing renewables.[122]

Curtailment is a choice

Policy decisions impact price setting and direct grid investments, which determine the prices received by energy producers. Some level of curtailment may be inevitable in a completely renewable-powered grid at times of low demand, but curtailing renewables in favor of fossil fuels is not a reflection of that dynamic.[123]

Curtailment rates do not correspond to a proportion of renewables as a percentage of capacity and vary significantly among electricity markets.[124] For example, Germany curtails far less than U.S. states with comparable levels of solar development.[125] Texas substantially reduced curtailment of wind through public investment in transmission and market design changes to properly value wind energy.[126] However, Texas curtailed 8.4 percent of its potential solar output in 2018.[127]

Investor-owned utilities have proved resistant to building the transmission infrastructure necessary to bring renewable electricity to distant markets.[128] Private utilities have gone out of their way to design transmission investments in such a way as to benefit their existing fleets and bottom lines.[129] Without significant reforms, these corporations will continue to use legal means to resist change, often with the help of in-their-pocket state governments.[130]

An electricity policy that prioritizes renewable energy and eliminating fossil fuels from the grid would go a long way to reduce curtailment. Incorporating storage and flexibility could significantly reduce curtailment in California.[131] And while natural gas apologists argue that the flexibility of gas power plants enables renewables to run more frequently, non-fossil alternatives (such as demand response and storage) are more effective at reducing curtailment than natural gas generation is.[132]

Leaders Must Directly Confront Fossil Fuel Production and Use

Supply-side energy policy is crucial for our future.

Policy makers representing fossil fuel-producing regions have signaled willingness to embrace half-hearted market-based climate policies. Even major oil producers have signaled willingness to support a carbon tax.[133] These policies pose no real threat to fossil fuel producers because they do not result in deep emissions reductions.[134] Not only do fossil fuel pricing schemes create political cover, the revenue streams created by these programs can entrench these industries — leaving policy makers reluctant to cut back on production.[135]

In Pennsylvania, rather than enact regulations to respond to the dire social and environmental consequences of fracking, lawmakers enacted an "impact fee" that returns payouts from drilling to affected communities — a move welcomed by fracking companies.[136] Pennsylvania gas companies supplement their tax contributions with voluntary charity to launder their image.[137] The strategies appear somewhat successful. Surveys of Pennsylvania residents find that the popularity of fracking rises in tandem with the size of impact fees.[138]

Would-be frackers in the United Kingdom openly extol the importance of impact fees for generating the political will to frack. In a plan modeled on the United States, the U.K. chemical company Ineos offered broad-ranging voluntary community payments as part of a comprehensive strategy to push fracking — giving an activity that depletes the environment and erodes our climate future the false patina of social good.[139]

> **"Giving 6% of revenues to those directly above Shale gas wells means the rewards are fairly shared by everyone. It's what they do in the USA and we think it is right to do this here. It democratises the Shale gas revolution."[140]**
>
> ***— Ineos CEO Jim Ratcliffe***

Conclusion: Public Policy — Not Market Mechanisms — Is the Only Way Forward

The viability of renewable electricity provides an off-ramp from climate chaos, but if fossil fuel development continues unchecked, we will be locked in to decades of continued carbon emissions and climate crisis.[141] Policies that address the fossil fuel supply are a vital component of any successful effort to address climate change. For example, reducing coal subsidies would have a much smaller impact on coal consumption than a ban on new coal mines.[142]

Limiting production is far easier to enforce than using market mechanisms to reduce consumption. Both carbon taxes and cap-and-trade schemes involve complex and detailed reporting and auditing at thousands of facilities — which creates a difficult job for the government agencies that oversee them.[143] In addition to financial costs, complex administration can lead to under reporting and gaming between regulated and unregulated entities, resulting in emissions.[144]

In contrast, supply policies are easily observable and have predictable outcomes with minimal overhead.[145] That is because supply policies impact a smaller number of firms and regulate easily observed commodities rather than the resulting greenhouse gas emissions.[146] Moreover, in an alternate scenario where demand reduction works, supply controls would have no additional cost and merely act as an insurance policy.[147]

The United States is the second largest greenhouse gas emitter, contributing 15 percent of total global emissions.[148] However, some politicians argue that the country cannot substantially reduce global emissions because developing countries continue to increase their emissions.[149] This is in part because the trade in carbon-intensive products has grown rapidly, undermining the effectiveness of domestic climate policy on the demand side.[150] Many of these same politicians have supported lax trade policies that allow corporations to relocate to other countries to avoid complying with regulations.[151] In some cases, countries export fuels that are used to produce products that they then import to consume.[152]

Even without global cooperation, removing the U.S. fossil fuel reserves from the world market would undermine fossil fuel generation globally.[153] While investment and (to a lesser extent) labor can cross borders, fossil fuel reserves are immobile.[154] By imposing limits on fossil fuel production within their own borders, countries can guarantee against the relocation of these fuels.[155] International agreements that target the supply of fossil fuels are easier to negotiate, verify and enforce because they deal with fewer polluters.[156]

Recommendations:

- President Biden should use his authority to stop fossil fuel extraction on federal lands.
- President Biden should use his authority to stop the construction of new fossil fuel infrastructure by denying the needed federal permits.
- Congress should ban fracking everywhere.
- Congress should pass legislation laying out a managed transition off fossil fuels that protects workers and communities that have depended on the industry.

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