Vox ENERGY & ENVIRONMENT

More natural gas isn't a "middle ground" — it's a climate disaster

To tackle climate change, natural gas has got to go.

A liquid natural gas (LNG) receiving terminal. Shutterstock

Expert opinion on climate change policy has been evolving quickly. The opinion of policymakers has not always kept up. One area where this split is particularly notable is around the role of natural gas in a clean energy future.

For Democrats, support for natural gas has always been a signifier of moderation on climate policy. President Obama encouraged natural gas production and proudly took credit for the emission reductions it produced when substituting for coal. It was en vogue during the Obama years to refer to natural gas as a "bridge fuel," a fossil fuel that could help reduce emissions while truly clean alternatives were developed.

To this day, there are "centrist" Democratic groups **pushing the line** that embracing natural gas (and nuclear, and carbon sequestration) is the "moderate" road forward on climate change.

No one knows yet what Joe Biden meant when he promised a "**middle ground**" on climate strategy a few weeks ago (he's expected to **release some policy shortly**). But the first thing I thought of when he said it was natural gas. Biden is likely to try to signal that he's a centrist by embracing natural gas's role as a bridge fuel.

It's a beguiling strategy for Democrats who are fearful of being seen as too liberal. But I'm afraid it's a dead end.

You see, all those arguments for natural gas that seemed so compelling during the Obama years have fallen apart. It's now clear that if the world is to meet the climate targets it promised in Paris, natural gas, like coal, must be deliberately and rapidly phased out. There's no time for a bridge. And clean alternatives *are* ready.

Since climate policy promises to be a hot item this primary season, let's quickly review the reasons natural gas has got to go. Helpfully, the think tank Oil Change International (OCI) has just put out a **paper** making those very arguments. Let's review the five topline ones for why natural gas is not, and can not be, a bridge to a cleaner energy system.

Fracking well head and pumps, in Texas. Shutterstock

Methane leakage may make natural gas as bad as coal, but it's not the reason gas has no future

The paper leads with a quick note on **methane leakage in natural gas production**. Methane is a fast-acting greenhouse gas with enormous short-term impacts on climate. It leaks at every stage of the natural gas production and transportation process.

While gas itself is less carbon-intensive than coal, if enough methane leaks during its production, its greenhouse gas advantages are wiped out.

Does that much methane leak? Some studies have suggested that, yes, methane leakage is bad enough to make natural gas the greenhouse equivalent of coal. Other studies have suggested that gas still has an advantage (and proponents note that leakage could be reduced).

For our purposes here, it doesn't matter. None of the five arguments against natural gas rely on any particular estimate of leakage. All of them would apply even if natural gas achieved zero leakage (which is impossible). The same is true regarding the local environmental impacts of natural gas production (air pollution, habitat loss, earthquakes) — they are dreadful, but even if they were eliminated, the following arguments would still apply.

1) Gas breaks the carbon budget

Honestly, this one is enough to rule out gas on its own.

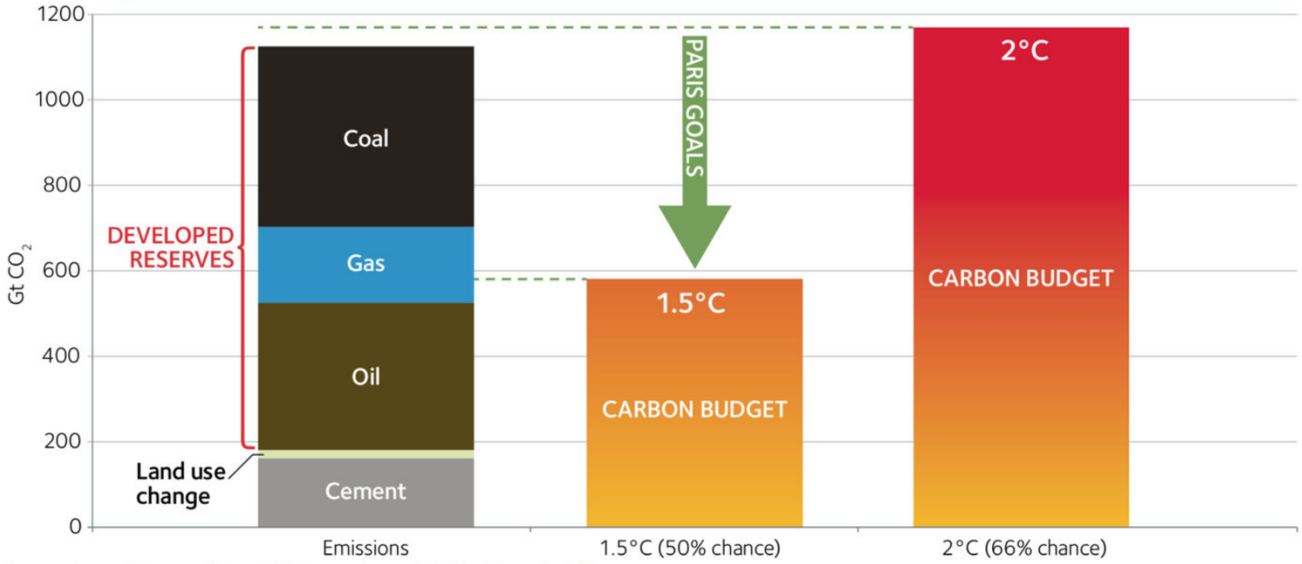
It's simple: Even setting aside methane leakage, there's too much carbon in the natural gas we've already discovered for us to stay within the carbon budget promised in Paris. Never mind finding more — if we burn what we've already found, we'll bust the budget.

The world's nations have agreed to hold the rise in global average temperatures to no more than 2 degrees Celsius, with efforts to hold it to 1.5. (You will recall that the **Intergovernmental Panel on Climate Change report** that came out last year specifically investigated the difference in impact between 1.5 and 2 degrees. Long story short: The difference is substantial and 2 degrees would be horrific.) Staying within those targets leaves humanity with a limited amount of greenhouse gases it can still release — its carbon budget.

The chart below from OCI is eye-opening. On the left is the carbon content of the "developed reserves" of

fossil fuels around the world, i.e., "already-operating or under-construction fields and mines." On the right are the carbon budgets for 1.5 and 2 degrees, respectively.

Figure 1: CO_2 Emissions from Global Developed Fossil Fuel Reserves, Compared to Carbon Budgets within Range of the Paris Goals



Source: Rystad Energy, IEA, World Energy Council, IPCC, OCI analysis[23]

If we burn the fossil fuels we are already exploiting, we will use up the 2-degree budget. Even if global coal use were eliminated overnight, burning the oil and gas we're already digging up would blow the 1.5-degree carbon budget.

OCI emphasizes the obvious implication: "There is no room for new fossil fuel development — gas included — within the Paris Agreement goals." If the countries of the world are serious about their shared targets, they must cease new fossil fuel exploration and cancel plans for new wells and mines.

The IPCC says the world needs to be half decarbonized by 2030, and fully decarbonized by 2050, to hit the 1.5-degree target. To give developing countries more room, wealthy developed nations like the US should ideally decarbonize faster.

To do that, the US will have to phase out all fossil fuel use as fast as it conceivably can. There's no room for a bridge. Policymakers must begin consciously encouraging and designing energy systems that run entirely on carbon-free resources.

2) Coal-to-gas switching doesn't cut it

Shutting down coal power plants and opening gas plants in their place will generally reduce emissions, depending on a variety of variables (again including methane emissions). Coal-to-gas switching is responsible for **a big chunk** of the emission reductions in the US electricity sector over the past few years.

But one thing is certain: Coal-to-gas switching doesn't reduce emissions to zero. And zero-as-soon-as-possible is the goal.

In its **New Energy Outlook for 2018**, Bloomberg New Energy Finance (BNEF) ran a scenario in which global coal use was phased out by 2035 and the market was otherwise left to work. It found that gas would fill about 70 percent of the void. That is incommensurate with Paris targets

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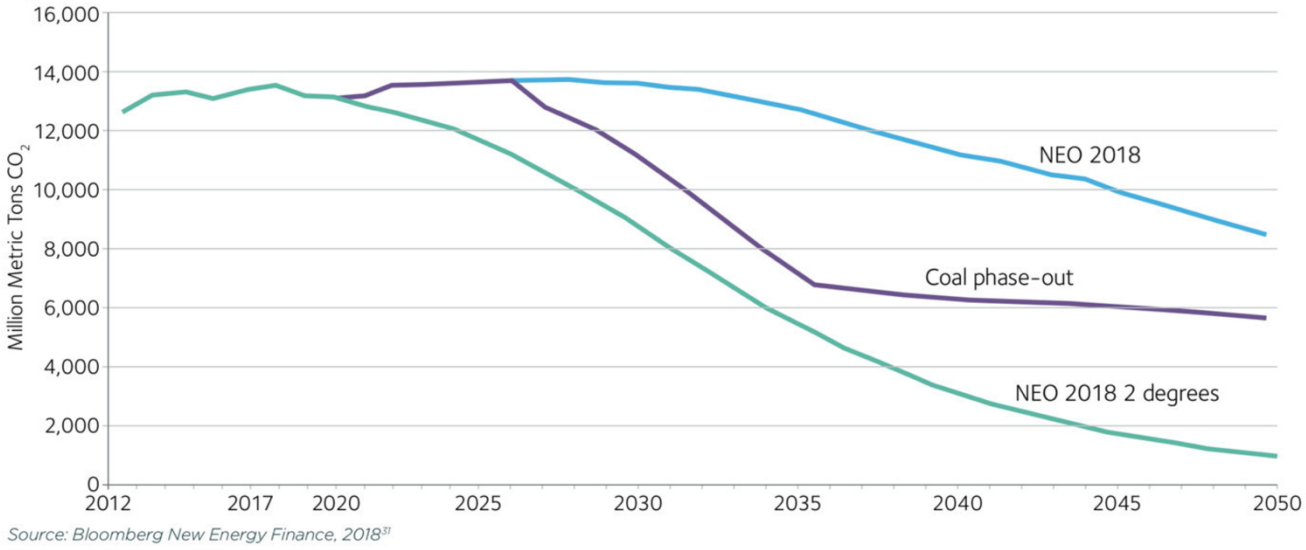
Figure 2: Global Power Sector Emissions in BNEF Scenarios



Source: Bloomberg New Energy Finance, 2018[31]

f Note that BNEF is only measuring emissions at the chimney stack. Methane leakage associated with gas production, processing, storage, and transport will mean that the actual reductions achieved in this scenario are less than stated.

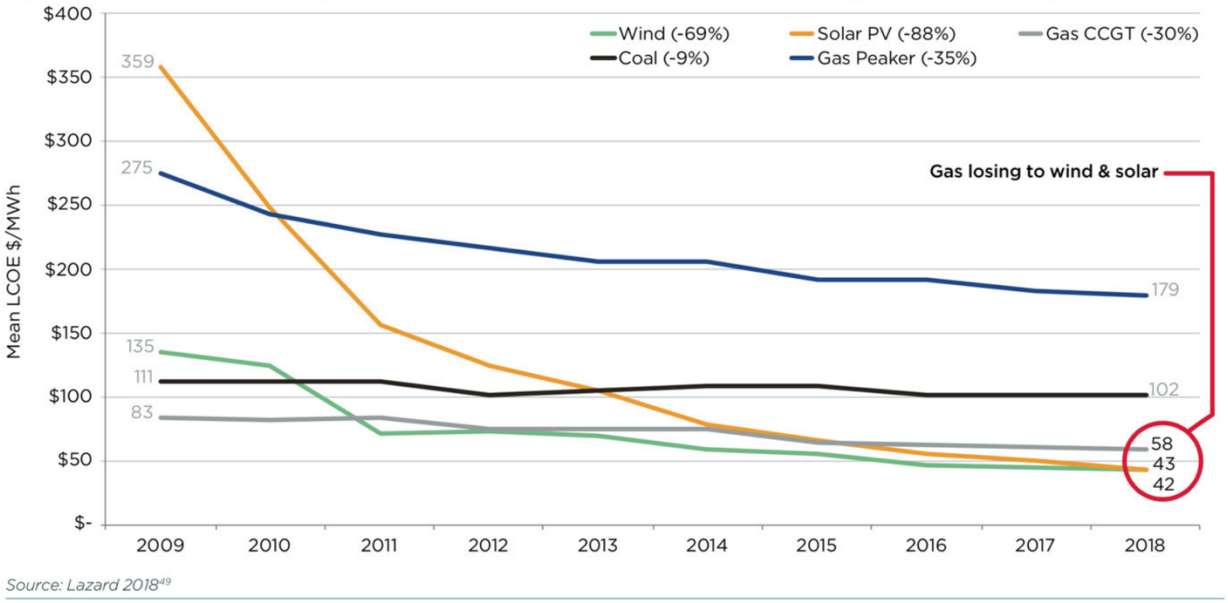
Even with a global coal phaseout, we'll blow through the 2-degree target, much less the 1.5-degree target, unless gas is phased out as well.

Fossil fuel industries **respond** by pointing to the potential for "negative emissions," but all such technologies are speculative at scale and face **potentially insurmountable challenges**. Allowing gas infrastructure to continue being built on the hope that negative emissions will pan out is madness.

3) Bulk renewables can displace both coal and gas

In most markets, bulk renewables — utility-scale wind and solar power plants — are the cheapest form of power as measured by the "levelized cost of energy" (LCOE, which seeks to take all costs into account). This was **confirmed last year** by the financial advisory firm Lazard, which publishes annual LCOE estimates.

Figure 4: Wind and Solar Are Cheaper than Coal and Gas: Mean Global Levelized Cost of Energy for Select Technologies



Source: Lazard 2018[49]

l Also known as Natural Gas Combined Cycle (NGCC).

BNEF also does **yearly LCOE analysis** and has found the same thing:

> The relentless decline of solar and wind costs has made these technologies the cheapest sources of new bulk electricity in all major economies, except Japan. This includes China and India, where not long ago coal dominated capacity additions, as well as the U.S., where the shale gas revolution has made gas cheap and abundant.

Renewables are already driving down prices in wholesale markets and causing existing natural gas plants to be run at much lower utilization rates than they were designed (and financed) for. And renewables are only getting cheaper, while cheap natural gas can't last forever.

Of course, LCOE is a limited measure. What matters for variable renewables is not their average cost but their value at particular times and locations. Wind and solar do, after all, come and go with the weather. Which brings us to ...

4) Gas isn't needed for grid reliability

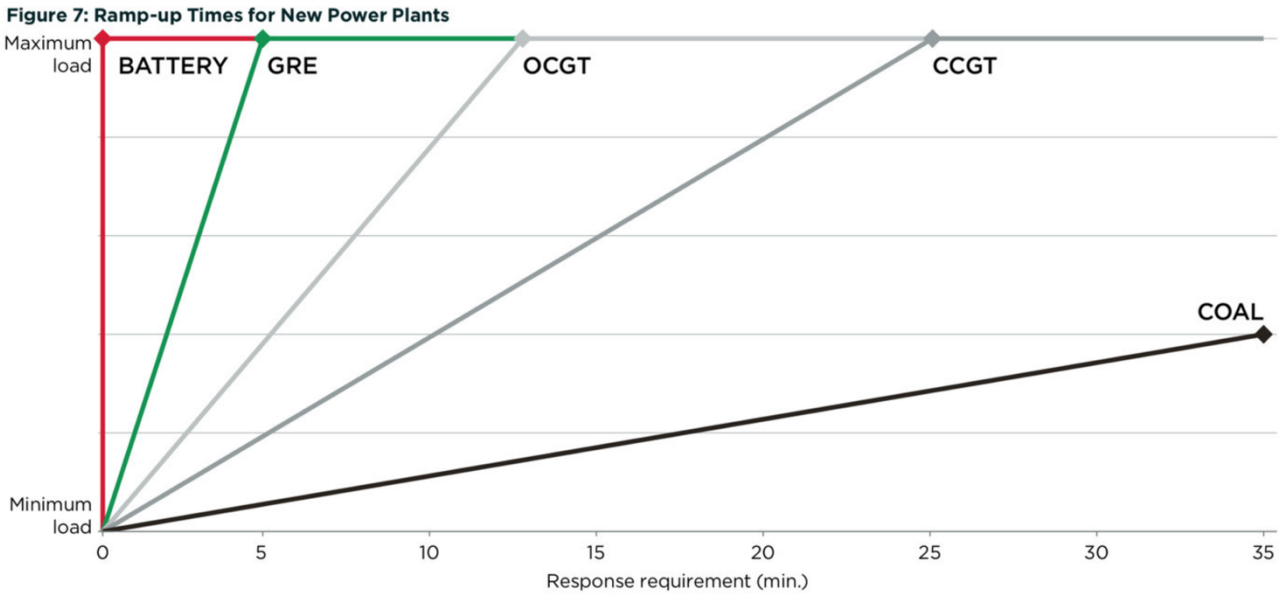
Renewable energy skeptics like to claim that natural gas power plants are required on the grid to balance out variable renewable energy, which comes and goes with the wind and sun.

OCI responds with three arguments.

First, most natural gas plants being built these days are combined cycle gas turbine (CCGT) plants, which produce the cheapest power. "In the United States alone, around 24 gigawatts (GW) of CCGT capacity was commissioned in 2017 and 2018, and more than 14 GW was under construction at the beginning of 2019," writes OCI. "There is more than 425 GW of CCGT capacity in operation globally."

But CCGT plants are not the plants that can ramp up and down quickly to balance renewables. They are big and relatively slow, meant to run at high utilization rates and provide bulk power. In other words, they compete with, rather than complement, renewables.

Second, the faster natural gas plants — gas reciprocating engines (GRE) and open cycle gas turbines (OCGT), or "peakers," named for their function of spinning up during peaks of energy demand — are increasingly being beat out by batteries, which respond even quicker.



Wind and solar plants coupled with battery storage — which can compete directly with peakers — are getting cheaper. OCI cites a BNEF report showing that they "are already able to compete with new coal or gas plants on an LCOE basis in Germany, the United Kingdom, China, Australia, and the United States."

For now, most utility-scale battery storage is in the four-hour range. Those battery installations are expected to get cheaper than natural gas peakers in the early 2020s. But they still have somewhat limited application.

However, OCI notes, "a **study by Wood Mackenzie in 2018** found that six- and eight-hour battery storage systems, which are beginning to enter commercial operation today, can address 74 percent and 90 percent of peaking demand, respectively." Once batteries get more sophisticated and cheaper, there won't be much left for natural gas peakers to do. (For a longer look at how natural gas is getting displaced, see **my article here**.)

Third, OCI argues that the key to stable, reliable grids is not any individual technology but the design of power markets and power systems. Today, in dozens of sometimes subtle and technical ways, they are designed around large, centralized power plants and one-way power flows. To keep grids reliable during the energy transition, policymakers need to redesign markets to encourage diverse portfolios of energy technologies, from distributed generation to storage and demand response. (The report contains some policy suggestions.)

OCI doesn't address the thorny question of whether getting to 100 percent clean electricity requires some form of dispatchable power (power that can be turned on and off), including nuclear and possibly natural gas or biomass with carbon capture and storage. (See **here** and **here** for more on that debate.) Regardless, it's been fairly well demonstrated that we know how to get to 80 percent renewables — if there's a modest role for gas in getting to 100, it certainly won't look anything like the modern gas industry.

5) New natural gas infrastructure locks in carbon

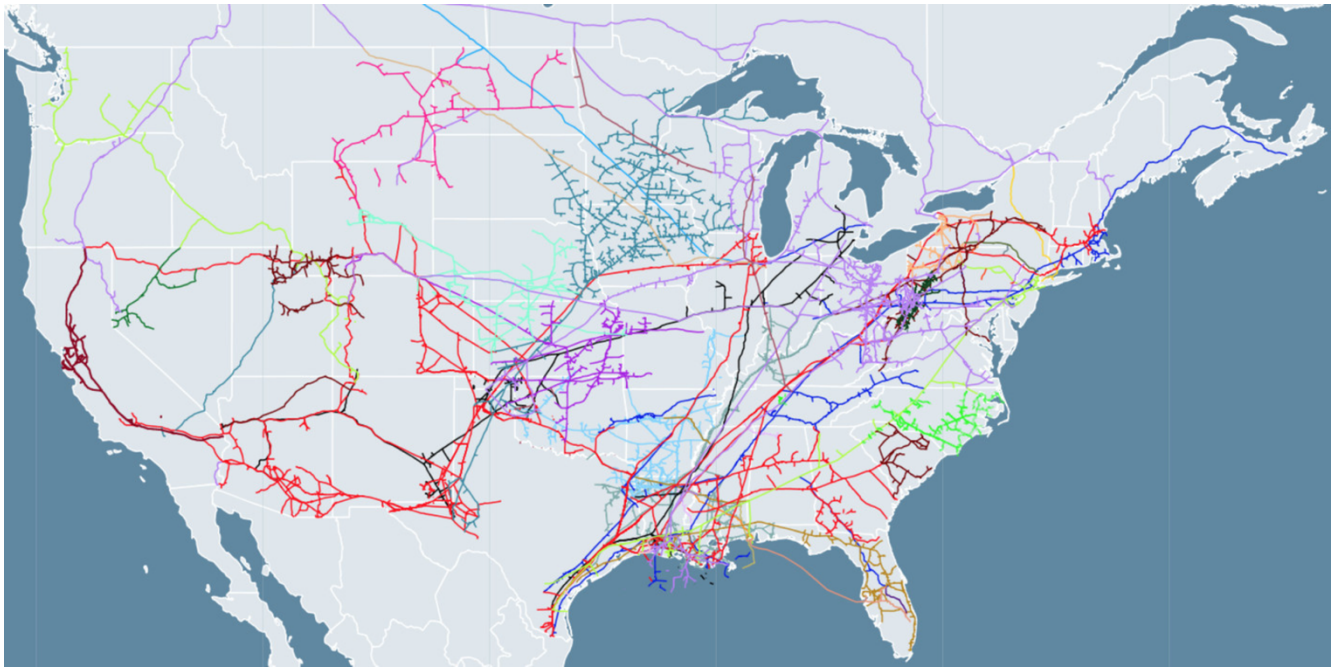
When big, capital-intensive assets get built, they tend to stick around. There are more than 400 natural gas plants in the US that were built in or before 1970. (Even older than me!)

Utilities are **currently incentivized** to build precisely those big, capital-intensive assets. And once they are built, it doesn't take much to keep them running.

"Once capital has been sunk," OCI writes, "operators can keep running a plant as long as it can sell power for more than the marginal cost of producing it — even if it incurs a loss on the invested capital." That means even cheaper renewables won't necessarily drive fossil fuel plants to retirement.

Yet dozens of new natural gas pipelines, power plants, and export terminals are in some stage of planning. The US is on a natural gas building binge.

Every bit of that gas infrastructure being built today must be retired before it is paid off, "stranded," if the US is to have any hope of hitting its Paris targets. The more we build in coming years, the more we will have to abandon later. It probably won't be big utility investors who get stuck with that bill.



Endorsing the IPCC targets means phasing out natural gas

So far in the Democratic primary, **Beto O'Rourke**, **Jay Inslee**, and **Michael Bennet** have released comprehensive climate plans. All of them acknowledge the imperative for the US to completely decarbonize by 2050 (Inslee **targets 2045 and sooner if possible**), per the IPCC.

Once that goal is in place, there is no space for expansion of natural gas infrastructure — wells, pipelines, export terminals, or power plants. That circle cannot be squared.

Rather, natural gas, like coal, must be phased out of the electricity system as rapidly as practically possible, and as many energy uses as possible must be **electrified** as fast as possible.

It's not clear whether mainstream Democrats fully understand that yet. The battle against coal was helped along by the market. Natural gas will not go as quietly; its economic footprint is much larger. Oil and gas companies have considerably more political clout than coal companies. There's a whole new set of battles and tricky political dilemmas ahead.

Nevertheless, supporting continued buildout of natural gas assets in the US is not "moderate" climate policy, nor a "middle ground." It is an admission of failure, an acknowledgment that the US will not do its part to avert 2 degrees of warming and the **horrors that will follow in its wake**. No candidate should get away with claiming otherwise.