RISKY WAGER:
THE IEA'S BET ON FOSSIL GAS AND THE NEED FOR WEO REFORM

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SUMMARY

- The International Energy Agency (IEA) is the global authority on energy policy. Its hallmark publication, the annual *World Energy Outlook* (WEO) maps out detailed, long-term pathways for energy demand and supply. Government officials, businesses, industry groups and investors rely upon and cite its figures.

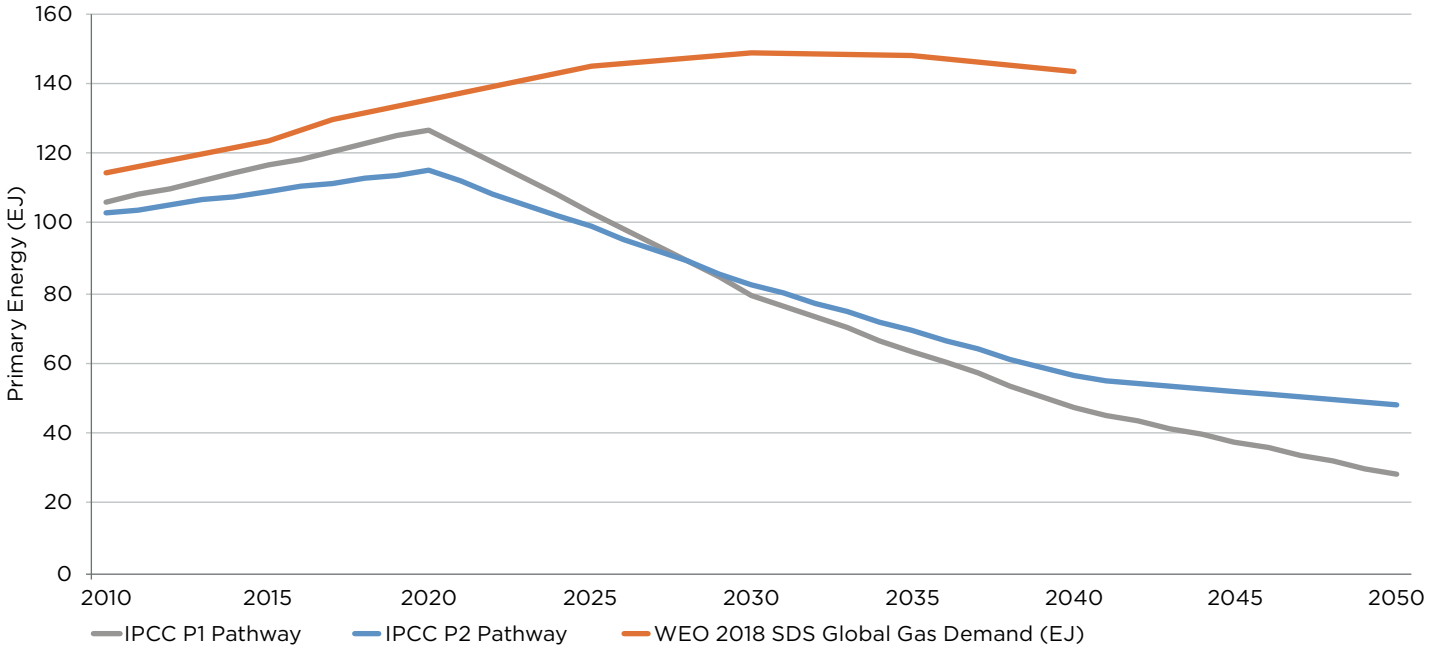
- The WEO's climate scenario, the Sustainable Development Scenario, is not fully aligned with the Paris Agreement goal of limiting warming to 1.5 degrees Celsius. Instead, it exhausts the 1.5°C budget by the early 2030s. The scenario provides a 50-50 chance of limiting warming to 1.7 to 1.8°C, with a heavy dependence on risky negative emissions technologies beyond the time horizon of the model. However, the less ambitious goal and the heavy reliance on these technologies enable the IEA to promote a massive expansion of fossil gas over the next few decades. This risky wager ignores that these technologies are unproven and may not effectively capture carbon or reverse temperature rise. Even if these technologies did work, they delay taking immediate action to reduce emissions, place an unfair economic burden on future generations, and would significantly increase food and water insecurity.

- Presenting gas as compatible with a decarbonized future is out-of-step with climate science, rapidly changing energy markets, and with the expectations of a growing number of stakeholders who rely on the WEO each year. More specifically, the IEA's use of fossil gas in its model breaks the carbon budget. The projections ignore not only the limitations of coal-to-gas switching, but also the rise of disruptive renewable energy and grid management technologies, as well as locking the world into future emissions from new gas infrastructure.

- The IEA is capable of reform. In the past it has shown leadership and created climate scenarios but these have not kept up with the latest science and politics. The agency can remain relevant by changing how WEO scenarios are produced. More specifically, it can
  1) Align the Sustainable Development Scenario with the Paris goal of limiting warming to 1.5°C and adopt a precautionary approach to the use of negative emissions technologies.
  2) Align IEA communications and policy recommendations on gas production and consumption with the implications of a fully Paris-aligned scenario (with a precautionary approach to negative emissions).
  3) Focus the WEO on a strengthened version of the Sustainable Development Scenario, instead of the business-as-usual path (New Policies Scenario) which ensures climate collapse.

THE 'GOLD STANDARD' OF ENERGY ANALYSIS

Figure 1: Global gas demand in the WEO 2018 SDS and the IPCC SR 1.5°C P1 and P2 illustrative pathways for global gas demand.



Sources: IPCC/IAMC 1.5°C Scenario Explorer and Data hosted by IIASA (Release 1.1); OCI analysis based on data from International Energy Agency's *World Energy Outlook 2018*

The International Energy Agency (IEA) is the world's most influential source of energy information. It describes its flagship publication, the World Energy Outlook (WEO), as the 'gold standard of energy analysis.'[1] The projections for energy demand contained in the WEO are used to help guide policy, infrastructure, and investment decisions by governments, investors, and energy companies globally.

The WEO's climate scenario, the Sustainable Development Scenario (SDS), calculates for a 50 percent chance of limiting warming to 1.7 to 1.8°C by 2100. The SDS is not aligned with the goals of the Paris Agreement, which strive to limit warming to 1.5°C. The SDS has the same emissions profile as the IEA's 450 Scenario from 2009, which gave a 50 percent chance of limiting warming to 2°C.

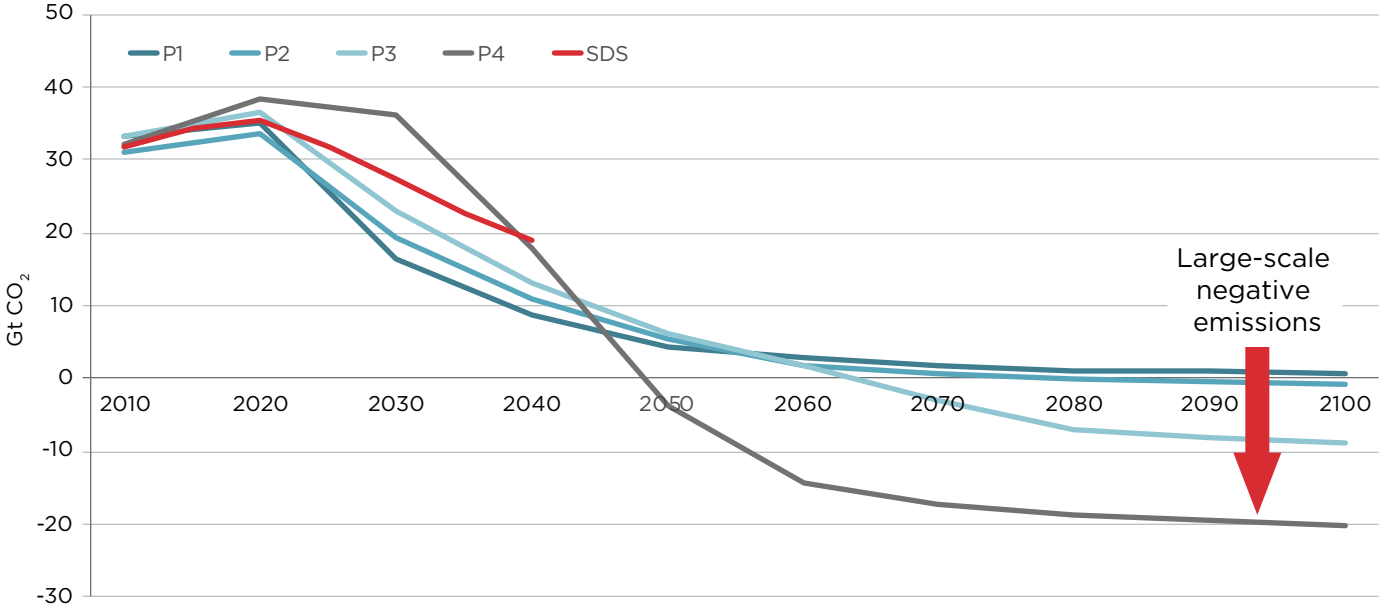
According to OCI analysis, fossil fuel demand in the SDS scenario will likely exhaust the 1.5°C budget in the early 2030s.[2] One reason why the IEA's climate scenario exhausts the carbon budget so quickly is that it models an increase in the demand for fossil gas. In the SDS, gas would be the single largest source of global emissions by 2040, just ahead of oil. Put another way, SDS projects that relative to 2017 levels, CO_2 emissions from coal fall by 73 percent, and oil by 39 percent in 2040, whereas CO_2 emissions from gas *increase* by 2 percent in 2040.[3] The IEA does not reconcile how this boom in gas is compatible with a transition away from all fossil fuels. To account for this, OCI analysis reveals that the only way that the SDS hits its warming targets is through large-scale deployment of negative emissions technologies (NETs) after 2040, when the SDS projections end. Meanwhile, the IEA's long track-record of under-predicting growth in renewable energy also increases the need for the use of NETs.[4]

The SDS trajectory for gas expansion is far out-of-step with the steady decline in demand for gas in the Intergovernmental Panel on Climate Change's (IPCC) illustrative pathways to 1.5°C that assume more precautionary levels of NETs (Figure 1). The IEA is making an implicit trade off: gas expansion over the next several decades requires future generations to pay for the carbon clean-up, or risks climate breakdown if carbon-removing technologies cannot be deployed or fail to work at scale.

Many climate scenarios rely on deploying massive levels of bioenergy with carbon

1 "World Energy Outlook: The gold standard of energy analysis," International Energy Agency, accessed 30 August 2019, https://www.iea.org/weo/.
2 The 2018 IPCC 1.5°C Special Report estimates the remaining carbon budget for a 50% chance of limiting warming to 1.5°C as 580 Gt (as of 1 Jan. 2018). That is for all emissions, including land-use and cement, whereas the IEA considers only fossil fuel emissions. If we subtract 2018 emissions (41.5 Gt CO_2) and an optimistic estimate of cumulative cement process emissions to 2100 (120 Gt CO_2, assuming annual emissions remain flat at around 1.5 Gt CO_2/y), while assuming zero net land-use emissions, that leaves 419 Gt CO_2 remaining for fossil fuels over the rest of this century. Applying a flat-line decline between available SDS data points, we find that SDS fossil fuel emissions would exceed that level by 2033. See: IPCC SR15, Chapter 2, Table 2.2 (carbon budgets); IEA, *World Energy Outlook 2018*, https://doi.org/10.1787/weo-2018-en, Annex A, World CO_2 emissions indicators (SDS CO_2 by fuel source); Corinne Le Quere et al., "Global Carbon Budget 2018," *Earth System Science Data*, 10, 2141-2194, 2018, https://doi.org/10.5194/essd-10-2141-2018 (2018 CO_2 emissions and annual CO_2 from cement).
3 In 2030, coal CO_2 emissions fall by 42% and oil by 16% while gas increases by 13%, all relative to 2017. See: WEO 2018, Annex A, p. 528-29.
4 Sandra Enkhardt and Becky Beetz, *IEA versus the reality of solar PV*, pv Magazine, 20 November 2018, https://www.pv-magazine.com/2018/11/20/iea-versus-solar-pv-reality/

Figure 2: CO_2 emissions from energy and industrial processes in the SDS and IPCC 1.5°C illustrative pathways.



Sources: IPCC/IAMC 1.5°C Scenario Explorer and Data hosted by IIASA (Release 1.1); OCI analysis based on data from International Energy Agency's *World Energy Outlook 2018*

capture and storage (BECCS), among other negative emissions technologies in order to still permit fossil fuel use and balance the carbon budget. Some scenarios rely on NETs at levels beyond what the IPCC indicates is reasonable given the significant social and ecological risks, and the governance challenges associated with their large-scale use.[5,6] The IPCC *Special Report on Global Warming of 1.5°C* (SR15) warns that heavy reliance on carbon dioxide removal is "a major risk in the ability to limit warming to 1.5°C," and that these technologies are "unproven" at scale.[7] The report contains four illustrative pathways that chart different ways of limiting warming to 1.5°C, with varying levels of NETs use. The P3 pathway relies on a level of BECCS that would consume a land area equivalent to 25-46 percent of all the world's arable and permanent crop land.[8] The P4 pathway would use 47-86 percent of the world's arable and permanent crop land for BECCS.[9] This is in contrast to the P1 and P2 pathways, which include NETs, but at much smaller levels.[10] Overlaying the SDS projection on these four illustrative pathways makes it apparent that the IEA's climate scenario falls between the P3 and P4 pathways in a 2040 timescale (Figure 2). In other words, the SDS has similar emissions levels to scenarios that use 25-86 percent of the world's arable and permanent cropland for BECCS.

The IEA's climate scenario, with its implied bet on NETs, carries with it a considerable risk that these technologies may simply not materialize, effectively sequester carbon, reverse temperature rise, or come at a reasonable cost. In doing so, the IEA invites the catastrophic consequences of unmitigated climate change. Even if no ecological tipping points were crossed, food and water security may be jeopardized. Moreover, NETs promote a delay in taking immediate action to reduce emissions, and in doing so, place an unfair burden on our children by having them pay to remove our greenhouse gas emissions.

5 This high dependence on BECCS would create acute food security trade-offs, as bioenergy crops compete with food for land and freshwater. It would also create significant governance challenges, as a global BECCS management system would have to built, implemented, and enforced. IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report, on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty, Section C.3.4, p. 17.

6 The SR15 database includes more than 200 scenarios that would lead to temperature rise in 2100 below-2°C (with 66% or higher probability) or 1.5°C (with low or no overshoot). However, only a small set of those scenarios aligns with IPCC estimates of the realistic potential of various negative emissions technologies in the year 2050. For example, the IPCC indicates that, in 2050, the feasible range for BECCS sequestration is between 0.5 to 5 Gt CO_2 (the midpoint being 2.75 Gt). Only 30 scenarios assume levels of BECCS sequestration in 2050 at or below that midpoint. See Greg Muttitt, The International Energy Agency and the Paris Goals: Q&A for Investors, Oil Change International and Greenpeace UK, January 2019, http://priceofoil.org/2019/02/07/the-international-energy-agency-and-the-paris-goals-qa-for-investors/, p. 6.

7 Joeri Rogelj et al., "Chapter 2: Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development," in: IPCC, 2018, in: *Global Warming of 1.5°C. An IPCC Special Report*, p. 96.

8 Pete Smith *et al*, "Biophysical and economic limits to negative CO_2 emissions," *Nature Climate Change*, 7 December, 2015, DOI: 10.1038/ NCLIMATE2870, p.5.

9 IPCC 2018, Summary for Policymakers, p.14

10 The cumulative CO_2 sequestered by BECCS by 2100 for the P1 pathway is zero $GtCO_2$, for the P2 pathway is 348 $GtCO_2$, for the P3 pathway is 687 $GtCO_2$ and for the P4 pathway is 1,218.$GtCO_2$. IPCC 2018, Summary for Policymakers, p.14.

WHY IS GAS A PROBLEM?

The IEA produced a special report ahead of the release of the 2019 WEO entitled *The Role of Gas in Today's Energy Transitions*.[11] The report is inconsistent in the way it addresses gas' place in the climate crisis; at first *The Role of Gas* exhibits caution about the long-term future of gas and its impotence as a climate solution. But the report proceeds to make a concerted pitch for increased gas consumption by insisting that it can reduce emissions. The analysis and policy recommendations in the report provide continued support for increasing gas production and consumption despite the clear risks as they relate to climate change.

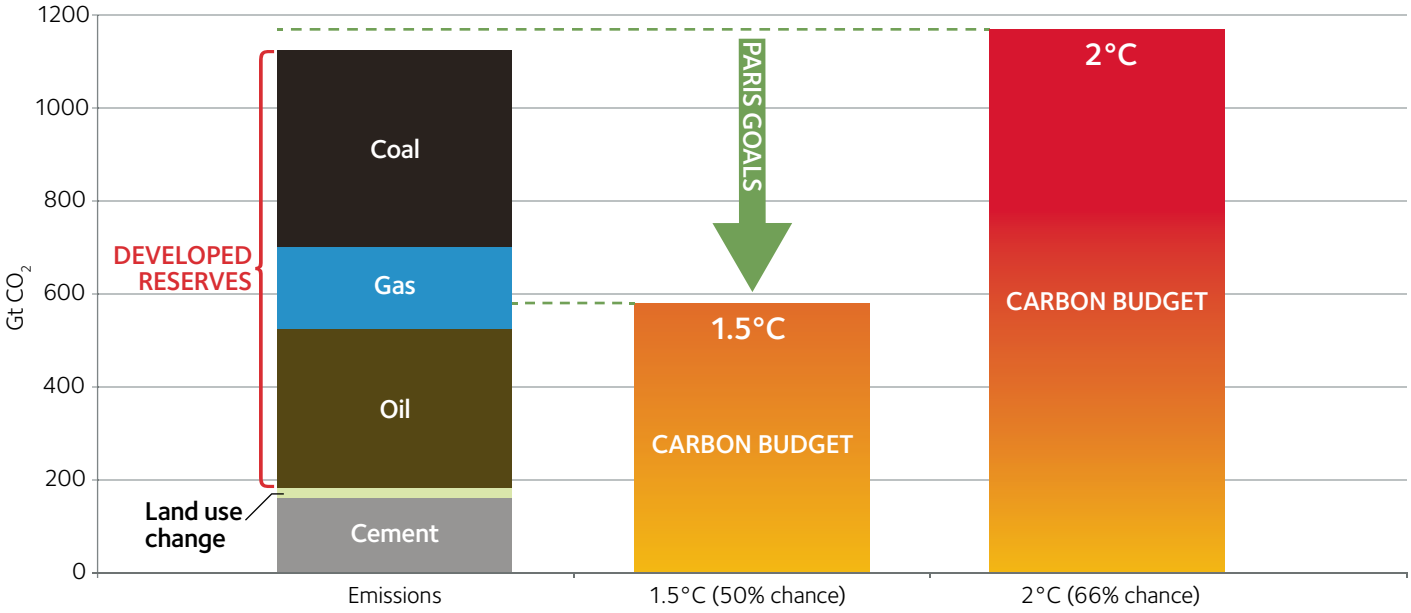
Figure 1 above shows that an energy transition which aligns with credible pathways to limit global heating to 1.5°C and uses credible levels of NETs requires less gas, not more. The IEA attempts to make the case that growing gas production and consumption can play a role in such an energy transition. But that case does not stand up to scrutiny. The following five points make clear that increasing the supply of and demand for gas plays no role in staying within a 1.5°C warming limit.

1) Gas breaks the carbon budget;
2) Coal-to-gas switching does not effectively cut emissions;
3) Low-cost renewables can displace coal and gas;
4) Gas is not essential for grid reliability, and;
5) New gas infrastructure locks in emissions.

GAS BREAKS THE CARBON BUDGET

Figure 3 shows how the economically recoverable oil, gas, and coal in the world's currently producing and under-construction extraction projects will warm the world far beyond a safe global average temperature. Further development of untapped gas reserves, including new shale wells, warms the atmosphere even further past the 1.5-degree goal of the Paris Agreement. Even if global coal use were phased out overnight, already-developed reserves of oil and gas would push the world above 1.5°C of warming.[13] There is simply no room for more gas in the carbon budget. The considerable pre-combustion emissions of supplying gas, primarily due to methane leakage, reinforce this case.

Figure 3: CO_2 from developed fossil fuel reserves, compared to carbon budgets within range of Paris Agreement goals.



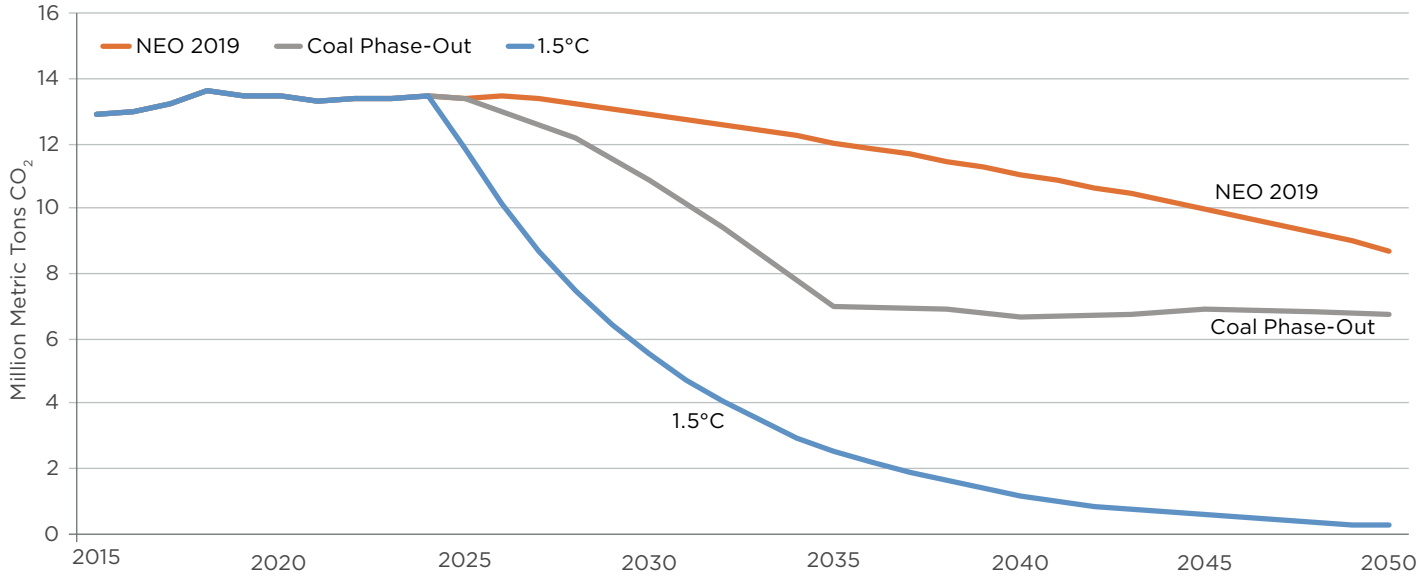
Source: OCI analysis based on figures from Rystad Energy, IEA, World Energy Council, IPCC

Box 1: The IEA Underestimates the Climate Impacts of Fossil Gas

Beyond these five points, the leakage of methane—the main component of fossil gas—is another crucial issue. The IEA's special report underestimates the leakage rate of methane and the impact that methane has on climate change, by lowballing the global warming potential of methane and relying on flawed U.S. government data.[12] Even if methane leakage was kept to a minimum, the following points make clear that gas is not clean, cheap, or necessary.

11 IEA, *The Role of Gas in Today's Energy Transitions*, International Energy Agency, July 2019, https://www.iea.org/publications/roleofgas/.
12 Lorne Stockman, *The IEA's Misplaced Techno-optimism*, Oil Change International, 12 August, 2019, http://priceofoil.org/2019/08/12/the-ieas-misplaced-techno-optimism/.
13 Note: This is accounting for hard-to-avoid land use and cement emissions.

Figure 4: Global power sector emissions in BNEF scenarios.



Source: Oil Change International analysis based on Bloomberg New Energy Finance, *New Energy Outlook 2019*

COAL-TO-GAS SWITCHING DOES NOT EFFECTIVELY CUT EMISSIONS

Climate goals require the energy sector to be largely decarbonized by mid-century. The IPCC's report on pathways to 1.5°C states that, "[s]ince the electricity sector is completely decarbonized by mid-century in 1.5°C pathways, electrification is the primary means to decarbonize energy end-use sectors."[14] This illustrates the importance of completely decarbonizing the power sector as quickly as possible.

Replacing coal plants with new gas plants will not cut emissions by nearly enough, even if methane leakage is kept to a minimum. Analysis from Bloomberg New Energy Finance (BNEF) found that in a scenario where coal is phased out and replaced with a combination of 70 percent new gas and 30 percent new renewables by 2035, power sector emissions would raise the global temperature to well above the 1.5°C target (Figure 4).[15] The analysis accounts for emissions from the power plant chimney stack only, excluding methane leakage and other process emissions. Therefore, full lifecycle emissions are higher than those accounted for. NEO 2019 is BNEF's reference case or business-as-usual scenario

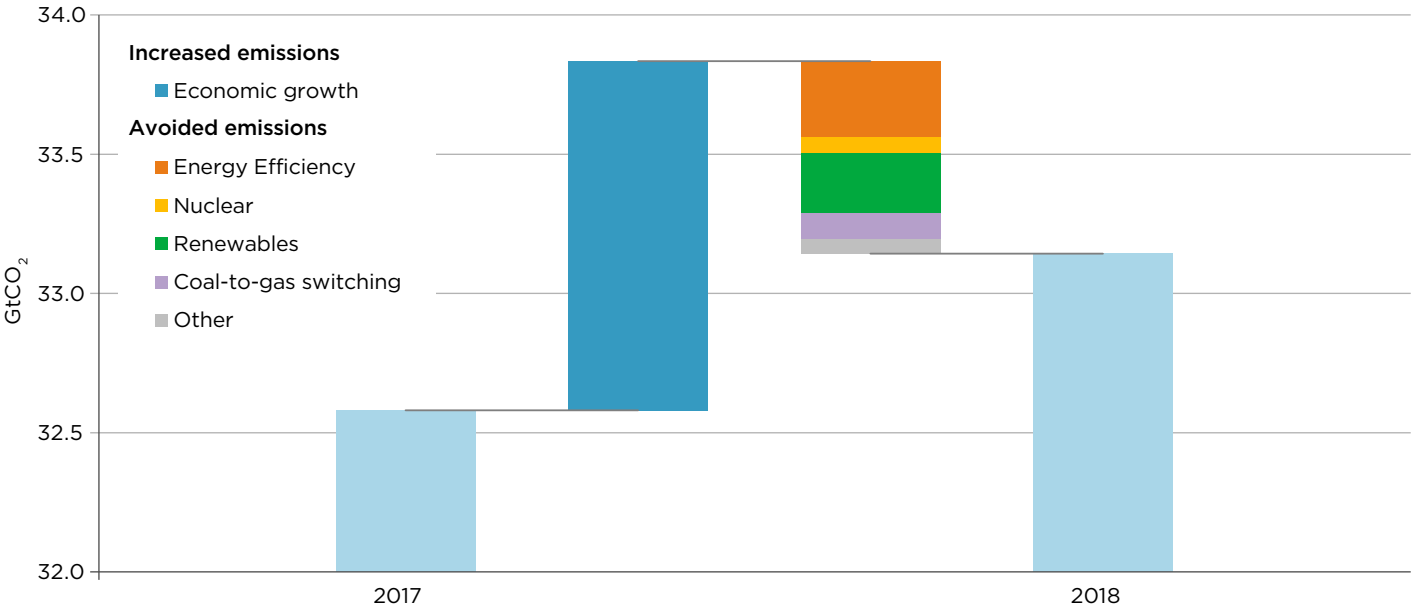
The IEA's special report on gas appears to agree that coal-to-gas switching is far from a silver bullet. The report states that "beating the most carbon-intensive fuel is not in itself a persuasive case for gas if there are lower emissions and lower-cost alternatives to both fuels."[16] The report goes on to warn that "the increased combustion of natural gas does not provide a long-term pathway to global climate objectives, so policy makers need to be wary about locking in gas-related emissions even as they reduce emissions from coal."[17]

Nonetheless, the IEA report advocates for policies to support coal-to-gas switching in the power sector. In particular, it suggests that carbon pricing could help increase the utilization of existing gas power plants, increasing gas consumption in the short- to medium-term. This plan entails a 12 percent increase in gas production,[18] which would require locking in billions of dollars of investment in gas extraction, pipelines, and LNG terminals.[19] This would further entrench gas supply, making it more difficult to close the gap in necessary power sector emissions reductions.

14 Joeri Rogelj et al., "Mitigation Pathways Compatible with 1.5°C in the Context of Sustainable Development," in IPCC, 2018.
15 Bloomberg New Energy Finance, New Energy Outlook 2019.
16 IEA *The Role of Gas*, p. 42.
17 Ibid
18 IEA *The Role of Gas*, p. 10.
19 Lorne Stockman, *The IEA's Plan to Increase Gas Consumption Locks In Climate Chaos*,' Oil Change International, 2 August, 2019, http://priceofoil.org/2019/08/02/the-ieas-plan-to-increase-gas-consumption-locks-in-climate-chaos/

Box 2: The Role of Gas in Reducing Emissions Is Far Smaller Than the Role of Renewables and Efficiency Improvements

Figure 5: Change in global energy related CO_2 emissions and avoided emissions, 2017-2018.



Source: International Energy Agency, *Global Energy and CO_2 Status Report 2018*

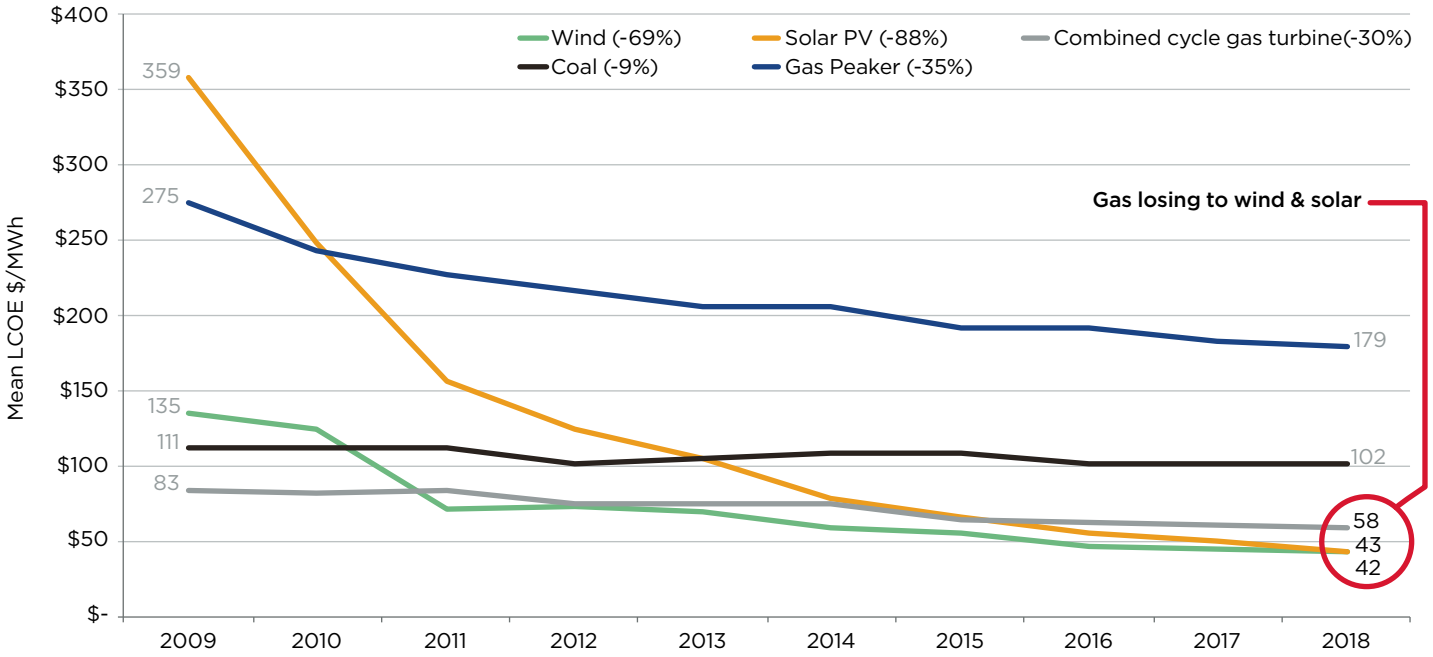
The IEA special report on gas provides a useful insight into the role of different energy sources and other factors in reducing CO_2 emissions. The report contains an analysis of emissions reductions compared to a baseline projection in 2010.

The analysis finds that emissions could have been 7 gigatons (Gt or billion metric tons) higher in 2018 if it were not for "changes in the global economic and energy system since 2010: these include reductions in the energy intensity of the world economy, in part due to greater efficiency, as well as reductions in the carbon intensity of the energy sector related to the rise of renewables and switching to less carbon-intensive fuels."[20] The stated emissions reductions from coal-to-gas switching between 2010 and 2018 was only 500 million tons of the total 7 Gt,[21] or about 7 percent of total reductions.

While global CO_2 emissions grew 1.7 percent year-on-year in 2018, the IEA itself has calculated that both renewables and energy efficiency play a far larger role than coal-to-gas switching in preventing even larger emissions increases. According to the IEA's *Global Energy and CO_2 Status Report 2018,* energy efficiency played the largest role in cutting emissions despite a slowdown in energy efficiency policy implementation. Renewable energy was listed as cutting 215 million tons compared to 95 million tons from coal-to-gas switching.[22] This is illustrated in the figure above, which is copied from the IEA report.

20 IEA, *The Role of Gas*, p. 8.
21 Ibid.
22 IEA, *Global Energy and CO_2 Status Report 2018,* International Energy Agency, March 2019, https://www.iea.org/geco/, pp. 8-9.

Figure 6: Wind and solar are cheaper than coal and gas: mean global levelized cost of energy for select technologies.



Source: Oil Change International analysis using Lazard 2018.[25]

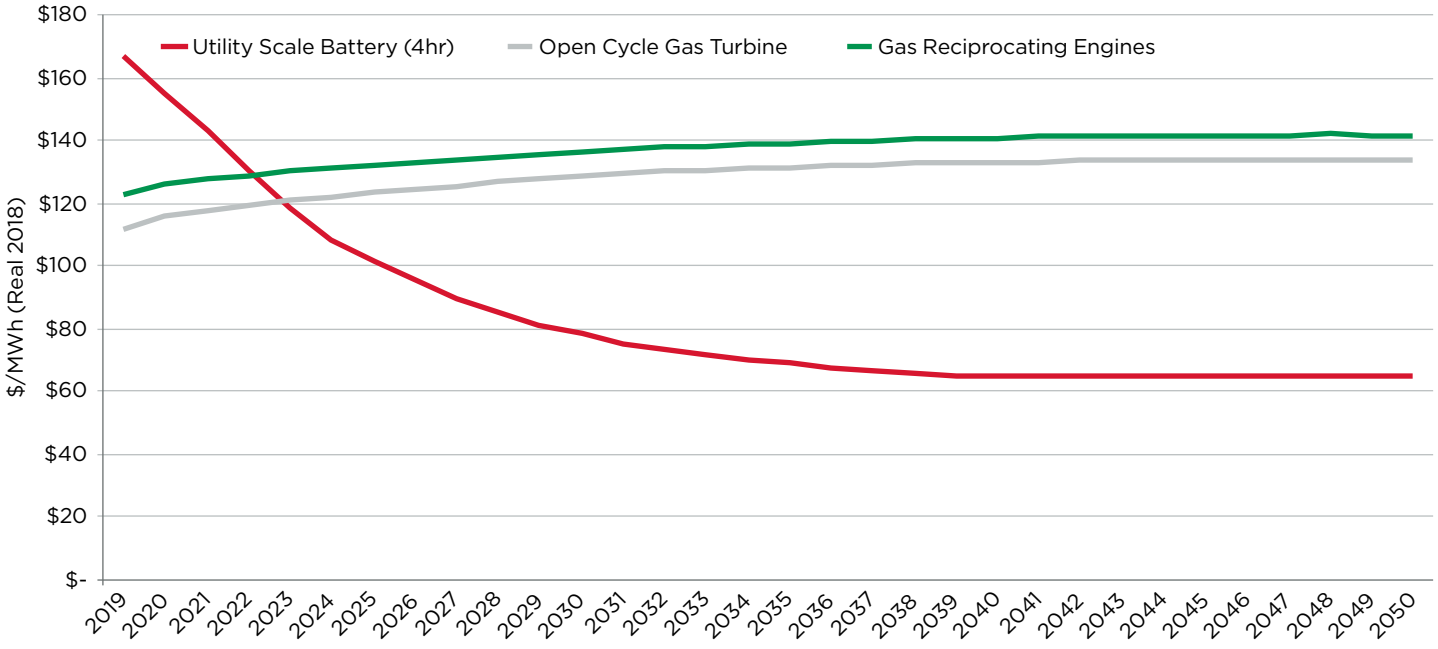
LOW-COST RENEWABLES CAN DISPLACE BOTH COAL AND GAS

The dramatic and ongoing cost declines for wind and solar disrupt the market justification for gas in the power sector (Figure 6). Wind and solar capacity is already cheaper to build and operate than coal and gas in most markets. As these technologies continue to gain from increasing economies of scale and implementation experience, the cost and performance of wind and solar power is only set to improve.[23] This means that renewable energy can and does replace coal as bulk generation while saving consumers' money, which is now happening in the U.S. and Europe.

The IEA's special report on gas confirms this trend and in several places warns that the economic case for building new gas plants is weak and increasingly threatened by cleaner and more affordable technologies.[24] As cost is clearly not a prohibitive factor to adding renewable generation capacity, whether to replace fossil fuel capacity or to meet rising energy demand, it is unclear why the IEA continues to advocate for increasing fossil gas consumption.

23 Bloomberg New Energy Finance, *New Energy Outlook 2019*, June 2019, https://about.bnef.com/new-energy-outlook/
24 IEA, *The Role of Gas*.
25 Lazard, Levelized Cost of Energy 2018, November 2018, https://www.lazard.com/perspective/levelized-cost-of-energy-and-levelized-cost-of-storage-2018/

Figure 7: Projected LCOE of battery storage and gas peakers - United States.



Source: Bloomberg New Energy Finance, 1H-2019 LCOE Update.

GAS IS NOT ESSENTIAL FOR GRID RELIABILITY

Wind and solar require balancing, but gas is not the best resource available for doing so. Battery storage is fast becoming economically competitive with gas plants designed for this purpose, known as peakers (Figure 7). Wind and solar plants that are coupled with battery storage are also becoming a competitive dispatchable source of energy, with faster response times than gas peakers.

Managing high levels of wind and solar on the grid requires optimizing a wide range of technologies and solutions, including battery storage, demand response, and transmission.[26] There is no reason to favor gas as the primary solution. Addressing seasonal or longer duration periods of low renewable energy availability may be the final piece in the clean energy puzzle. Even if gas may be needed as an occasional backup power source, such limited demand provides no justification for increasing gas production.

NEW GAS INFRASTRUCTURE LOCKS IN EMISSIONS

The IEA is well aware of the dangers of carbon lock-in. In its 2019 special report on the role of gas in energy transitions, it warned policymakers about locking in the greenhouse gas emissions made inevitable by additional gas infrastructure.[27] Despite this, the IEA's so-called Sustainable Development Scenario foresees an expansion of fossil gas in the short-to medium-term, which would risk locking in emissions for the long-term even as the economic case for gas increasingly erodes.

Multibillion-dollar gas infrastructure built today is designed to operate for decades to come. Gas infrastructure is capital intensive and requires long periods of operation to return investment. Once capital has been sunk, operation is meant to continue as long as revenues exceed marginal operating costs. Given the barriers to closing down infrastructure ahead of its expected economic lifespan, it is critical to stop building new gas projects, whose full lifetime emissions would not fit within Paris-aligned carbon budgets.

26 European Climate Foundation, *Towards Fossil-Free Energy in 2050*, Cambridge Econometrics and Element Energy, March 2019, https://europeanclimate.org/wp-content/uploads/2019/03/Towards-Fossil-Free-Energy-in-2050.pdf
27 IEA, The Role of Gas, p. 42.

WEO MUST BE REFORMED

The IEA is currently the most influential authority on energy in the world; however, that reputation and relevance is in danger. Through its promotion of fossil gas, it guides energy decision-makers towards an increasingly risky investment. Moreover, for those who continue to rely on the WEO, the IEA risks derailing climate progress by steering countries and investors towards a hothouse world with growing gas demand and diminishing profitability. In the meantime, future generations are unjustly left with the costs of cleaning up this additional pollution from fossil gas.

The WEO's fixation on gas prevents users from realizing the limitations of coal-to-gas switching and the dangers of carbon lock-in. In its promotion of gas, the IEA does not consider the highly disruptive technological change underway with renewables and grid management, and the unacceptable risks of relying on unproven technologies to remove emissions well beyond the time horizon of WEO scenarios.

The IEA has demonstrated its capacity for reform in the past. It has the opportunity to rise to the challenge of guiding the world to a more secure and sustainable energy future. It can remain relevant by changing how WEO scenarios are produced. More specifically, it can

1) **Align the Sustainable Development Scenario with the Paris goal of limiting warming to 1.5°C and adopt a precautionary approach to the use of negative emissions technologies.**
2) **Align IEA communications and policy recommendations on gas production and consumption with the implications of a fully Paris-aligned scenario (with a precautionary approach to negative emissions).**
3) **Focus the WEO on a strengthened version of the Sustainable Development Scenario, instead of the business-as-usual New Policies Scenario.**

These enhancements to the WEO would generate many benefits. It would map out for a world with less transition risk, and fewer physical, social, and economic risks from climate change by avoiding dangerous overshoot, reducing the demand for all fossil fuels, and encouraging a rapid deployment of renewables and energy efficiency. These reforms reflect the expectations of a growing number of IEA member countries, investors, and energy experts. Following these recommendations would also help ensure that the IEA remains relevant as the world moves to rapidly transition away from fossil fuel dependence.

OILCHANGE INTERNATIONAL

Oil Change International is a research, communications, and advocacy organization focused on exposing the true costs of fossil fuels and facilitating the coming transition towards clean energy.

This briefing is endorsed by 350.org, Center for Biological Diversity, Earthworks, Friends of the Earth Europe, Global Witness, Greenpeace USA, Rainforest Action Network, Sierra Club, and urgewald.

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To learn more about the gas 'bridge fuel' myth, download the full report at: priceofoil.org/gas

To learn more about the need for IEA scenario reform, download our *Off Track* report at: priceofoil.org/2018/04/04/off-track-the-iea-and-climate-change

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