

# COLUMBIA GLOBAL ENERGY DIALOGUE

## NATURAL GAS FLARING WORKSHOP SUMMARY

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### Executive Summary

The rapid expansion in tight oil production with its associated natural gas has made the United States the fourth largest source of flared gas in the world. The waste, emissions, and pollution caused by this flaring threatens not only the environment and human health but, ultimately, the license to operate for oil and natural gas companies. Responding effectively to the challenge of flaring requires technically and economically sound solutions that also enjoy political credibility and support. To be most credible, solutions for flaring need to be developed through open and transparent processes that provide for candid and constructive engagement by a diverse group of stakeholders.

In January 2020, Columbia University's Center on Global Energy Policy and the Energy Institute of the University of Texas at Austin gathered senior executives from the US oil and natural gas industry; current and former state government regulators; technical, market, and academic experts; and non-governmental organization (NGO) representatives with expertise in this topic for a workshop under the Chatham House Rule to discuss challenges and potential solutions to gas flaring, primarily in the Permian Basin. The gas flaring workshop focused on trends in gas flaring and greenhouse gas emissions in the United States, flaring and public policy, the disconnect between production growth and midstream infrastructure capacity, best practices and technological solutions for minimizing flaring, and regulatory and other solutions.



Participants identified challenges to tackling flaring in the Permian, including poor data quality, the disconnect between the start of associated gas production and the availability of pipelines and other takeaway capacity, and the competition gas faces in the important Texas and California markets from lower-emission energy sources, and from coal in Texas. Participants also discussed potential solutions to these and other Permian flaring challenges. While not all solutions had consensus support, the following is a brief summary of some of the suggestions discussed:

- **Best practices.** There was general agreement that the industry should demonstrate leadership in developing best practices for reducing gas flaring, and they should be shared with operators across the industry. Several participants referenced best practices established under the Methane Guiding Principles initiative as an appropriate model for this activity.
- **Flaring data.** New technologies such as drone, aircraft, and satellite imaging can provide better flaring data that can be used to hold specific Permian operators accountable for their performance. Industry leaders could work with the states to make flaring data more transparent, accurate, and accessible to the public. There was general agreement among participants that this is an important solution.
- **Greater use of natural gas with existing technology.** Gas from the Permian Basin can be used either for additional LNG exports from the U.S. or for local power generation.
- **New uses and storage options.** New technologies offer potential new uses for associated gas, such as enhanced oil recovery and mobile LNG to replace Permian diesel use, drive field turbines, generate power, or be used as marine fuel to reduce flaring. Permian reservoirs can temporarily store gas, although delays in selling the gas would hurt the economics of a project.
- **Regulation.** The ability to flare liberally reduces the economic incentives for producers to invest in the infrastructure required to process and ship associated gas. Thus, regulation may be necessary to constrain flaring. Any regulations put in place to reduce flaring will work best if they build on what the industry is already doing.
- **Performance-based targets.** Motivated oil and gas companies could take a leadership role and develop performance-based targets to voluntarily improve the industry's flaring performance today, which could possibly become part of state regulation at some point.
- **Internalizing the cost of surplus gas disposal.** Internalizing the cost of flaring would incentivize companies to curtail or end the practice, in the same way they internalize the costs of wastewater they produce. Companies could be required to commit to takeaway gas infrastructure before wells can be brought online. Taxing flared gas would create an economic incentive for companies to invest in equipment and infrastructure to avoid flaring. Many participants noted flaring should not be the lowest cost means of dealing with surplus gas.

- **Better coordination with midstream infrastructure.** Producers could extend production plans out for a longer period (e.g., five years or more) and communicate them to midstream providers. Upstream companies could commit to firm transportation plans that could then be used to underwrite new gas infrastructure investment.
- **Pipeline permitting.** Several producers suggested that permitting of pipelines could be streamlined, as could resolving issues around eminent domain to speed up pipeline additions.
- **Oil and gas companies should work more actively with other stakeholders on a transparent process to reduce gas flaring.** The industry also needs to show significant progress over the next one to two years to be credible.

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## Introduction

This document summarizes the proceedings and findings from a workshop on gas flaring that Columbia University's Center on Global Energy Policy and the Energy Institute at the University of Texas at Austin jointly sponsored at the University of Texas campus on January 30, 2020. The workshop addressed challenges and potential solutions to gas flaring, primarily in the Permian Basin. Attendees of this invitation-only workshop were senior executives from the exploration and production and midstream sectors of the US oil and natural gas industry; present and former state government regulators; technical, market, and academic experts; and nongovernmental organization (NGO) representatives with expertise in this topic. All the views provided in this report were expressed by one or more of the participants at the workshop.

This workshop was held under the Chatham House Rule. While participants are free to use the information received, neither the identity nor the affiliation of the speaker(s), nor that of any other participant, may be revealed. Thus, this report does not reveal any participant or speaker but rather indicates the type of organization the information came from (e.g., oil and gas company, NGO, consultant). Since the workshop, COVID-19 and the oil price collapse have substantially lowered the near-term oil production outlook in the Permian Basin as well as reduced the prospects for gas flaring. However, when the market eventually stabilizes, gas flaring in the Permian Basin will resume its growth unless something is done to stop it.

## Reasons for the Workshop

The United States is the fourth largest flarer of natural gas in the world in terms of volume behind Russia, Iran, and Iraq. The US flares about 1-1.5 percent of its produced gas, accounting for about 11 percent of global flaring. Flaring in the US has been rising rapidly in recent years with the expansion of US tight oil production, particularly in the Permian Basin, which has a significant component of associated natural gas.

Flaring has numerous negative implications. Globally, flaring results in more than 350 million tons of CO<sub>2</sub> equivalent emissions every year; in addition, methane is emitted from inefficient or unlit flares. Flaring wastes a valuable resource and creates local pollution. Flaring is highly visible and receives a great deal of media attention, and it raises questions regarding the oil and natural gas industry's "license to operate"—namely, the public's tolerance for continued development activity by the industry. The investor community is increasing its focus on environmental, social, and governance issues pertaining to the oil and gas industry. Thus, flaring could affect the industry's access to and cost of capital. Flaring also calls into question the role of natural gas in decarbonization of the world's energy systems, as consumers and governments are becoming more focused on the carbon footprint of their energy supplies.

Responding effectively to the challenge of flaring requires not only technically sound and economically effective solutions but also solutions that enjoy political credibility and support. To be most credible, solutions for flaring need to be developed through open and transparent processes that provide for candid and constructive engagement by a diverse group of stakeholders. This workshop was an attempt to bring together a diverse set of actors in this spirit.

In terms of greenhouse gas emissions, venting and fugitive methane emissions are larger

issues than flaring. Thus, they also deserve considerable attention. However, this workshop focused on flaring because it is highly visible to the public, is garnering media attention, and is giving the US oil and gas industry a black eye, in the words of one of the producers who attended the workshop. Flaring is often an intentional decision by producers rather than a unintentional circumstance like methane leakage. Flaring is viewed by many industry and environmental experts, and some regulators, as a solvable problem that should be addressed.

## **Trends in Gas Flaring**

Flaring in the US has been rising steadily in recent years with the expansion of Permian Basin oil production and the production of large volumes of associated gas. Between 2017 and 2018, the volume of natural gas flared in the US rose by 48 percent, accounting for the lion's share of the increase in gas flared globally. US tight oil production rose by 31 percent during the same period. In 2019, the United States accounted for about 1.6 billion cubic feet per day of the estimated 14.3 billion cubic feet per day flared globally. Close to half of US flared gas was in Texas, although flaring is also an issue in North Dakota and New Mexico.

The rise in flaring in the Permian Basin has been driven by the dramatic resurgence in US oil production. At the time of our workshop, 4.8 million barrels per day of oil and 17 billion cubic feet of natural gas were being produced in the Permian Basin, including natural gas liquids (NGLs), 8 million barrels of oil equivalent per day was being produced in the Permian Basin, making it the largest oil-producing basin in the world. It has provided the United States and world with affordable energy and provided a substantial number of jobs and considerable tax revenues to the producing states. A producer indicated that even though oil production growth has probably slowed to between 300,000–500,000 barrels per day per year, there may still be a rise in flaring in the Permian Basin. Gas production in the Permian Basin will continue to grow both with oil production and as natural gas-to-oil ratios increase as previously drilled wells mature. Natural gas pipelines will need to be added every two years to prevent increased flaring. (It is important to note the discussion took place during the early stages of COVID-19 and before the oil price war ensued, events that will temporarily slow Permian production growth rates even further, slowing down any increase in flaring. However, when oil prices are restored to a more typical level, production growth accompanied by gas flaring is likely to increase.)

The workshop focused on flaring increases in the Permian Basin, reflecting the interests of the attendees. One consultant indicated that Permian gas flaring has averaged about 800 million cubic feet per day, or an average of about 6 percent of gross gas production. They also indicated that flaring intensity varies across the Permian Basin with the Midland North and Delaware Basins on the high side and the Midland South and New Mexico Delaware Basins on the low side of the average. There tends to be more flaring in new areas under development with limited infrastructure.

One academic noted that data reported to the US Environmental Protection Agency indicates that a small number of associated gas flares account for more than half of flared gas volumes in the United States. This indicates that the average flaring volume would be greatly reduced if the problem spots were fixed.

A consultant also showed Permian flared gas and flaring intensity by operator. There was a wide range around the 6.1 percent average flared gas to gross gas production ratio in 2019. Some large producers in the region had significantly lower flaring intensity than the average, with a number of companies having flaring intensities closer to 1 percent. Larger companies tended to have a smaller percent of their gas production flared than smaller companies.

Wellhead gas flaring was shown to be by far the most CO<sub>2</sub> intensive upstream activity in the Permian Basin, compared with pressure pumping and trucking of crude, sand, and water. A consultant indicated that CO<sub>2</sub> emissions intensity is set to decline naturally in the Permian Basin as production growth slows and more infrastructure is added. However, without any change in behavior, flaring volumes will likely increase in the Permian Basin with oil production growth and with the gas-to-oil ratio increasing in older wells.

Flaring also occurs at gas processing plants and compressor stations. About 170 million cubic feet a day of gas has been flared since 2018's fourth quarter in Permian gas processing plants.

### More Accurate Data on Flaring Is Needed

Many participants across the various groups attending agreed that more accurate, standardized, and timely reporting of flaring data is needed. The volume of gas flared changes quickly with growth in oil and gas production and the start-up of new infrastructure to deliver gas to markets. Without real-time data, companies cannot fix problems quickly, and the Texas data is reported to come in two to three months late.

One participant made the point that companies cannot be made fully accountable for flaring if it is underreported or unreported.

It was noted that National Oceanic and Atmospheric Administration (NOAA) satellite data systematically indicates a greater volume of flaring than the data collected by states and the US Energy Information Administration (EIA). In 2017, for example, the NOAA data for Texas, New Mexico, and North Dakota was about 55 percent higher than the EIA data. The larger companies were believed to generally report accurately, while a significant number of small producers don't report flaring at all.

Participants believed that the delay in the data and the absence of small producer data require adjustments that degrade the quality of the data.

Several participants indicated that it is currently difficult to access Texas flaring data, as it is not organized in a user-friendly way and is currently stored on a 40-year-old mainframe computer.

Another issue raised with the data reported to the state in Texas is that it currently does not separate flaring from venting. They are reported separately in New Mexico.

The technology for collecting flaring and methane emissions data has greatly improved in recent years. One aerospace company indicated that it employs sensor pods on light aircraft, allowing it to image and quantify methane from three thousand feet. Satellite imaging is also being deployed to more accurately measure flaring. For example, NOAA processes near-infrared satellite images to estimate flared volumes.

With improved technology for collecting data, it will soon be easy for third parties to access the data and call for better performance by operators. The higher visibility of the data will also politicize flaring to a greater degree going forward.

## Flaring and Public Policy

### Growing Recognition of the Need for More Ambitious Climate Policy

One presentation at the workshop described the recent World Economic Forum in Davos, Switzerland, and how it demonstrated a sense of urgency among the broader business and financial communities, and among activists, about making progress on reducing greenhouse gas emissions. Little progress has been made in addressing climate change despite the sharp drop in the cost of renewables. Globally, the demand for oil and coal continues to rise, mostly in developing countries.

The same presentation indicated that there is a growing recognition for the need for more ambitious climate policy. The frustration about the lack of progress the oil and gas industry has made on climate issues is leading to calls for extreme actions in the US, such as a moratorium on new oil and gas leases on federal land or fracking bans. Combined with the federal pendulum swinging against regulation, there is likely to be a regulatory backlash perhaps at the state and local levels, depending on the outcome of the 2020 presidential election.

Furthermore, one requirement to head off a regulatory backlash against oil and gas production in the United States would be for the oil and gas industry to show leadership on issues like gas flaring. The industry can demonstrate leadership by improving the data collected on methane emissions and flaring and developing and sharing best practices to reduce them. The oil and gas industry also needs to show significant progress on reducing flaring and methane emissions to convince policy makers and the public that voluntary solutions can work.

Even without national or international policy on carbon prices, participants observed that capital markets are creating surrogate carbon pricing by allocating capital to more environmentally sustainable investments and away from fossil fuels. Financial investors are raising the cost of capital for the entire energy industry and fossil fuels in particular, which is akin to a price on carbon. For example, Blackrock's CEO, Larry Fink, stated in a letter to clients that climate change concerns are driving a profound reassessment of risk and asset values in the financial community. He stated, "In the near future—and sooner than most anticipate—there will be a significant reallocation of capital."<sup>1</sup>

### Threats to Social License to Operate

Social and political acceptance of flaring is changing, even in Texas. One participant from the midstream sector indicated that the type of local opposition to production observed in Colorado would likely come to Texas. Landowners in certain parts of Texas are already searching for endangered species to stop pipeline projects. There is also a greater focus on local health effects of flaring and issues surrounding lighting the night sky.

One participant noted that the flaring of gas is becoming a symbol to the public of a



wasteful and polluting oil and gas industry. The industry is also viewed by the public as being monolithic. Those few companies that try to reduce flaring won't get credit for it among the local stakeholders unless the entire industry changes.

Consumers can also show their displeasure with products or companies using social media and boycotts. One recent example of this is the taboo on single-use plastics due to their environmental effect in oceans. Governments can also require that products entering their borders have a low-carbon footprint.

The industry image was noted to be important in terms of attracting the best students to study oil and gas at universities and have them enter oil and gas companies. Applications for petroleum engineering have fallen by 75 percent in the last five years. Students express the desire to go into green and high-tech businesses. It would be a more appealing story to prospective workers if the industry were to announce and follow through on stringent targets to reduce gas flaring.

### Strategy for Reducing Flaring in Texas

One participant reminded the group that 70 years ago, regulators in Texas aggressively phased out the flaring of gas. Today there is an even greater need to do so. There have been enormous economic benefits from the miraculous production growth. However, there have also been growing pains in terms of lagging regional infrastructure and local effects such as traffic fatalities. By now, what was once called *unconventional* oil and gas production in the United States should be viewed as *conventional* production, and there needs to be a change in the lax regulatory and operational attitude toward it.

Views were shared on the characteristics of an effective process to phase out gas flaring in Texas. Regulatory officials (in Texas, both the Railroad Commission and the Texas Commission on Environmental Quality) need to develop clear phaseout objectives. For example, it should include a quantitative drop in flaring (e.g., 80 percent) and a time period for accomplishing it (e.g., 42 months). There should also be rigorous criteria for when flaring rule exemptions should be allowed. For example, it should be shown why drilling cannot be delayed until infrastructure is available. If infrastructure is unavailable, the state should determine whether the operator has made a financial commitment to adding infrastructure. Operators should also be required to show that they could not use the gas on site for field purposes. The view was expressed that actions should not be based on industry or company profitability. The analogy was made that you don't stop wearing safety glasses at work based on profitability.

It was also stated that the industry should play a role as experts on technology and operations rather than playing an advocacy role in the process. Universities with technical and legal expertise should also be engaged. Developing a regulatory framework could take six to eight months.

Some participants asserted that a consensus process should be avoided because it would result in an inadequate "lowest common denominator" solution. It was also deemed important that there be a level playing field among operators. Operators who are proactive in investing to reduce flaring should not be penalized by letting smaller companies off the hook.

Operators in the top decile who have invested in technologies and have a good track record of reducing flaring should also be given priority in the exemption process to permit flaring.

## The Role of Natural Gas in the Energy Transition

Participants reached no agreement about the role for natural gas in the energy transition. One view was that the role of natural gas is increasingly being questioned by policy makers in the developed world, with some states and cities in the US going as far as banning new gas hookups and gas pipelines. Other government entities including the European Union are considering regulating the carbon content of oil and gas that enter their borders. Some policy makers are losing interest in increasing the use of natural gas in the power sector because costs have fallen considerably for renewable power sources, and there are rising climate concerns about fugitive methane emissions and flaring and venting of methane. Many policy makers are viewing the role for gas to be smaller in the energy transition than was thought a decade ago. Part of that change in sentiment is due to the lack of progress in reducing greenhouse gas emissions and concern about adding gas-related infrastructure that might not be desirable in a decade. An NGO participant added that natural gas will only have a future if methane emissions are dealt with and carbon capture is available by 2030.

In contrast, the case was made that US LNG exports are a great opportunity to reduce gas flaring in the United States, while also reducing greenhouse gas emissions internationally by replacing coal in the power sector. It was deemed possible that the United States could eventually export 200 million tons of LNG, which is four times what the nation is exporting today. One participant indicated that replacing coal internationally could reduce CO<sub>2</sub> emissions by one gigaton. In its reference or Stated Policies Scenario, the International Energy Agency projects that global natural gas demand will increase 20 percent by 2030. That could double the size of the LNG market. There is rising international demand for natural gas in developing countries to replace fuels that generate local pollution.

The question was raised about the greenhouse gas emissions footprint of LNG given that it is more energy intensive and could have methane leakage issues. Several participants asserted that there isn't sufficient data to be able to quantify LNG's emission footprint. One also needs to take into account what fuel the imported LNG will replace.

The concern was also raised that the US should not be seeking additional natural gas demand just to reduce flaring. A more appropriate energy policy should be to deliver the lowest cost energy possible while accounting for the social cost. One participant stated that a carbon price rather than tax credits or feed-in tariffs that specifically benefit renewable technologies was the best way to level the playing field for different power generation technologies.

*Differentiation of natural gas by emissions profile*—Several participants indicated that the greenhouse gas footprint of natural gas will increasingly matter to investors as well as customers. The United States is on the cusp of obtaining and disseminating much better data on flaring and methane emissions. The Environmental Defense Fund will likely launch a satellite for tracking methane emissions in 2022 with data available in 2023. It is also looking at unlit and malfunctioning flares in the Permian Basin. NASA's Jet Propulsion Laboratory is collecting data on emissions from flares. Both of these sources will allow investors to assess

the environmental footprints of producers. There was agreement among several participants that whatever environmental, social, and governance pressure is currently being applied to producers, the situation is about to get much worse.

Another participant indicated that there is an emerging market for differentiated gas based on the enhanced availability of data by well and company. They envisioned the development of bilateral contracts for low emissions gas. The European Union is trying to get to zero greenhouse gas emissions by 2050. It is considering an emissions standard for natural gas purchased both within Europe and for imports from other regions. If the US doesn't reduce flaring and methane emissions, this could hamper the ability to sell US natural gas to Europe. From a policy standpoint, differentiated low emissions gas needs to be supported by harmonization of standards globally that allow low emissions gas to be sold at a premium to high emissions gas. The premium would pay for the investments required to reduce the emissions profile of the gas.

## Causes of Natural Gas Flaring

One participant indicated that there are several reasons why natural gas is flared:

- Flaring may be needed for safety reasons at wells and gas-processing facilities during activities such as well completion (making a well ready for production), routine and nonroutine maintenance, and emergency shutdowns.
- Flaring may be used as a routine emission control to control some types of emissions that might otherwise be vented and released into the atmosphere.
- Flaring may be needed because more gas is produced than can be used. This may be for a number of reasons, including lack of infrastructure for gathering or shipping gas, oversupplies and pressure imbalances, equipment being temporarily shut down, and NGL pooling. Even if there is infrastructure for gathering gases, the initial, high-pressure, high-flow production from new wells can overwhelm gathering systems, and the excess gas may be flared. Condensate forming in gathering lines can also lead to flaring.

This workshop focused on discretionary causes of flaring. There was general agreement that the main causes of discretionary gas flaring are insufficient midstream natural gas infrastructure relative to gas production and insufficient local demand to absorb the production. Given concerns about the role of natural gas in the energy transition, it is not obvious whether policy makers should view the solution as the need to slow down gas and therefore oil production growth or to add gas infrastructure and increase local gas demand. The discussion at the meeting focused on adding infrastructure and LNG exports and finding other uses for gas.

### Insufficient Midstream Gas Infrastructure

An oil and gas expert presented views of Permian crude production and the development of infrastructure to support it. Today, US crude, natural gas, and NGL markets balance only because of increasing dependence on exports. The US exports 25 percent of crude production, 15 percent of natural gas production, and 40 percent of NGL production. While

exports are considered to be the safety net for oversupply, it may require lower domestic prices to justify the extra cost of exporting.

Permian crude oil production is expected to rise significantly from today's level regardless of whether one uses a conservative or aggressive projection. Permian crude oil production is expected to rise from nearly five million barrels per day to about seven million barrels per day in the base case for 2025, which is based on a \$55 per barrel oil price. (The first quarter 2020 oil price collapse, which occurred after the workshop, will likely slow this growth.) In the low and high cases, based on \$10 per barrel lower or higher oil prices, production should grow to six to eight million barrels per day, respectively. There are significant differences between growth in the various subregions of the Permian Basin. The biggest oil production growth is expected in Texas's Delaware West region and in the Delaware Basin in New Mexico. With the new and expected pipeline additions, there is likely to be sufficient oil infrastructure to deliver the crude oil to markets, and the discounts on Permian crude oil prices to oil price markers in the Gulf Coast will shrink.

Gross natural gas production in the Permian Basin is currently about 17 billion cubic feet per day, and about 70 percent in 2019 is associated with oil production. Growth through 2025 ranges from about 2.5 billion cubic feet per day in the low case, to 6 billion cubic feet per day in the middle case, to 9 billion cubic feet per day in the high case. Growth in natural gas production is not expected to slow as much as in crude oil production because the existing wells are becoming more gassy as they mature and companies are drilling in gassier areas. Growth rates are more a function of oil prices than gas prices.

Gas production growth in the middle case would require the addition of a two billion cubic feet per day pipeline every other year. Natural gas pipeline capacity satisfied demand toward the end of 2019 after Kinder Morgan's Gulf Coast Express pipeline came on line. However, that pipeline was filled up immediately, and there is currently a shortage of pipelines in 2020 with the next tranche of pipeline capacity not coming online until the second half of 2021. In the middle forecast case, pipeline capacity will become short again in the 2024-2025 time period. While there has been significant pipeline capacity added to take gas to Mexico, there are delays in finishing the pipes on the Mexican side of the border and in the development of gas demand associated with fuel switching to gas in the power sector. New gas pipelines will relieve the capacity shortages only if they come online as projected.

An oil and gas expert noted that insufficient gas pipeline takeaway capacity out of the Permian Basin results in low natural gas prices at the Waha regional hub relative to Henry Hub prices. Waha gas prices average under one dollar per million British thermal units (Btus) and sometimes go negative when there isn't sufficient pipeline capacity to move gas out of the Permian Basin. Stated as a basis to Henry Hub, when the Gulf Coast Express pipeline came on, Waha gas prices were one dollar per million Btus below Henry Hub gas prices. When the Gulf Coast Express's pipeline capacity is fully absorbed, Waha gas prices will trade two to three dollars per million Btus under Henry Hub until Kinder Morgan's Permian Highway gas pipeline comes online in the second half of 2021. The discount for Waha gas prices will then fall to 50 cents to one dollar per million Btus until the next pipeline is needed.

The forward price for Henry Hub natural gas prices was around \$2.50 per million Btus at the

time of the workshop. This price is highly dependent on whether US LNG export facilities come online as planned.

The oil and gas market expert also indicated that there has been a sharp rise in production of NGLs in the United States along with unconventional oil production. US NGL production from processing plants rose from under three million barrels per day in 2014 to over five million barrels per day today. As a result, the United States is now exporting about 40 percent of its NGL supply to balance the domestic NGL market. NGL prices in the United States over the next five years are likely to remain relatively flat. However, that flat price expectation depends on international markets absorbing US NGL exports and the export facilities in the United States being in place. (Again, this forecast could be changed due to the recent oil price collapse.)

The oil and gas market expert also indicated that oil prices are driving well economics in the Permian Basin. Given low NGL and natural gas prices, particularly in the Permian Basin, 87 percent of the revenues come from crude oil in a typical Permian well with only 10 percent from NGLs and 3 percent from natural gas. This also means that the higher the price of crude oil, the more crude oil production there will be, along with more associated liquids and gas. Thus, the higher the crude oil price, the greater the need there will be for gas midstream infrastructure. It also means that natural gas prices have little effect on the economics of oil wells in the Permian Basin.

*Disconnect between natural gas production and midstream infrastructure*—The Federal Reserve Bank of Dallas recently surveyed 146 oil and gas firms in the United States on what they believe have caused the increase in gas flaring.<sup>2</sup> More than 70 percent said it was a lack of pipeline takeaway capacity for natural gas. The second biggest reason given was the lack of gathering and processing capacity. A third reason given was that processing and transport fees exceed the value of the gas.

The workshop addressed the reasons why midstream infrastructure has not kept pace with gas production. The observation was made that midstream gas infrastructure is getting added. It has just not been added as quickly as production.

A major reason cited for the disconnect was different planning and development horizons for production and midstream infrastructure. It takes 6 months to bring a well online, and it could take 18 months to bring gas processing plants and 3 years to bring pipelines online. It was asserted that many small US producers do not develop long-range plans, while a few larger companies develop 10-year plans. A complementary issue is that many upstream companies do not share their production plans with midstream companies early enough for the midstream companies to add sufficient infrastructure to meet production forecasts. Better communication between upstream and midstream players was called for.

Producers' lack of economic incentive to invest in midstream infrastructure was perhaps the biggest reason suggested why there is underinvestment in midstream infrastructure. Particularly the smaller companies have no incentive to invest in infrastructure or sign up for firm transportation out of the basin when they are allowed to flare surplus gas without penalty.

Another reason cited for the disconnect is that well performance has been much better than

expected. Since productivity improvement appears to be slowing down, this cause could fade.

A third reason cited for the disconnect is the headwinds from low Henry Hub natural gas prices and subsequent poor economics of delivering natural gas to the market. The natural gas price may not be high enough to cover the costs of delivering gas to the market. This also puts pressure on midstream margins, thereby discouraging investment in midstream infrastructure. If producers are allowed to flare when it is uneconomic to ship the natural gas, many will choose to flare. Regulators should be looking at the economics of the whole project, where most of the revenues are coming from crude oil production. It is possible and in some cases likely that a well can have a negative netback price from natural gas but still be profitable when the oil revenues are taken into account. A few participants indicated that regulators and producers should look at the economics for the whole well and not just the gas portion.

Another reason stated for the disconnect between production and infrastructure is the high risk of building fixed infrastructure or producers contractually committing to it. Midstream infrastructure investments are made for 15-year time horizons, while the exploration and production business is highly cyclical depending on oil prices. Particularly, small producers do not want to take the risk of committing to firm transportation and minimum volumes because it will commit them to spending capital to grow production during times when they do not want to. They want the flexibility to vary production with oil price cycles. For commitments to LNG projects, only large players with large balance sheets are likely to invest in or commit to sell a large volume of gas to these roughly \$25 billion projects.

Small producers may not commit to midstream infrastructure because they do not have the credit to take on the required commitments, and the commitment could sink the company in a down price cycle. The sentiment was expressed that if the producer does not make a long-term infrastructure commitment, then it assumes the risk of not having firm transportation. The analogy was given of purchasing a seat on a plane to fly to New York. If you don't purchase the ticket, you should not expect a firm seat on the airplane, and you accept the risk of not being able to fly when you want to. Sentiment was expressed that even small producers should support infrastructure. However, several participants indicated that as long as producers are being given a free pass on flaring, it will be difficult to get sufficient support for infrastructure.

Short-term investors who intend to sell the development or flip the company in a short period of time, like private equity companies, may not be interested in investing in gas infrastructure, particularly when they can flare freely. Several participants who recently acquired companies from financial investors observed that the acquired companies flared a higher percentage of their gas production than the parent company did. The belief was expressed that as the industry consolidates and short-term financial investors exit, the risk of companies unmotivated to reduce flaring should decline.

Industry structure is another explanation for disconnects between production and infrastructure. Producing companies used to be more integrated downstream in the gas business but sold those assets off years ago so they could focus on their main business of oil and gas production. Perhaps they will reintegrate at least financially by owning a part of the infrastructure that is critical to their operations. Upstream companies can own equity shares of the downstream

infrastructure but still let midstream experts manage that segment of the business.

Capital discipline was also thought to play a role in midstream companies' reluctance to build infrastructure. Just like financial investors' imposition of capital discipline on upstream companies, midstream investors have not been pleased with returns and do not want midstream companies to invest in speculative projects that are not well supported by producers. Capital discipline is also slowing the rate of production growth, so this disconnect could balance out over time.

Delays in pipeline permitting was another reason offered for the disconnect between production growth and infrastructure. Adversaries of pipelines have become really effective in stopping or rerouting them or otherwise causing significant costs and delays. Pipelines are viewed as the Achilles' heel of the oil and gas industry by the "Keep It in the Ground" movement. A participant from the midstream business stated that Texas will not be immune to this trend. Opposition to pipelines increases their risk and raises a midstream company's cost of capital. Oil and gas industry participants recommended a streamlined permitting process, although some participants were skeptical that this was possible. They also recommended that the courts should become prepared to opine on eminent domain issues as they arise.

Regulatory uncertainty was also cited as something that would have a chilling effect on infrastructure development. If regulators do not enforce pipeline contracts, then fewer pipelines will be built. Another participant asserted that there is no such thing as regulatory certainty in this highly volatile world.

### Constraints on Domestic Gas Demand

A presentation was made on constraints on domestic gas demand. Domestic natural gas demand is not expected to absorb projected US natural gas production. The projected US natural gas demand growth in the EIA's 2019 Annual Energy Outlook is nearly 25 billion cubic feet per day of growth between 2018 and 2030. Only one-third of that growth is expected to be for domestic consumption of gas, and the other two-thirds are for LNG and pipeline exports. Stated another way, US dry gas production is expected to grow at a rate three times faster than domestic consumption.

Only two billion cubic feet per day of gas demand growth in the US power sector is projected by 2030. Power generation growth has weakened in the US due to improved energy efficiency standards, slowing population growth, and the shift to a less energy intensive economy. Power demand grew by 2.3 percent per year in the 1990s and is now expected to grow by less than 1 percent per year going forward. Renewable generation capacity additions are also expected to outpace natural gas-fired capacity additions. Renewable power generally subtracts from demand in existing gas-fired power plants because renewables have a very low variable cost because they have no fuel costs. Natural gas plants have a relatively low capital cost but high variable costs due to the cost of natural gas. Since power plants are dispatched on a variable cost basis and gas plants are at the end of the dispatch curve, gas plants likely would be backed down when renewables are added into the mix.

Traditional markets for natural gas in the Permian Basin are Texas and California. California

has a target of 100 percent zero carbon emissions in their power sector by 2045, and they are adding renewables and backing out natural gas to meet this target. According to EIA's 2019 Annual Energy Outlook, California is projected to back natural gas out of its power sector at a rate of 3 percent per year through 2030.

Power demand grows at a much faster rate in Texas than the rest of the United States, in part due to the industrial activity resulting from the shale revolution and low cost feedstock. In recent years, Texas power generation has grown at 2.5 times the national average.

While natural gas presently comprises nearly 50 percent of power generation in Texas today, little gas-fired power capacity growth is expected beyond 2021, and gas capacity is projected to decline from 2022–2024.<sup>3</sup> Gas plant capacity is likely declining because some old inefficient gas plants that use more gas than new combined cycle plants are being phased out. There are few plans to build new gas-fired power plants in the state or any other plants that aren't subsidized by federal tax credits. The economics for building gas plants in Texas is poor due to low power prices in the state. Power prices are low in part because natural gas prices are low. Since gas-fired power plants have the highest variable costs, they are the marginal price-setting plants. Thus, low natural gas prices lead to lower power prices. Power prices are also low because renewables receive a production tax credit and wind continues to run at night when power demand is low. There are sometimes negative electricity prices at night based on the amount of the renewable production tax credit. Solar capacity coming into Texas will more directly compete with natural gas demand during peak demand hours.

A gas-fired power developer was asked to discuss whether there was an opportunity to use more natural gas in the power sector in Texas. The participant pointed out that the regulatory structure in Texas makes it difficult to add gas-fired power capacity given the low power prices in the state. Unlike a number of other states, Texas does not have a capacity market, where capacity earns some revenues from being able to run reliably anytime it is needed. The power developer did not believe Texas was likely to develop a capacity market.

This participant expressed the view that a carbon price would be more effective than federal tax credits for renewables in reducing carbon emissions, and it would put all fuels on an equal footing. A carbon price of \$20 per ton would result in the shuttering of all the coal capacity in the state. In 2018, 24 percent of Texas's power generation came from coal. Phasing out coal could increase other power demand by the equivalent of two billion cubic feet per day along with expected growth in power demand of about one billion cubic feet per day over the next five years. However, renewables will likely supply at least half of that growth. Unless renewable tax credits are allowed to expire, the participant indicated that gas has limited growth opportunities in the utility-scale power sector in Texas.

## **Best Practices and Better Data**

### **Best Practices**

There was general agreement that best practices should be developed for minimizing gas flaring and shared with operators across the industry. This would entail getting the best technical people together across the industry and getting companies to commit to operating



standards. Standards for gathering and processing are also important for flaring reduction.

A presentation was made on the process of developing best practices with the example of the Methane Guiding Principles organization, which includes 21 large gas producing companies, NGOs, and academics. It collected examples of best practices from the participants and combined them into a 20-page guide. There were technical, language, and legal reviews. The end product was a series of guides for operations managers. While the focus of the Methane Guiding Principles was obviously methane, best practices were also developed for gas flaring.<sup>4</sup>

Another example of a process to develop best practices presented was an examination of how flares are operated in the refining industry. It turns out that there is a much narrower operating envelope for flares than is reflected in regulations. If large flares are run at high turndown, the result would be incomplete combustion. The end product was the development of an online training course designed for plant operators.

### Improving Flaring Data Quality

There was general agreement that the industry should work with the states to make reported flaring data more transparent, accurate, and accessible to the public. There should also be consistency in how they are reported within and across jurisdictions. There also needs to be a better system of collecting data. Use of better technology to measure flaring is also important. If states don't have the capability to develop a better system, one participant indicated that the industry should step up like it eventually did with FracFocus, a registry website designed to provide information about chemicals used in hydraulic fracturing. The Texas Oil and Gas Association is prioritizing improving the quality of reported data in its deliberations on flaring.

There was general agreement that new technology to measure methane emissions and flaring is transforming how information is shared and how companies will be held accountable to take action to reduce emissions and flaring. The data are increasingly becoming available closer to real time and at low cost.

When real-time emissions and flaring data from satellites, aircraft, drones, and handheld devices become available, it was stated that companies will have the opportunity to better manage their environmental performance. Poor performers will no longer be able to hide. Some companies have made commitments to reduce emissions, and it is time that they now demonstrate with data that these commitments are being met.

### Gas Solutions: Existing Technology

*Prospects for increased US LNG exports*—A presentation was made about the prospects for increased US LNG exports. Global LNG demand has been robust, growing by 14 percent in 2019. Demand in Asia is strong, particularly in China, because of the need to reduce local pollution and particulates associated with coal more so than climate concerns. LNG demand in Europe has been robust to allow Europe to limit dependence on Russian gas and to displace coal in the power sector and meet greenhouse gas emissions targets. For example, US LNG exports have allowed the United Kingdom and Iberian Peninsula to reduce coal use to 2–6 percent of its fuel for power generation.

The United States is exporting 8 billion cubic feet per day of LNG today, and by the end of 2021, the view was expressed that the nation could be exporting double that. Given US natural gas production forecasts alluded to by producers, the United States could be exporting over 20 billion cubic feet per day by the time that natural gas production is expected to plateau. It is likely that 15 percent of US gas production will be exported as LNG.

Several potential impediments to expanding US LNG exports were mentioned. They include the need to raise a large amount of capital—both project debt and equity. One LNG project cited could cost upward of \$25 billion. Another impediment cited is the need to get pipeline interconnections with permitted LNG terminals. It currently takes the Federal Energy Regulatory Commission three years to permit an interstate pipeline. Again, the comment was made that there needs to be a streamlined regulatory process.

Views were also expressed that the LNG market will be very competitive and there will be market limits on how much LNG the United States can export to international markets. One participant compared the relentless increase in US LNG exports in the coming years to the increases in tight oil production that led Saudi Arabia to pursue a market share strategy for oil in 2014. The result was a collapse in the global oil price. In Europe, natural gas prices are currently very low, and Russia could decide to maintain its market share and deliver gas into Europe at two dollars per million Btu. The US would have to compete with that. In Asia, China is the biggest growth market, but there are uncertainties about how strong its demand for LNG will be given its large coal reserves and increases in domestic gas production and pipeline imports. (The recent slowdown in economic growth due to COVID-19 is slowing LNG demand growth in 2020.)

Several participants indicated that the global LNG market will face long periods of oversupply. US LNG has higher variable costs than some of the international LNG suppliers due to an alternative market and value for the gas domestically (versus countries like Mozambique and Papua New Guinea) and due to higher distances and shipping costs to Asia. Thus, during periods of oversupply, either some US LNG will need to be shut in or US gas prices may need to fall in the US to keep US LNG competitive in the global market. While LNG is an important solution to reducing gas flaring, as with all solutions, it could face limitations.

*Surplus gas use in Texas power generation*—One opportunity suggested for using surplus natural gas in Texas that would also lower carbon emissions in the power sector would be to switch the 24 percent of power generation currently from coal-fired power to natural gas.

### Gas Solutions: New Technology

Presentations were made on three new technology gas solutions to avoid gas flaring. They were (1) reinjecting gas for enhanced oil recovery, (2) using reservoirs to store gas, and (3) portable LNG to move the gas to a market.

*Enhanced oil recovery*—The Permian Basin produces more oil by enhanced oil recovery (EOR) than any other basin in the United States. Traditionally, CO<sub>2</sub> has been used for EOR in conventional fields because of the ready sources of CO<sub>2</sub> near the basin and available transmission infrastructure.

There are two types of EOR being considered for natural gas. The first is miscible gas flooding, where the gas is dissolved in oil and increases volume and decreases viscosity. Permian crude oils need to be tested with produced gas to assess minimum miscibility pressure, viscosity reduction, and recovery efficiency. The second type of EOR is foam flooding, where the gas is mixed with a surfactant. Much work has already been done on surfactant blends for CO<sub>2</sub> flooding, but it is unclear whether they will work with produced gas. It is also unclear for both styles of EOR whether any gas processing is needed before the gas is used.

One presenter indicated that EOR is an interesting opportunity in the Permian Basin because a large volume of gas is being produced, and significant gas infrastructure is already present. Gas-based EOR may also be lower cost than using CO<sub>2</sub>. One logistical issue raised with EOR was that the midstream company will probably own much of the gas. However, that could be resolved by commercial agreement.

*Gas storage*—In addition to gas EOR, another possibility for using surplus gas is to store it in Permian reservoirs. The Permian Basin has rocks that can store large volumes of gas. The Gomez Field is a giant dry gas-producing region in the Delaware Basin and would be a good candidate. One challenge of storing the gas is that it significantly delays when the gas is sold, which hurts the economics of this approach.

*Mobile LNG*—A presentation was made on mobile LNG as a means to monetize surplus gas. This technology has already been deployed in the Marcellus and Bakken Basins. It has also been used in the Vaca Muerta in Argentina and in Colombia. LNG can be used to replace diesel fuel in the Permian Basin. It can be used for turbines in the field, for trucking and power generation, and also as a marine fuel. Local and regional markets for the LNG would need to be developed. The NGLs would have to be removed before the gas is liquefied. It was asserted that LNG can be produced at a cost of \$3.50–\$4 per million Btu. One question that was raised is whether this can be done at the scale required given the expected volumes of gas exceeding pipeline takeaway capacity.

One oil company participant expressed the view that given the sense of urgency to reduce flaring, the focus should be on the technologies that are actionable today and that would move the needle. The suggestion was made that the US oil and gas industry should come together and determine how to prioritize these technologies.

## Existing State Flaring Regulations

The workshop included a session on regulatory solutions with feedback from participants from the oil and gas industry, former state regulators, and NGOs.

### Comparison of Key State Existing Regulations on Flaring

The first topic was a presentation comparing flaring regulations for Texas, North Dakota, New Mexico, and Colorado. The table below compares the volumes and percentages of gas flared as reported by operators in each of these states.

**Table 1:** Percent of Natural Gas Flared and Vented by State

State	2018 Flared/ Vented Volumes (million cubic feet)	2018 Gas Withdrawals (million cubic feet)	Future Undeveloped Associated Gas Potential	% Gas Flared and Vented
Texas	238,054	8,911,530	High	2.67%
North Dakota	147,485	858,969	High	17.17%
New Mexico	37,220	1,527,319	Medium	2.44%
Colorado	5,097	1,836,422	Low	0.28%

Source: US EIA, *Natural Gas Gross Withdrawals and Production*

Texas has the highest volume flared due to the highest gas production, but in terms of flaring intensity, North Dakota is the highest due to the lack of infrastructure and gas demand in the area. Colorado has the lowest flaring and venting of the four oil and gas producing states.

All oil and gas producing states have a regulatory framework for flaring. However, many states, including Texas and North Dakota, do not require reporting of flare volumes as distinct from venting. Reporting is voluntary, and satellite imagery technology indicates underreporting. States have rules that in theory limit flaring but that in practice allow the flaring of large volumes of natural gas. States that are highly dependent on oil revenues are reluctant to restrict oil production to limit flaring. Comments on each of these four producing states follow.

### Texas

The Railroad Commission of Texas (RRC) has jurisdiction over flaring.

- The RRC allows operators to flare gas for up to 10 producing days after completion.
- The RRC issues flare permits for 45 days at a time, for a maximum limit of 180 days.
- Extension beyond the initial 45 days requires documentation that progress is being made toward getting access to infrastructure.
- Extensions beyond 180 days must be granted through a Final Order by the RRC. One participant expressed concern that the RRC hasn't denied any requests for flaring permits received in the past seven years.
- The 180 days' limitation does not apply for gas volumes less than or equal to 50 thousand cubic feet per day for each gas well.
- Current law exempts the state from applying the natural gas production tax to flared gas from oil wells.
- The majority of flaring permits issued by RRC are for casinghead gas flaring from oil wells (associated gas).

## North Dakota

The North Dakota Industrial Commission (NDIC) has jurisdiction over flaring.

- The NDIC bans venting of natural gas, casinghead gas needs to be flared, and the flared volume needs to be reported to the North Dakota Department of Mineral Resources.
- The NDIC allows production of horizontal wells in Bakken and Three Forks pools up to 90 days at maximum efficient rate. After 90 days, the operator must either meet gas capture goals or limit production.
- The NDIC allows flaring of all other oil wells up to one year. After one year, operators must either meet beneficial use requirements or obtain an exemption.
- If connection to a gas gathering system is not economically feasible, operators must either seek exemptions or pay taxes and royalties on flared gas.
- The NDIC requires a gas capture plan with every drilling permit application. The plan is provided to midstream operators.

In November 2018, North Dakota revised its goals of gas capture policy to focus on the following:

- Increased gas capture rather than reducing flaring volume
- Removed goals for reducing flare volume and duration
- Added goals to incentivize infrastructure investment

## New Mexico

In New Mexico, the Oil Conservation Division (OCD) has jurisdiction over flaring.

- Operators shall not flare or vent casinghead gas more than 60 days following the completion of a well unless an exemption is obtained.
- The OCD requires reporting of volume of gas flared (separate from venting).
- The OCD requires gas capture plans.
- The OCD has not made any amendments to laws since 2008.

In February 2019, the New Mexico governor signed an executive order mandating comprehensive methane regulations to cut energy waste and improve air quality.

- This created a Methane Advisory Panel (MAP) to make recommendations; MAP includes 28 members from industry, regulatory bodies, and NGOs.
- In December 2019, MAP issued a technical report on oil and gas methane emissions containing several recommendations to reduce flaring and venting. Detailed recommendations are meant to be a resource for regulators during rule making. Recommendations include, among other things, the following:

- Producers engage with midstream companies in more active development planning
- Proposed regulation change to prohibit flaring or venting casinghead gas produced from a well after 30 days of production, rather than the current 60-day rule
- Require auto igniters for new flares
- Ensure that all venting and flaring is reported on a monthly basis
  - Require use of reliable tools for measuring or estimating flare volumes and regulatory oversight of purchase and calibration of tools
  - Establish electronic reporting systems for all sources of venting and flaring and make results publicly available online
- Adopt performance standards for new and existing flares for removal efficiencies and continuous burning pilots
- Set overall limits on gas flared by each operator
- Establish automatic consequences for failure to meet capture percentages
- Assess severance tax and royalties on all gas produced rather than only on gas sold
- Streamline permitting for reinjection solutions and alternative technology to avoid flaring.

### Colorado

In Colorado, the Oil and Gas Conservation Commission regulates oil and gas development.

- The Colorado Code of Regulations addresses natural gas flaring and venting, calling for the prohibition of unnecessary or excessive venting or flaring from a well.
- The code defines acceptable flaring as that which is necessary to protect public health, safety, and welfare.
- In 2014, Colorado was the first state to regulate methane emissions from oil and gas drilling (Reg 7).
- Colorado regulations are more stringent than Environmental Protection Agency New Source Performance Standards.
  - Require stringent control requirements on oil and gas production operations
  - Require comprehensive periodic monitoring
  - The presenter indicated that the EIA reported that methane leakage rates dropped by 75 percent as a result.
- Senate Bill 181 required a major overhaul of oil and gas regulations to minimize emissions of methane and other hydrocarbons from oil and gas industries.

## Insights on Regulation in Colorado and North Dakota

A former state regulator discussed the reasons for Colorado's low flaring rates versus North Dakota's. Colorado has been helped by the 30 years of conventional oil production it has had in places where unconventional production is growing. It also has substantial gas infrastructure in place. In addition, the rules in Colorado are more stringent than in other states. If the operator cannot get its gas into a pipeline, then it is not allowed to produce the well with the exception of holding the lease. Inadequate infrastructure capacity has not been a long-term problem, so shut-ins of wells have been temporary. Most of the producers also had other opportunities in the Denver-Julesburg Basin that they could invest in to avoid areas with limited infrastructure. The obvious regulatory solution is to take flaring off the table. The presenter asked how flaring was any different from how produced water is treated. Both are costs that need to be incorporated into production economics.

North Dakota is likely to be more cautious about restricting production to limit flaring because oil production growth has been so important to the state's economy. Before the shale revolution in the mid-2000s, the state had been losing population, and its population was aging. The shale revolution reversed those trends.

In 2013, the government reevaluated its flaring regulations as a result of national media attention to satellite photos of flaring in the state and as a result of numerous landowner lawsuits against oil companies claiming they were owed royalty payments on natural gas that was flared in violation of North Dakota statutes. At the time, only 65 percent of the gas production was captured. The chief state regulator indicated that part of the problem was that the upstream and midstream companies were not coordinating with each other. Between 2013 and 2015, \$1 billion was invested in infrastructure. In 2015, the gas capture rate rose to 85 percent. The presenter questioned whether it was a legitimate role of regulators to oversee relationships between segments of the value chain. However, the former regulator indicated that if that is what it takes to reduce flaring, it should be done.

After the oil price collapse in 2014–2015, there was generally no spending on infrastructure for two years. Oil production rebounded quickly in 2017 and exceeded most expectations. Thus, production exceeded takeaway infrastructure again, and the gas capture rate eroded. It was estimated that \$6 billion of infrastructure investment was needed between 2017 and 2020 to catch up. Of that, \$3 billion–\$4 billion of spending occurred.

In November 2018, North Dakota revised its goals to focus on increased gas capture rather than reduced flaring volume. It also added goals to incentivize investment in infrastructure. The presenter indicated that the state also changed its measurement of gas capture to exclude gas that could not get into a pipeline because pipes were full. This would water down the metric. The presenter believed that the state is again reevaluating its policy to reduce exceptions and to reach a percent capture goal of 91 percent by November 2020. The state is still likely to seek alternatives to shutting off production growth. A final comment by the presenter was that state regulators have a limited toolbox to work with.

## Environmental Priorities of Oil and Gas Producing States

Another presenter on state regulations indicated that the three highest environmental priorities for most oil and gas producing states are (1) management of produced water; (2) idle and orphan wells; and (3) climate issues, including methane emissions and flaring.

The Interstate Oil and Gas Compact Commission (IOGCC) provides its 31 state members with resources to help states manage climate issues. Commissioners are appointed by the governors of member states. The IOGCC provides a forum where states come together and compare experiences and lessons learned, do benchmarking, and compare regulatory programs. It provides a portal for information sharing and helps members keep up with technology advances. It also provides support on jurisdictional and infrastructure issues. This commission could be an important resource in helping state regulators grapple with reducing gas flaring in their respective states.

## Federal Regulatory Actions

There are several federal regulatory actions that are relevant to discuss.

### New Source Performance Standards

- Control methane and volatile organic compound emissions from affected facilities
- On September 11, 2018, the Environmental Protection Agency proposed changes to the frequency for monitoring fugitive emissions at well sites and compressor stations, among others.

### US Bureau of Land Management Venting and Flaring Rule Established in 2016

- Operators of crude oil and natural gas facilities on federal and Indian lands are required to take various actions to reduce the waste of gas, and the rule established criteria when flaring will be subject to royalty.
- The rule was amended in 2018.
  - The amendment removed the requirements of waste minimization plans, well drilling and completion, and leak detection and repair, among others things.
  - It deferred to state or tribal regulations in determining when the flaring of gas will be royalty free.
  - It modified measuring and reporting volumes of gas vented and flared.
  - This rule change is tied up in court.

## Regulatory and Other Solutions

Generally, oil and gas companies that participated supported voluntary industry measures, while academics and NGOs were more supportive of regulatory and tax measures. There was



some agreement across the different constituent groups. Most constituents were in favor of collecting and publishing better data on gas flaring. A few oil and gas participants favored a gas flaring tax, although there was also opposition for it from other oil and gas company participants. There seemed to be a greater amount of support for performance-based voluntary flaring reduction targets.

### Role of Regulation in Reducing Flaring

There was a lack of consensus among the different groups of participants about the role of regulation in reducing gas flaring. Several oil and gas industry participants indicated that the industry shouldn't wait for the government to fix this problem since there have been wild swings in government regulation over time. Given the sense of urgency, the industry should lead regulators by changing its practices as soon as possible. Other participants from the oil and gas industry expressed the view that regulation should not be jumped on as the only solution because a broader set of opportunities exists to reduce flaring that goes beyond what regulators can accomplish.

Another industry view was that oil and gas flaring in the United States needs to be put in context. The United States is the number 1 oil producer in the world but the fourth in terms of flaring volumes. The United States is number 44 in terms of flaring intensity per barrel of oil produced. Whatever regulatory solution is proposed, it should be partially judged on whether it will reduce production in the United States and move it to countries with much higher flaring intensities.

If additional regulation is considered, regulators need to decide what an appropriate level of flaring is. Some participants said the answer probably is not zero, but regulators ought to explore an appropriate goal before comparing potential solutions.

The view was also expressed that regulation might not be the best solution versus other policies. One former regulator at the event indicated that regulators have a limited toolbox for dealing with issues like flaring. Flaring is a result of a combination of a disparate set of challenges and inefficiencies. Thus, a holistic set of solutions is needed. Concern was also expressed that the agendas of some stakeholders included putting producers out of business rather than solving the flaring problem.

It was noted that a voluntary industry program could be developed, and it could be converted to regulations when there is sufficient buy-in for them.

In contrast, one of the NGO participants expressed the view that flaring is a collective action problem. The problem will not get fixed unless all players in the industry take action. Regulation would be required to make that happen. Regulation to stop flaring should be instigated by the industry so the companies who continue to flare don't have a competitive advantage.

Another NGO participant believed that lax regulatory oversight is the problem that needs to be fixed. Flaring from the downstream industry in Houston was greatly reduced by regulatory enforcement actions. There are enough rules on the books about local air quality to solve the flaring problem. They just need to be better enforced.

Another NGO participant who favored market solutions indicated that the economics of flaring reduction are unfavorable compared to unpenalized flaring. Today's natural gas prices do not provide a strong incentive for producers to support infrastructure build-out. This presenter believed regulatory action would be required to ensure that flaring is no longer on the table.

One academic called for smart and sensible regulation, which works best when it follows what the industry is already doing. If there is a market failure that needs to be fixed, then regulation (or taxation) may be necessary.

### Other Solutions for Gas Flaring

The following nonregulatory solutions for reducing flaring were suggested by various participants.

*Develop performance-based targets*—A group of oil and gas companies can develop performance-based targets to voluntarily improve the industry's performance. For example, the target could be that all companies need to get their flaring intensity to the level of the best performers. The level should tighten over time as the costs of technologies for alternative solutions decline. These targets may become a regulatory requirement at some point following the lead of the industry. One NGO participant stated that the industry as a whole needs to set aggressive targets to reduce flaring just as the Oil and Gas Climate Initiative has done with reducing methane emissions.

One participant stated that any program or policy that addressed flaring needs to make sure that the high performers are not disadvantaged relative to the poor performers. In fact, this participant suggested that high performers should be allowed preference in the granting of flaring permits.

*Internalizing the cost of disposing of surplus gas*—One oil and gas company indicated that although flaring is a complex problem, it is more of a business problem than a technical problem. The industry is not required to and does not currently take into account the costs of avoiding flaring in its economics like it would with disposal costs of produced water. As a result, true lifting costs of production are underestimated and returns are exaggerated.

Representatives of several companies, academics, and NGOs supported the concept of taxing flared gas as the most direct means to reduce flaring. Flaring should no longer be the lowest cost means of dealing with surplus gas. If flared gas was taxed, companies would have an economic incentive to invest in equipment and infrastructure to avoid flaring. Another view expressed was that flaring should be taxed up to the "social cost" of flaring to internalize the externalities. It was noted that in leases on some University of Texas lands, companies have to pay royalties on flared gas. As a result, there has been lower levels of flaring on those leases. Several participants from oil and gas companies indicated that there might be merit in a state gas flaring tax.

An academic stated that it would not be easy to design a flaring tax, but it would be helpful to borrow from the literature of carbon market design. In contrast, at least one participant believed that the Texas legislature would never enact a flaring tax. Perhaps that could be

changed if there were additional revenues that the tax provided to the state for such purposes as better flaring data, community health and infrastructure, and so on. Another action that could be taken along the same lines would be to apply the severance tax to flared gas.

Another area of economic misalignment identified was that companies make infrastructure commitment decisions based on gas economics, which look poor due to low Henry Hub natural gas prices. Since well economics are driven by oil revenues, companies should base gas infrastructure decisions on what the total well economics can afford, which would better maximize shareholder value.

*Better coordination on midstream infrastructure*—It was suggested that producers should extend their production plans out for a longer period of time (e.g., five years) and communicate them to midstream infrastructure providers. More companies should commit to firm transportation out of the region either directly or through gas processors to ensure that the appropriate level of infrastructure is built. There was some pushback about whether smaller companies would be able to accomplish this.

For small upstream companies, taking firm transportation can be a source of existential risk if there is a downturn and they still are holding the capacity or the obligation to ship a certain volume. Small producers may also have credit issues signing up for firm transportation given that they mostly have noninvestment grade credit ratings. There are other commercial arrangements that can be made for them. For example, upstream companies who sell their gas directly to midstream companies can receive a lower netback for moving the marketing risk to the midstream player. They can reduce the risk to midstream companies by dedicating acreage and production to the infrastructure. However, this still doesn't guarantee that the midstream player will build sufficient infrastructure to get surplus gas out of the basin.

Permitting of infrastructure is becoming increasingly difficult. Companies believed that the state needs to streamline the permitting process and resolve issues around eminent domain to improve the timeliness of pipeline additions.

The importance of having adequate gathering and processing facilities in all locations where they are needed is also an important issue to address. There are some specific problem areas where infrastructure is not keeping pace with gas production.

*Initiate process for reducing flaring*—Participants generally agreed that it takes leadership by a handful of companies to drive change in the industry. Change needs to be driven by senior executives from those companies. As with the Methane Guiding Principles, the process can start with a small group of leaders and then broaden to a larger industry group and other stakeholders.

One participant expressed the view that the oil and gas industry needs to publicly acknowledge that flaring is at an unacceptably high level.

Several academics, NGOs, and oil and gas companies indicated that the process by which the industry reduced flaring matters in terms of its credibility and political acceptance. It needs to be an open and transparent process with diverse views of stakeholders incorporated. External validation is needed to give credibility to the process and outcome. Several former regulators

indicated that the processes to deal with methane emissions in Colorado and seismicity in Oklahoma were successful because regulators partnered with the industry and NGOs to solve the problem. One participant commented that they hoped the Texas Oil and Gas Association finds a way to get input from a diverse group of stakeholders as it determines how to address flaring and methane emissions in Texas. The importance of having midstream companies in the process was also noted.

Setting performance commitments and principles and communicating them to the public will also garner credibility. Results also matter. The industry needs to show significant progress over the next one to two years to be credible.

*State assistance*—States could help reduce flaring by streamlining infrastructure permitting and providing clarity on eminent domain policy. Other stakeholders would like to keep the system the way it is, so they have the ability to challenge pipelines or routes.

The state of Texas could help with the challenge of using more natural gas in the power sector at the expense of coal, which was 24 percent of power generation in Texas last year. That would reduce flaring as well as carbon dioxide emissions in the power sector. In Texas, the suggestion was made that the state should consider developing another Competitive Renewable Energy Zone-type power line to transmit power from renewables and natural gas in West Texas to the power demand centers in East Texas. The state could also intervene with the federal government to ensure that LNG liquefaction plants are approved in a timely fashion.

## Summary and Path Forward

### Summary

Pressures are increasing on the US oil and gas industry, including in Texas, to improve performance on gas flaring. Increasingly, governments and financial investors are differentiating between industries and companies based on their environmental performance. This trend is being enabled by greater transparency and public availability of flaring data by well and operator. The US oil and gas industry is at a decision point about whether to take action to reduce flaring and protect the industry's social license to operate.

The workshop addressed the need for improving the quality and consistency of reported data so that companies can be held accountable for their performance. There was complete agreement among participants that this needs to be done. This was deemed to be a great topic for the Texas Oil and Gas Association's flaring process.

There was general agreement that the US oil and gas industry needs to develop and share best practices to minimize flaring in its operations.

Some participants favored a voluntary performance target that advised all producers to move to the flaring intensities of the best performers.

There was not complete agreement on how to alleviate the disconnect between production and infrastructure growth. Participants generally agreed that if producers had longer term

production plans and shared them with midstream partners, the disconnect would be reduced. However, it was questioned whether small companies would ever be able to acquire firm transportation for gas out of the basin either directly or through gas processors. Large and medium-sized exploration and production companies may be the only ones that can invest in infrastructure built in sync with gas production.

Taking discretionary flaring off the table through more stringent environmental regulation or by enacting a gas flaring tax were two ideas that were raised to provide an economic incentive to build gas infrastructure for all players. A few participants favored a gas flaring tax, while others thought it would not be politically feasible in Texas. There was general agreement that all other actions may not have a material effect if you don't give producers an economic or regulatory incentive to stop flaring gas.

There was also general agreement that oil and gas industry leadership is required to minimize flaring, but any process to solve the problem should also include input from a diverse group of stakeholders to be credible.

### Path Forward for Columbia University's Center on Global Energy Policy

The Center on Global Energy Policy (CGEP) presented the next steps it would take after this workshop. The first is to write a summary of what was discussed at this workshop, provide it to all participants, and publish it on Columbia University's website.

CGEP frequently convenes diverse groups of stakeholders to discuss critical energy issues. One group that was not strongly represented in this workshop was the financial community. The financial community is struggling with the issue of how to assess environmental risks of oil and gas companies and how to allocate capital to the oil and gas industry and its various players. CGEP intends to have a second workshop at Columbia University in New York City to (1) understand financial investors' environmental assessment of oil and gas companies, (2) learn how financial investors' environmental assessments are affecting the valuation of companies and capital allocation, and (3) discover how oil and gas companies are responding to these investor pressures.

Having observed the value of the Methane Guiding Principles, CGEP is prepared to help a group of interested oil and gas companies and a diverse group of other stakeholders to develop high-level performance targets and guiding principles for reducing flaring. It would require commitment and participation from senior leaders of the organizations participating.

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## Notes

1. New Larry Fink, "2020 Letter to CEOs: A Fundamental Reshaping of Finance," BlackRock, January 2020. <https://www.blackrock.com/us/individual/larry-fink-ceo-letter>.
2. Federal Reserve Bank of Dallas, survey conducted December 11-19, 2019.
3. Electric Reliability Council of Texas, *Demand and Reserves Report* (CDR), December 5, 2019.

4. Methane Guiding Principles, “Reducing Methane Emissions: Best Practice Guide, Flaring,” November 2019, <https://methaneguidingprinciples.org/wp-content/uploads/2019/11/Reducing-Methane-Emissions-Flaring-Guide.pdf>.
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## About the Author

**Marianne Kah** is an Adjunct Senior Research Scholar and Advisory Board member at the Center on Global Energy Policy (CGEP). Before joining CGEP, Ms. Kah worked as the Chief Economist of ConocoPhillips for 25 years. Previously, she was the Manager of Corporate Planning at Cabot Corporation and a Coordinator of Strategic Planning at Conoco. In the early 1980s, Ms. Kah was a Senior Analyst in the Policy Development Group of the Synthetic Fuels Corporation in Washington, D.C. Prior to that she was a Policy Analyst at the Energy and Minerals Division of the Government Accountability Office. She is the Past President of the U.S. Association for Energy Economics and is co-chairing the Energy Roundtable for the National Association for Business Economics. She is also an independent director of PGS and ATI. Ms. Kah is also a member of the Advisory Board of the Energy Institute at the University of Texas at Austin.

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