Wasted natural gas – heavy burden of Permian Basin producers

Free report

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Introduction

The Permian Basin in West Texas and New Mexico has become one of the world’s most important oil producing regions. A dramatic increase in activity levels in 2017 and 2018 – followed by robust well completion programs even under the constraints of tight capital discipline in 2019 – brought many new challenges into the area. A massive increase in oil and associated gas production was accompanied by a substantial rise in the volume of waste gas (wellhead natural gas flaring and venting). While the industry has become significantly more focused on environmental, social and governance (ESG) issues, market participants have increasingly challenged the sustainability of current flaring intensities in the shale patch.

Is the industry doing enough to reduce emissions associated with waste gas?
It is no secret that substantial production growth requires a significant ramp-up in the number of new well completions, which in turn involves material capital expenditure. In the Permian Basin, it took the industry two years (2015-2016) to adapt to the new realities of $50-$60 oil prices. The new boom started in 2017 with operators arguing about significant structural efficiency gains, which helped them to achieve sustainable economics in a $50-per-barrel world. The number of horizontal well completions in the Permian increased by more than 100% between late-2016 and mid-2018. Since that time, activity levels have been robust with some 1,200-1,400 horizontal completions per quarter. Proppant consumption and completed lateral footage – both of which are key service demand indicators – increased even more quickly due to growing well complexity and completion intensity. As of 2019, the basin has seen between 11 million and 12 million tons of proppant pumped quarterly, and the same amount of completed lateral footage in million feet, representing a 200% increase from the activity levels seen in late-2016.
Permian Basin: historical horizontal activity

Number of wells

Horizontal well count* (LHS)
Total Horizontal Footage (RHS)
Total Proppant Consumption** (RHS)

*Number of horizontal wells put on production each quarter
**Proppant consumption for horizontal wells only

Source: Rystad Energy ShaleWellCube
This vast rise in activity naturally resulted in a huge increase in oil production, with basin-wide output growing from 2 million barrels per day (bpd) in the second half of 2016 to 4.5 million bpd in the third quarter of 2019.

Contrary to common belief, associated gas production in the Permian did not grow faster than oil output.

In other words, Permian output did not get gassier as new wells were largely drilled in liquids-rich areas with low gas-oil-ratios, thus offsetting the rising gas-oil-ratios of maturing legacy output. As a result, gross gas production followed oil output closely, increasing from 7 billion cubic feet per day (Bcfd) in 2H16 to 15.5 Bcfd in 3Q19.

Expansion of both oil and gas resulted in the need for new takeaway infrastructure. In the case of gas production, new projects were slower to respond to the new demand, resulting in a large number of gas bottlenecks and poor local gas prices. Generally speaking, gas production does not drive well economics for most contemporary activity in the Permian. However, there are some high GOR areas, such as Culberson County and Alpine High, where key operators were forced to delay their completion programs in 2019 in order to coincide with the commissioning of new gas infrastructure.
The significant increase in activity levels was accompanied by a new challenge facing E&P companies in the Permian. The volume of waste natural gas – that which is flared or vented at the wellhead – tripled between 1H17 and 4Q18. Since that time it has been range bound between 550 million and 750 million cubic feet per day (MMcfd), which is undoubtedly a very high volume.

**Permian Basin: natural gas flaring and venting by sub-basin**

Million cubic feet per day

Source: Rystad Energy research and analysis, Rystad Energy ShaleWellCube
The Delaware Texas sub-basin has a dominant share of basin-wide flaring, fluctuating recently at around 40%, but this represents a significant decline from the 55-to-60% share it held in 2016-2017. Meanwhile, the flaring intensity in Delaware Texas has been stable since early 2017, range-bound between 4.3% and 5.2%.

Flaring in Delaware New Mexico declined from around 130 MMcfd in 4Q18 to a flat level of about 100 MMcfd in 3Q19. This represents a material decline in flaring intensity, from 4.6% in 4Q18 to 2.8% in 3Q19, the lowest level among core sub-basins in the Permian.
Midland North, meanwhile, had a spike in flaring intensity in 4Q18-1Q19 due to infrastructure outages. Yet its flaring intensity remains at or above the level observed in Delaware Texas, representing a vast contrast to the exceptionally low flaring intensity seen in Midland North prior to 2018. This negative trend is associated with increased activity levels in some of the less developed regions in Midland North, such as Howard Country and certain parts of Martin County.

A significant increase in flaring intensity has also been observed recently in Midland South, where flaring of gross gas climbed from 2.7% in 2Q19 to 4% in 3Q19.
Permian Basin: natural gas flaring and venting by county* in 1Q-3Q 2019

Gas flared, bcf

Flared gas to gross gas production ratio

Ten counties accounted for about 80% of basin-wide flaring in the Permian in the first three quarters of 2019. The top 10 counties, measured in gross gas production, also account for just above 80% of basin-wide output.

Reeves and Eddy counties occupy the top two spots on both lists, yet Reeves exhibits higher flaring intensity (4.8%), which is also slightly above the basin-wide average. Martin County ranks only as number nine in terms of gross gas output in the Permian, but its recent flaring intensity of 10.1% makes it the third largest county in terms of total volume of flared gas.

Lea, Midland and Loving counties are the next three largest counties by gas production, after Reeves and Eddy. Flaring intensity is the lowest in Lea County (2.7%), while Midland and Loving exhibit intensity levels of 4.1-4.2%. This results in comparable total volumes of gas flared in all three counties.

Two of the top 10 flaring counties are not found among the top 10 list for gas production, as Howard and Pecos counties exhibit flaring intensities of 11.3% and 7.6%, respectively. However, producers in Howard County did achieve significant reductions in flaring intensity between 1Q19 and 3Q19, as shut-in infrastructure was turned back online.
We have analyzed the flaring intensity (1Q19–3Q19) of the 10 largest gas producers in the five counties with the largest total volume of flared gas – Reeves, Eddy, Lea, Martin and Midland. One can clearly observe that the frequency of high flaring intensity cases increases as we move from larger to lower production cases. Among the large contributors to gross gas production in these counties, we draw particular attention to the cases of flaring intensity below 1.5% despite a large production base. In our view, such low flaring intensity levels – achieved during periods of basin-wide gas infrastructure bottlenecks and aggressive oil production growth – is indicative of the industry’s commitment to sustainable and environmentally responsible development.

<table>
<thead>
<tr>
<th>Company</th>
<th>County</th>
<th>Flaring intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>APACHE</td>
<td>Reeves</td>
<td>0.78%</td>
</tr>
<tr>
<td>Apachen</td>
<td>Lea</td>
<td>0.41%</td>
</tr>
<tr>
<td>OXY</td>
<td>Reeves</td>
<td>0.61%</td>
</tr>
<tr>
<td>Oxy</td>
<td>Lea</td>
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<tr>
<td>EOG RESOURCES</td>
<td>Reeves</td>
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<tr>
<td>Lea</td>
<td>1.02%</td>
<td></td>
</tr>
<tr>
<td>CONCHO RESOURCES</td>
<td>Eddy</td>
<td>1.23%</td>
</tr>
<tr>
<td>Lea</td>
<td>1.28%</td>
<td></td>
</tr>
<tr>
<td>CIMAREX ENERGY</td>
<td>Eddy</td>
<td>0.91%</td>
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<td>CHEVRON</td>
<td>Eddy</td>
<td>0.24%</td>
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<tr>
<td>Lea</td>
<td>0.02%</td>
<td></td>
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<tr>
<td>Midland</td>
<td>1.26%</td>
<td></td>
</tr>
<tr>
<td>PIONEER NATURAL RESOURCES</td>
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<tr>
<td>DIAMONDBACK ENERGY</td>
<td>Midland</td>
<td>0.78%</td>
</tr>
<tr>
<td>PARSLEY ENERGY</td>
<td>Midland</td>
<td>1.50%</td>
</tr>
</tbody>
</table>

One can clearly observe that the frequency of high flaring intensity cases increases as we move from larger to lower production cases.
Permian Basin: gross gas production and flaring by county and operator*

Gross gas produced, billion cubic feet

Flared gas to gross gas production ratio

*Includes top-10 producers in five counties with the largest volume of flared and vented gas in 1Q-3Q19
The five counties are Reeves, Eddy, Lea, Midland and Martin
Source: Rystad Energy research and analysis, Rystad Energy ShaleWellCube
In Texas, operators have an opportunity to provide a comment on their production reports submitted to RRC, indicating the reason behind gas flaring. It would be fair to say that in almost 70% of the cases, the reasons do not provide much insight as operators simply apply default rules indicating that the gas was flared (“Flared/Vented”, “Flared”, “No comment”, “Vented”, “intermittently flaring”).

Based on our dialogue with industry players, operators typically indicate that most of these flaring cases correspond to a so-called “routine” flaring, predominantly coming from new well completions that have not yet been connected to the infrastructure or tested. Among the more informative reasons, we see that most of the flared volumes are associated with gathering line or gas plant bottlenecks (also including high line pressure as a result of gas plant outages).

The nature of the reasons given for flaring varies from operator to operator. Some operators – including the likes of Chevron, Parsley Energy, Cimarex Energy and Concho Resources – provide good visibility on the actual reasons behind flaring operations. However, at the current stage we can clearly conclude that the reporting is not standardized across the industry.

Permian TX: frequency of different reasons for flaring reported by operators in PR reports in 2017-2018

![Chart showing reasons for flaring in Permian TX]"}

Selected operators*: frequency of different reasons for flaring reported in PR reports in 2017-2018

![Graph showing reasons for flaring for selected operators]"}

*Includes only Permian, TX activity of selected companies
Source: Rystad Energy research and analysis, Rystad Energy ShaleWellCube
We look at some (but not all) segments contributing to CO2 emissions in the Permian Basin. Sand, water, crude tracking and other transportation directly related to oil and gas extraction in the Permian, along with pressure pumping, accounted for between 5.5 and 7.7 kilograms of CO2 emissions per barrel of oil produced in 2014-2019. In fact, emission intensity from these segments reached record-low levels in 2019, as most of these segments are linked to activity levels (i.e. the number of new wells) rather than production. Activity stabilized in 2019, whereas oil production kept growing.

One striking observation is that wellhead natural gas flaring alone generates more CO2 emissions than all the aforementioned transportation segments and pressure pumping activity. As of 2019 wellhead gas flaring produced more than 10 kilograms of CO2 emissions per barrel of oil produced. Nevertheless, even without new regulations, we argue that emission intensities in the Permian will decline sharply in 2020-2022. It should be noted that natural gas flaring is also driven more by activity levels than by out-bound takeaway capacity. As the outlook for completion activity in the Permian remains strong but with limited potential of further growth, no increase in flaring volumes is expected in 2020-2022. In fact, some reduction is forecasted (assuming no gas plant outages) due to the increased industry focus on ESG matters and the shift towards more responsible operational practices, regardless of the regulatory environment.
Permian Basin: CO2 emission intensity for selected segments by year
KG CO2 per barrel of oil produced

Source: Rystad Energy research and analysis
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