

# Natural Gas Production Report

Q4

October to December 2019

## Production Trends

For the fourth quarter of 2019, recent data from the Pennsylvania Department of Environmental Protection (DEP) show that total natural gas production volume was 1,776.0 billion cubic feet (bcf) (see **Table 1**). This output represents an increase of 7.6 percent from the fourth quarter of the prior year, the lowest growth rate in over two years. Calendar year production is up 11.4 percent compared to the same period in 2018.

Table 1: Production Volume (bcf)

	Fourth Quarter			Calendar Year		
	2018	2019	Growth	2018	2019	Growth
Horizontal	1,649.0	1,774.5	7.6%	6,115.1	6,815.0	11.4%
Vertical	<u>1.8</u>	<u>1.5</u>	<u>-15.4%</u>	<u>8.3</u>	<u>6.5</u>	<u>-21.4%</u>
Total	1,650.8	1,776.0	7.6%	6,123.4	6,821.5	11.4%

**Table 2** decomposes fourth quarter and calendar year production volume from horizontal wells by spud year. All production growth for the fourth quarter was from wells spud in 2018. These wells comprised 23.7 percent of all production for the quarter. Wells spud in 2017 exhibited the largest decline in production (-30.5 percent) and production from wells spud in 2016 or earlier declined by 16.7 percent (not shown in table).

Table 2: Production Volume by Spud Year (bcf)

Spud Year	Fourth Quarter				Calendar Year			
	2018	2019	Growth	Share	2018	2019	Growth	Share
2019	n.a.	136.4	n.a.	7.7%	n.a.	190.2	n.a.	2.8%
2018	114.1	419.9	267.9%	23.7%	140.3	1,353.7	864.8%	19.9%
2017	439.5	305.5	-30.5%	17.2%	1,324.1	1,390.4	5.0%	20.4%
2016	212.2	151.3	-28.7%	8.5%	908.0	693.2	-23.7%	10.2%
2015	156.0	127.3	-18.4%	7.2%	661.8	538.6	-18.6%	7.9%
2014	230.3	187.6	-18.5%	10.6%	1,016.5	797.0	-21.6%	11.7%
2013	150.9	135.7	-10.0%	7.6%	648.4	567.4	-12.5%	8.3%
2012	<u>346.0</u>	<u>310.7</u>	<u>-10.2%</u>	<u>17.5%</u>	<u>1,416.1</u>	<u>1,284.6</u>	<u>-9.3%</u>	<u>18.8%</u>
Total	1,649.0	1,774.5	7.6%	100.0%	6,115.1	6,815.0	11.4%	100.0%

Notes: Horizontal wells only. This table displays 2018 and 2019 production based on the year wells were spud. For example, wells with spud year 2014 were spud during calendar year 2014, and their production is shown for the fourth quarter of 2018 and the fourth quarter of 2019. Spud year 2012 includes all wells spud in 2012 or earlier.

Figure 1 displays horizontal well production over the last nine quarters. From the fourth quarter of 2017 to the fourth quarter of 2019, horizontal production increased by 26.8 percent. There has been a quarter-over-quarter increase in horizontal production for 14 consecutive quarters.

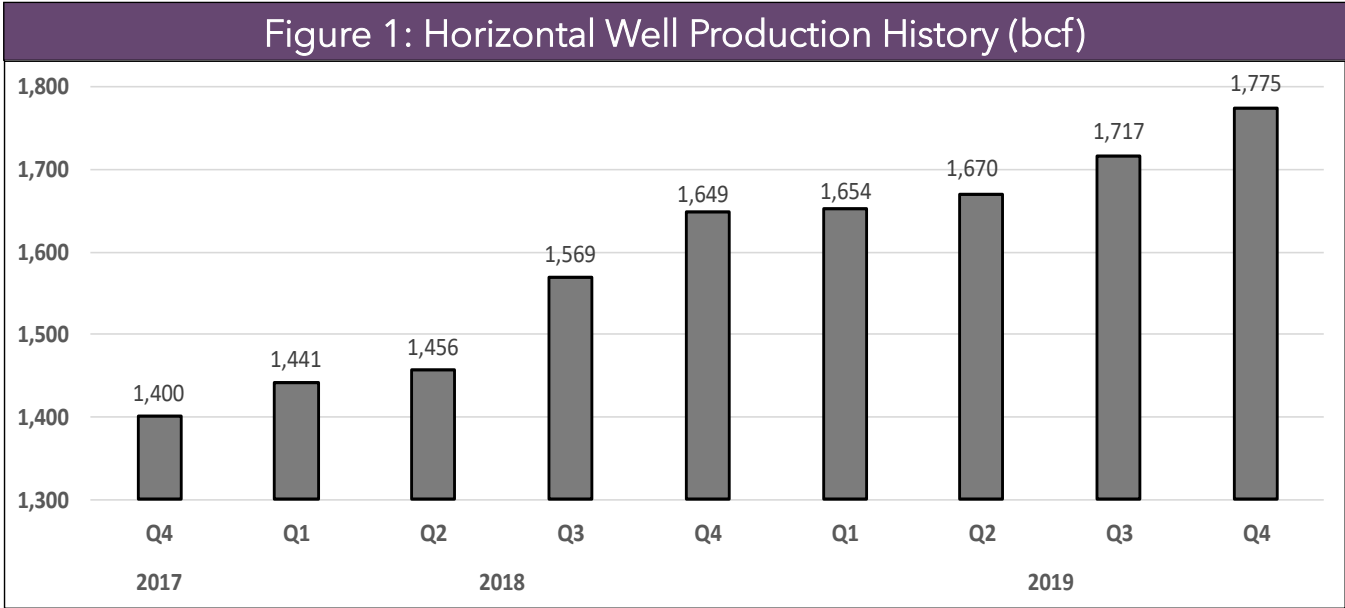
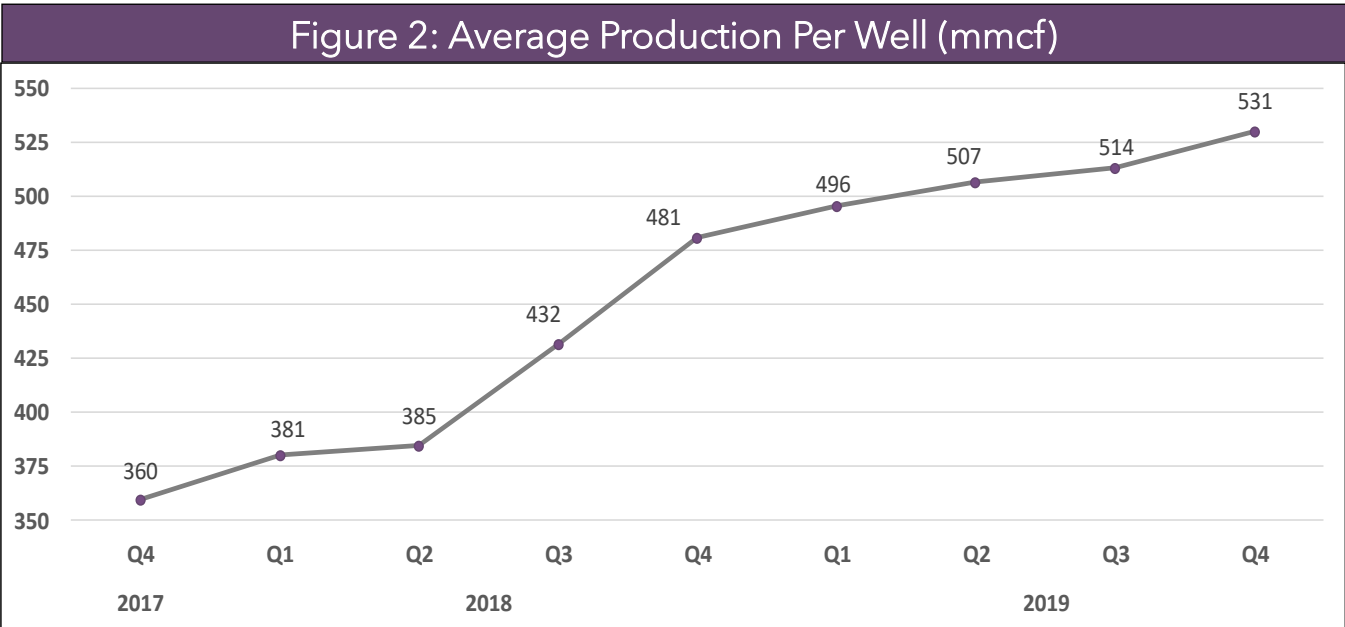


Figure 2 displays the average production per well for selected horizontal wells. Each data point in this figure represents horizontal wells that (1) were spud at least three quarters before the reporting period and no earlier than 12 quarters before that date and (2) produced above 90 mcf per day (i.e., did not qualify for stripper well status). After recording significant gains in 2018 (33.9 percent for the year), average production per well growth moderated in 2019 (10.3 percent).



## Well Count Trends

**Table 3** displays the number of wells in the fourth quarter of 2019 and provides a breakdown based on well type (horizontal vs. vertical) and production status. There were 9,319 producing horizontal wells in the fourth quarter, an 8.3 percent increase over the prior year. Total producing wells increased by 7.6 percent compared to the prior year. Total non-producing wells decreased by 2.8 percent compared to the prior year.

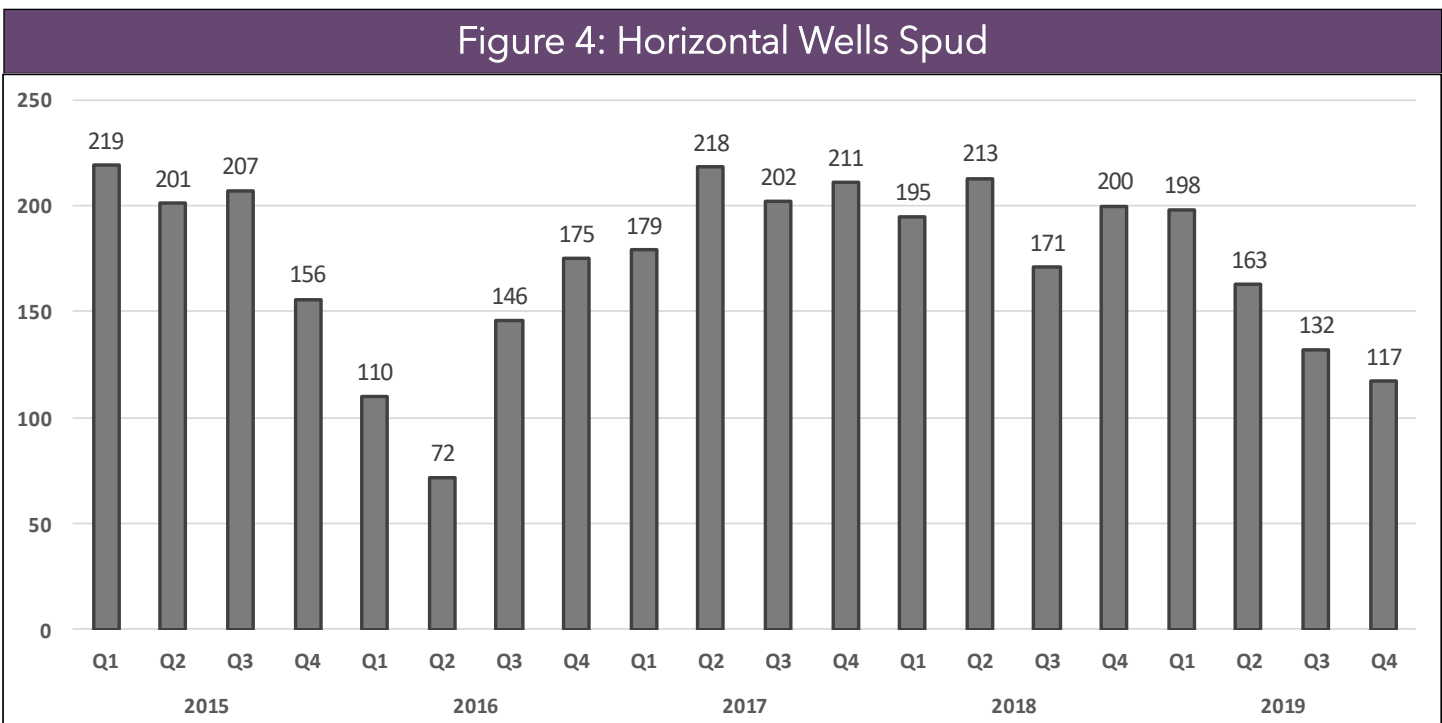
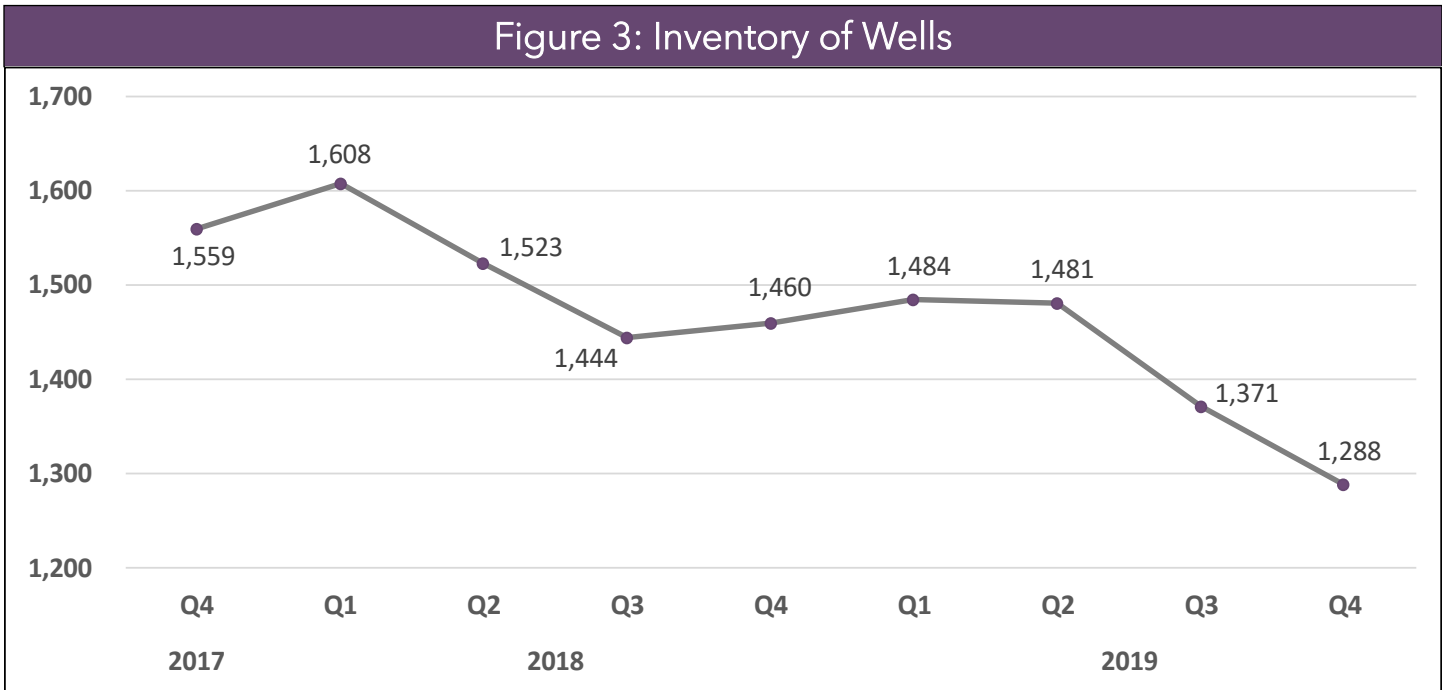
Table 3: Number of Wells, Fourth Quarter									
	<u>Producing</u>			<u>Non-Producing</u>			<u>Total</u>		
	2018	2019	Growth	2018	2019	Growth	2018	2019	Growth
Horizontal	8,606	9,319	8.3%	2,102	2,004	-4.7%	10,708	11,323	5.7%
Vertical	<u>486</u>	<u>462</u>	<u>-4.9%</u>	<u>516</u>	<u>541</u>	<u>4.8%</u>	<u>1,002</u>	<u>1,003</u>	<u>0.1%</u>
Total	9,092	9,781	7.6%	2,618	2,545	-2.8%	11,710	12,326	5.3%

**Table 4** shows a history of well counts broken down by well type and production status over the last nine quarters. It also provides detail for non-producing horizontal wells. Since the fourth quarter of 2017, total producing wells increased by 18.2 percent, while total non-producing wells decreased by 4.4 percent.

Table 4: Quarterly Well Count History										
	<u>2017</u>		<u>2018</u>				<u>2019</u>			
	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
Producing Wells										
Horizontal	7,779	7,917	8,197	8,432	8,606	8,766	8,898	9,123	9,319	
Vertical	<u>493</u>	<u>494</u>	<u>483</u>	<u>488</u>	<u>486</u>	<u>479</u>	<u>480</u>	<u>476</u>	<u>462</u>	
Total	8,272	8,411	8,680	8,920	9,092	9,245	9,378	9,599	9,781	
Non-Producing Wells										
Horizontal	2,153	2,208	2,140	2,076	2,102	2,140	2,171	2,083	2,004	
Vertical	<u>508</u>	<u>507</u>	<u>519</u>	<u>514</u>	<u>516</u>	<u>523</u>	<u>524</u>	<u>527</u>	<u>541</u>	
Total	2,661	2,715	2,659	2,590	2,618	2,663	2,696	2,610	2,545	
Horizontal Detail										
Shut In	854	843	747	722	756	733	746	705	706	
Spud, Not Completed	705	765	776	722	704	751	735	666	582	
Plugged	587	592	610	621	640	645	665	694	704	
Other	<u>7</u>	<u>8</u>	<u>7</u>	<u>12</u>	<u>2</u>	<u>11</u>	<u>25</u>	<u>18</u>	<u>12</u>	
Total	2,153	2,208	2,140	2,077	2,102	2,140	2,171	2,083	2,004	

Notes: All characterizations of wells are based on information submitted by the operator or DEP. "Other" includes wells with miscellaneous designations such as abandoned.

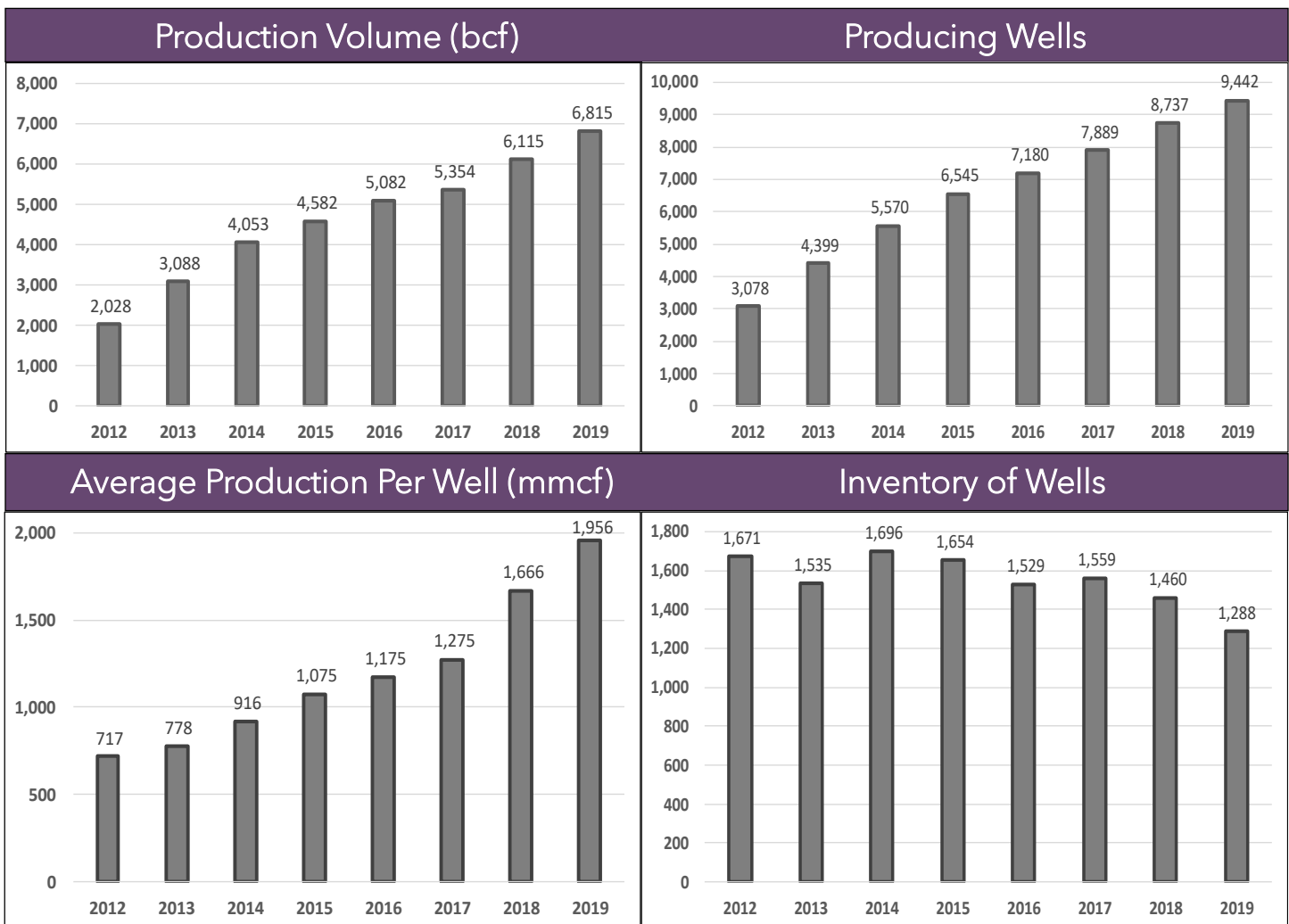
Figures 3 and 4 display recent trends in well counts. Figure 3 shows the quarterly history of the inventory of wells in Pennsylvania. Well inventory includes horizontal wells that are in the “Shut In” or “Spud, Not Completed” categories from Table 4. These wells are already spud and considered available to be brought into production in the future. The inventory of wells for the fourth quarter represents a decrease of 172 wells (-11.8 percent) from the prior year. Figure 4 displays the number of horizontal wells spud in each quarter over the last five calendar years. There were 117 horizontal wells spud in the fourth quarter of 2019, a decrease of 83 wells (-41.5 percent) from the prior year. This figure represents the lowest number of wells spud since the second quarter of 2016.



## Annual Trends

The following graphs display annual totals for production volume, producing well counts, average production per well and inventory well counts (i.e., non-producing wells that could produce at some point in the future). These graphs pertain only to horizontal wells. All figures are based on production and spud well data reported by DEP through 2019.

For 2019, total production was 6,815 bcf, an increase of 11.4 percent over the prior year. From 2012 to 2019, production volume increased at an average rate of 18.9 percent per annum. The number of producing wells was 9,442, which was 8.1 percent higher than 2018. From 2012 to 2019, the number of producing wells grew at an average rate of 17.1 percent per annum. Average production per well in 2019 was 1,956 mmcf, an increase of 17.4 percent. The cumulative increase of average production from 2012 to 2019 was 172.8 percent (15.4 percent per annum). The inventory of wells was 1,288 in 2019, a decrease of 11.8 percent from 2018.



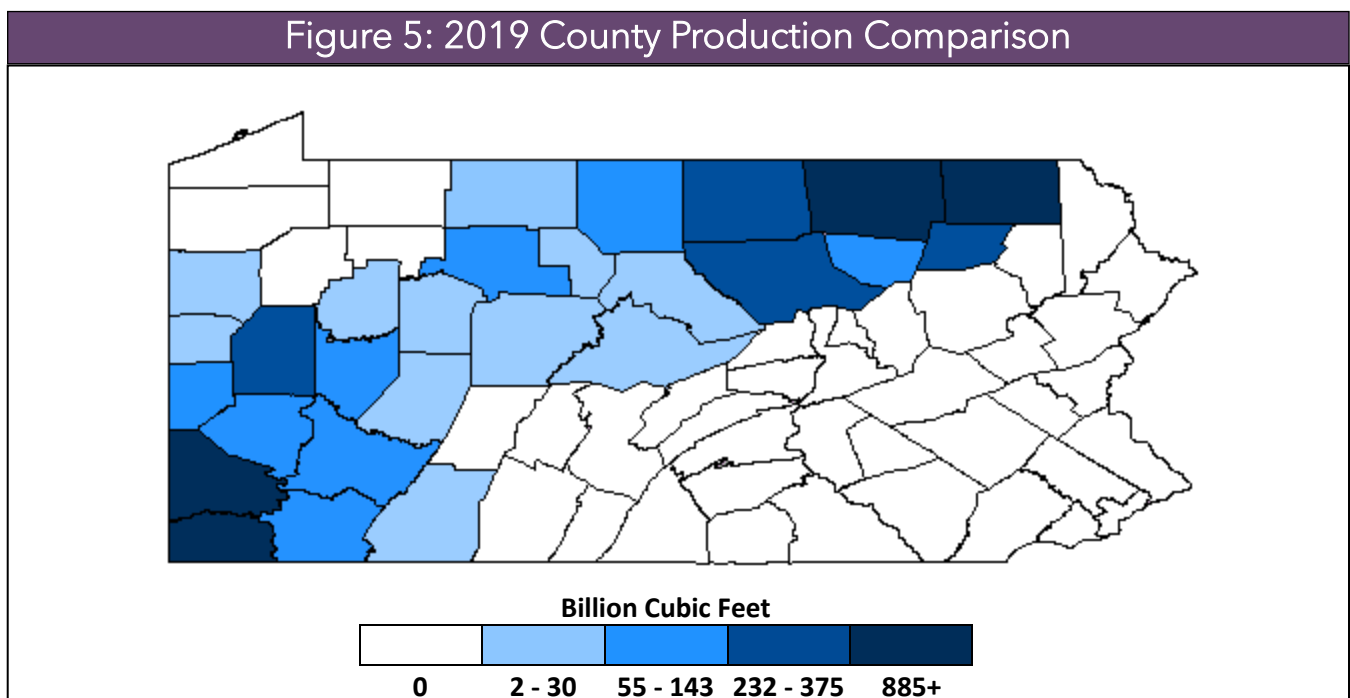
Notes: Producing Wells represents the number of wells that produced gas at any point during the year. Average Production Per Well represents horizontal wells that produced above the stripper well threshold of 90 mcf per day and were spud in any of the previous three years. Inventory of Wells represents the number of wells that did not produce gas at any point during the year and were characterized as shut in or spud, but not completed at the end of the listed calendar year.

## County Comparison

**Table 5** shows county-level production volume and producing well counts through the fourth quarter of 2018 and 2019. Four counties (Susquehanna, Washington, Greene and Bradford) comprised over two-thirds of statewide production. For the top ten, all counties except Wyoming registered production gains. **Figure 5** displays a map of calendar year production by county.

Table 5: 2019 County Production Comparison									
Rank	County	Production Volume (bcf)				Number of Producing Wells			
		Calendar Year		2019 Metrics		Calendar Year		2019 Metrics	
		2018	2019	Share	Growth	2018	2019	Share	Growth
1	Susquehanna	1,463	1,667	24.5%	13.9%	1,347	1,499	15.9%	11.3%
2	Washington	1,164	1,181	17.3%	1.4%	1,504	1,599	16.9%	6.3%
3	Greene	797	1,012	14.9%	27.0%	998	1,116	11.8%	11.8%
4	Bradford	764	886	13.0%	15.9%	1,203	1,265	13.4%	5.2%
5	Lycoming	356	374	5.5%	5.3%	816	852	9.0%	4.4%
6	Tioga	301	348	5.1%	15.6%	643	705	7.5%	9.6%
7	Wyoming	345	316	4.6%	-8.4%	247	274	2.9%	10.9%
8	Butler	216	232	3.4%	7.3%	461	490	5.2%	6.3%
9	Sullivan	135	148	2.2%	9.5%	124	130	1.4%	4.8%
10	Allegheny	107	143	2.1%	34.4%	109	132	1.4%	21.1%
11	All Other	466	507	7.4%	8.8%	1,285	1,380	14.6%	7.4%

Note: Horizontal wells only. Data shown pertain to the full calendar year.



## State Comparison

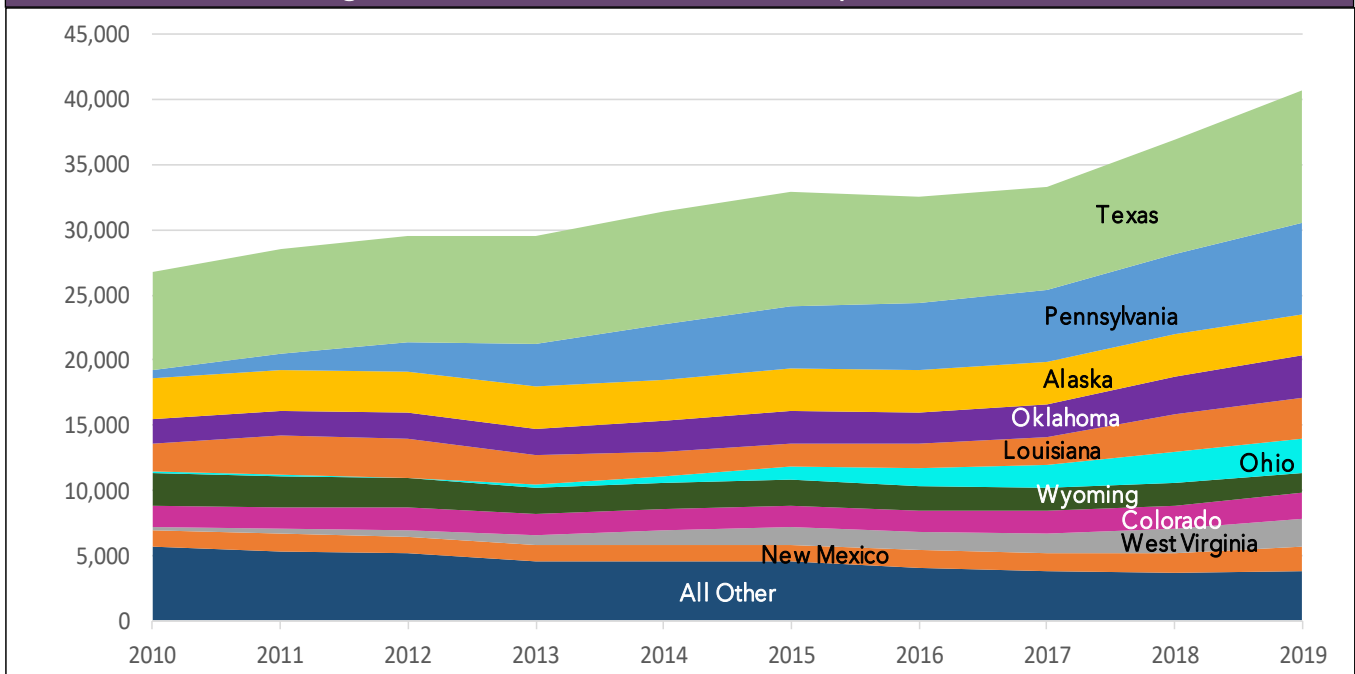
**Table 6** provides a state comparison of gross natural gas production from all well types. Nationwide production grew by 10.9 percent in 2018, which was the largest year-over-year increase on record (since 1980). Through November 2019, nationwide production grew by 10.2 percent compared to the prior year, largely driven by significant gains in Texas and Pennsylvania. **Figure 6** displays the composition of total U.S. production by state over the last decade.

Table 6: State Production Comparison (bcf)

Rank	State	Production Volume			Annual Growth Rate		
		CY 2017	CY 2018	CY 2019	CY 2017	CY 2018	CY 2019
1	Texas	7,996	8,814	10,218	-2.0%	10.2%	15.9%
2	Pennsylvania	5,464	6,207	6,984	4.9%	13.6%	12.5%
3	Alaska	3,251	3,255	3,243	0.6%	0.1%	-0.4%
4	Oklahoma	2,514	2,946	3,190	1.8%	17.2%	8.3%
5	Louisiana	2,148	2,830	3,159	19.8%	31.8%	11.6%
6	Ohio	1,773	2,385	2,616	23.4%	34.5%	9.7%
7	West Virginia	1,601	1,799	2,146	15.6%	12.4%	19.3%
8	Colorado	1,688	1,831	1,993	0.0%	8.5%	8.9%
9	New Mexico	1,325	1,524	1,863	3.3%	15.1%	22.2%
10	Wyoming	1,805	1,721	1,556	-2.4%	-4.6%	-9.6%
11	All Other	3,794	3,697	3,795	-7.3%	-2.6%	2.6%

Source: U.S. Energy Information Administration. Production does not directly correspond to DEP data. For CY 2019, December production is estimated by the IFO.

Figure 6: State Production Comparison (bcf)



## Glossary of Natural Gas Terminology

<b>Abandoned</b>	No longer producing, but not plugged, and without an available operator.
<b>Bcf</b>	Billion cubic feet. Used as a measure of production volume.
<b>Completed</b>	Capable of producing. Includes drilling and casing and, in the case of an unconventional well, fracturing the shale formation to release gas.
<b>Mcf</b>	Thousand cubic feet. Used as a measure of production volume.
<b>MMcf</b>	Million cubic feet. Used as a measure of production volume.
<b>Non-Producing</b>	A well with no production activity during the time period.
<b>Plugged</b>	Permanently sealed with cement or by some similar method.
<b>Production</b>	The natural gas recovered from a well.
<b>Shut In</b>	Temporary suspension of production activity. Directly corresponds to the term Capped, as defined in Act 13 of 2012.
<b>Spud</b>	The commencement of drilling activity. Often refers to the first stage at which casing is placed into the wellbore. Spud Year refers to the year in which a well was spud, as reported to the Department of Environmental Protection.
<b>Unconventional</b>	Requiring technological methods that go beyond merely drilling a well and capturing the gas. These methods usually include horizontal drilling into deep formations and fracturing with fluids.

## About the Report

The IFO publishes this report on a quarterly basis each May, August, November and February for the preceding quarter using monthly production data submitted to DEP by natural gas extractors that operate in the state. Unless otherwise noted, this report uses those data, in conjunction with DEP data on wells spud, to develop statewide tabulations of production volume and well counts. These data pertain only to gas produced from unconventional formations, which include the Marcellus and Utica. The data included in this report are current as of February 21, 2020.

## Staff Acknowledgements

This report was produced by Jesse Bushman and Rachel Flaugh. Questions regarding this report can be directed to [jbushman@ifso.state.pa.us](mailto:jbushman@ifso.state.pa.us).