

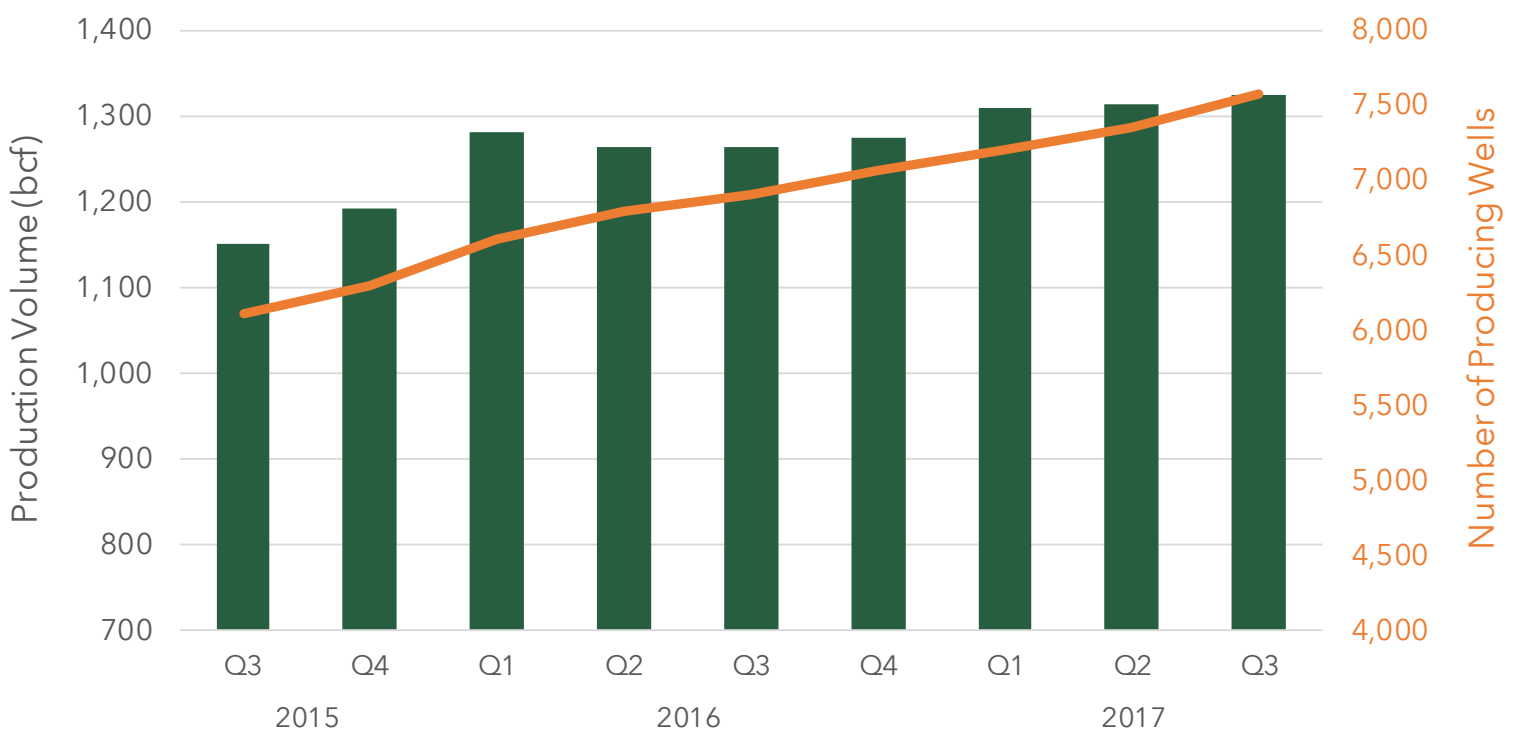
Natural Gas Production Report

JULY TO SEPTEMBER

THIRD QUARTER - 2017

- ▶ **PRODUCTION UP 4.8% FROM PRIOR YEAR**
+3.6% for the calendar year
- ▶ **PRODUCING WELLS UP 9.3% FROM PRIOR YEAR**
+8.1% for the calendar year

Quarterly Production and Well Counts



Natural Gas Production Report

Q3

Quarterly Trends

For the third quarter of 2017, recent data from the Department of Environmental Protection (DEP) show that total natural gas production volume was 1,326.2 billion cubic feet (bcf) and the number of producing wells was 8,073. Compared to the third quarter of 2016, total production grew by 4.8 percent, while the number of producing wells increased by 9.3 percent.

Table 1: Production Volume (bcf)

	Third Quarter			Calendar Year-to-Date		
	2016	2017	Growth	2016	2017	Growth
Horizontal	1,263.0	1,323.9	4.8%	3,807.9	3,955.2	3.6%
Vertical	<u>3.1</u>	<u>2.4</u>	<u>-22.6%</u>	<u>9.6</u>	<u>7.6</u>	<u>-20.7%</u>
Total	1,266.1	1,326.2	4.8%	3,817.4	3,962.8	3.6%

Table 2: Number of Wells

	Third Quarter			Calendar Year-to-Date		
	2016	2017	Growth	2016	2017	Growth
Producing Wells						
Horizontal	6,898	7,579	9.9%	7,022	7,645	8.9%
Vertical	<u>493</u>	<u>494</u>	<u>0.2%</u>	<u>516</u>	<u>510</u>	<u>-1.2%</u>
Total	7,391	8,073	9.3%	7,538	8,155	8.1%
Non-Producing Wells						
Horizontal	2,050	2,147	4.7%	1,926	2,081	8.0%
Vertical	<u>496</u>	<u>495</u>	<u>0.0%</u>	<u>473</u>	<u>479</u>	<u>1.5%</u>
Total	2,546	2,642	3.8%	2,399	2,560	6.7%
Horizontal Detail						
Shut In	901	837	-7.1%	777	772	-0.6%
Spud, Not Completed	683	783	14.6%	683	783	14.6%
Plugged	451	520	15.3%	451	520	15.3%
Other	<u>15</u>	<u>7</u>	<u>-53.3%</u>	<u>15</u>	<u>6</u>	<u>-60.0%</u>
Total	2,050	2,147	4.7%	1,926	2,081	8.0%

Notes: The number of producing wells in each quarter does not directly correspond to the year-to-date total because some wells do not produce in every quarter. The year-to-date number represents wells that were producing in any quarter of that year. For non-producing wells, the year-to-date number represents wells that produced no gas for that entire period. "Other" includes wells with miscellaneous designations such as abandoned. All characterizations of wells are based on information submitted by the operator or DEP.

Tables 3 and 4 decompose third quarter and calendar year-to-date production volume from horizontal wells by spud year. Most of the production gains in the third quarter and calendar year-to-date were from wells spud in 2015 and 2016. Wells spud in those years comprised more than one quarter of total production during both periods. For wells spud in 2014 and earlier, production declined in the third quarter (-18.8 percent) and calendar year-to-date (-17.2 percent), despite small increases in the number of producing wells.

Table 3: Third Quarter Production, by Spud Year

Spud Year	Production Volume (bcf)			Number of Wells			Producing Wells		
	2016	2017	Growth	2016	2017	Growth	2016	2017	Growth
2017	n.a.	25.5	n.a.	n.a.	602	n.a.	n.a.	47	n.a.
2016	1.3	194.4	n.a.	328	504	53.7%	6	317	n.a.
2015	185.9	230.0	23.7%	782	782	0.0%	437	616	41.0%
2014	366.2	294.8	-19.5%	1,349	1,349	0.0%	1,092	1,181	8.2%
2013	251.3	191.6	-23.8%	1,187	1,187	0.0%	1,073	1,078	0.5%
2012	165.0	135.3	-18.0%	1,311	1,311	0.0%	1,046	1,062	1.5%
2011	<u>293.4</u>	<u>252.3</u>	<u>-14.0%</u>	<u>3,991</u>	<u>3,991</u>	<u>0.0%</u>	<u>3,244</u>	<u>3,278</u>	<u>1.0%</u>
Total	1,263.0	1,323.9	4.8%	8,948	9,726	8.7%	6,898	7,579	9.9%

Notes: Horizontal wells only. This table displays 2016 and 2017 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 third quarter of 2016 and the third quarter of 2017. Spud year 2011 includes all wells spud in 2011 or earlier.

Table 4: Calendar Year-to-Date Production, by Spud Year

Spud Year	Production Volume (bcf)			Number of Wells			Producing Wells		
	2016	2017	Growth	2016	2017	Growth	2016	2017	Growth
2017	n.a.	26.9	n.a.	n.a.	602	n.a.	n.a.	47	n.a.
2016	1.3	358.1	n.a.	328	504	53.7%	6	318	n.a.
2015	409.1	748.6	83.0%	782	782	0.0%	440	618	40.5%
2014	1,145.3	966.2	-15.6%	1,349	1,349	0.0%	1,099	1,192	8.5%
2013	818.4	611.8	-25.2%	1,187	1,187	0.0%	1,080	1,089	0.8%
2012	523.5	428.5	-18.1%	1,311	1,311	0.0%	1,055	1,070	1.4%
2011	<u>910.3</u>	<u>815.1</u>	<u>-10.5%</u>	<u>3,991</u>	<u>3,991</u>	<u>0.0%</u>	<u>3,342</u>	<u>3,311</u>	<u>-0.9%</u>
Total	3,807.9	3,955.2	3.9%	8,948	9,726	8.7%	7,022	7,645	8.9%

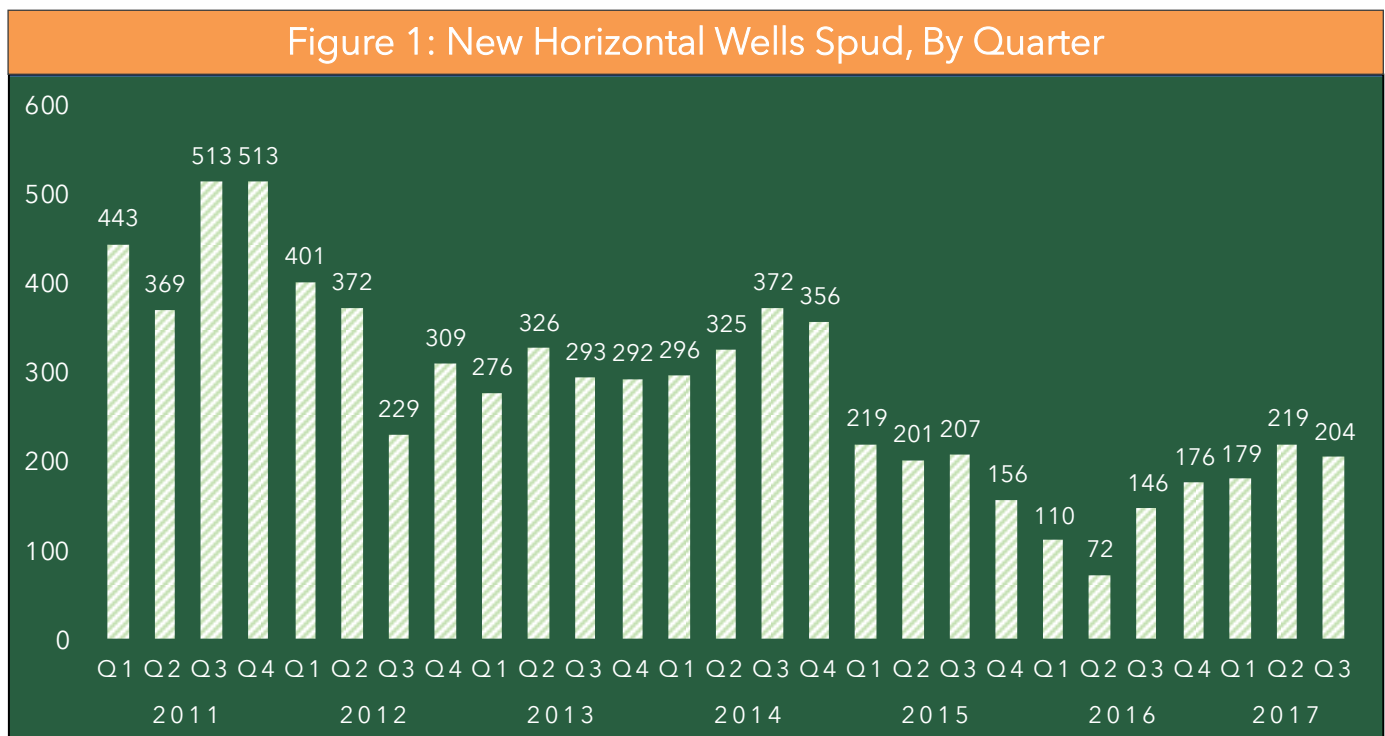
Notes: Horizontal wells only. This table displays 2016 and 2017 production based on the year wells were spud. For example, wells with spud year 2014 were spud during calendar year 2014, and their production is shown for the first three quarters of 2016 and the first three quarters of 2017. Spud year 2011 includes all wells spud in 2011 or earlier.

Table 5 displays production volume, total well counts, producing well counts and average production per well over the last nine quarters. Production growth accelerated modestly during the last two quarters after decelerating from 14.5 percent in the second quarter of 2016 to 2.2 percent in the first quarter of 2017. The number of producing wells has grown steadily over the last seven quarters.

Table 5: Historical Quarterly Production Volume and Well Counts									
	2015		2016				2017		
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
Production Volume (bcf)	1,151.3	1,192.1	1,280.5	1,264.4	1,263.0	1,273.7	1,309.1	1,322.2	1,323.9
Annual Growth Rate	n.a.	n.a.	12.8%	14.5%	9.7%	6.8%	2.2%	4.6%	4.8%
Number of Wells	8,465	8,621	8,730	8,802	8,948	9,124	9,303	9,522	9,726
Annual Growth Rate	n.a.	n.a.	8.4%	6.6%	5.7%	5.8%	6.6%	8.2%	8.7%
Producing Wells	6,104	6,295	6,605	6,794	6,898	7,068	7,205	7,348	7,579
Annual Growth Rate	n.a.	n.a.	15.4%	14.2%	13.0%	12.3%	9.1%	8.1%	9.9%
Avg. Prod. per Well (mmcf)	280.8	290.8	304.4	302.0	299.7	306.7	317.0	324.9	327.2
Annual Growth Rate	n.a.	n.a.	13.3%	16.0%	6.7%	5.5%	4.1%	7.6%	9.1%

Notes: Horizontal wells only. Average production per well represents 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.

Figure 1 displays the number of new horizontal wells spud in each quarter since 2011. There was a slight decline in new wells spud for the third quarter of 2017 after consecutive increases in the four previous quarters.

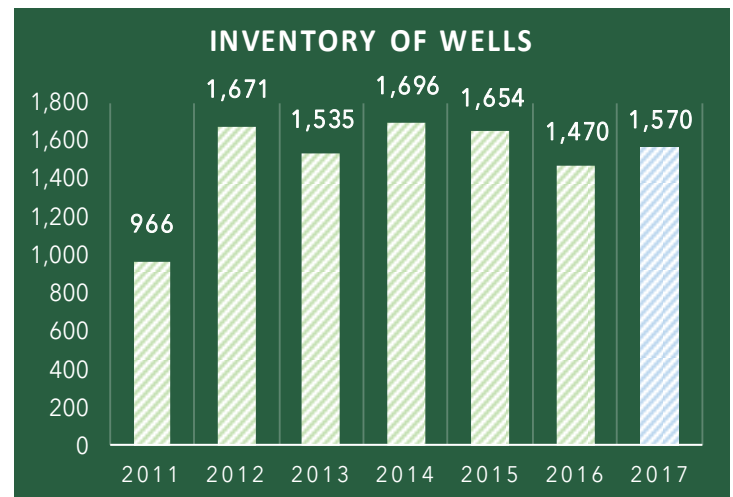
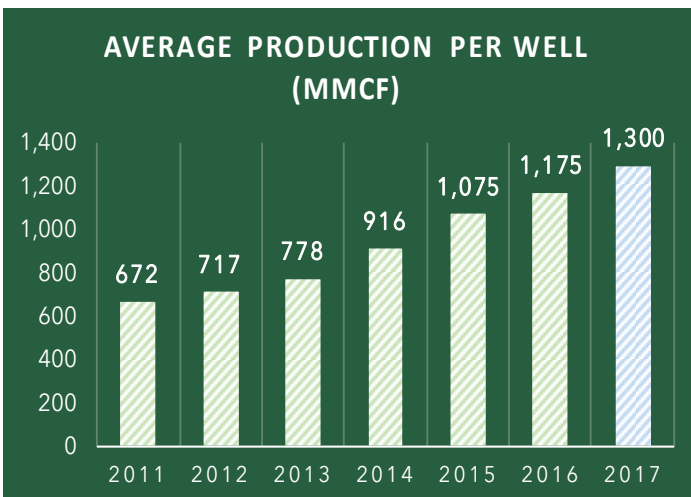
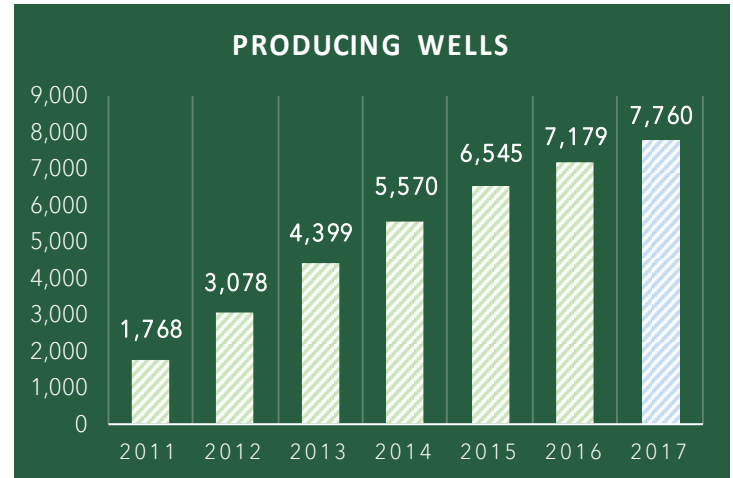
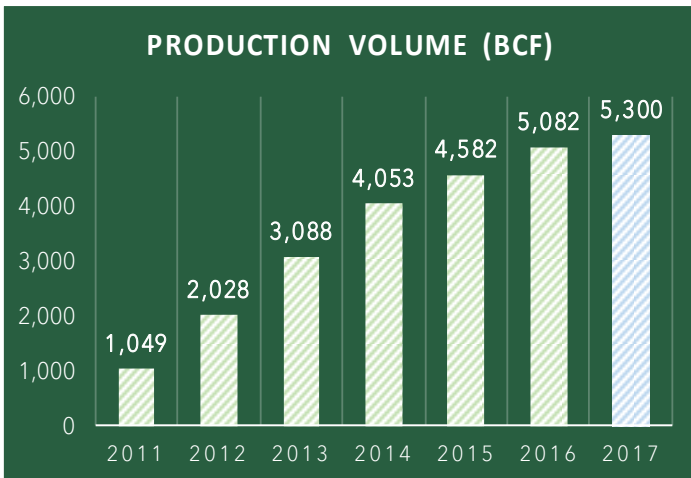


Annual Trends

The following graphs display annual totals for production volume, producing well counts, average production per well and inventory well counts (non-producing wells that could produce at some point in the future). These graphs pertain only to horizontal production and well counts. Figures for 2017 are estimates based on year-to-date spud and production data published by DEP and forecasts by Bentek Energy. Figures for 2011 to 2016 are based on DEP data for the full calendar year.

For 2016, total production volume was 5,082 bcf, an increase of 10.9 percent from the prior year. From 2011 to 2016, production volume increased at an average annual rate of 37.1 percent. The number of producing wells in 2016 was 7,179, which was 9.7 percent higher than 2015. From 2011 to 2016, the number of producing wells grew at an average annual rate of 32.3 percent. Average production per well in 2016 was 1,175 mmcf, a cumulative increase of 74.9 percent since 2011. The inventory of wells in 2016 was 1,470, a decline of 11.1 percent from the prior year.

For 2017, total production volume is estimated to be 5,300 bcf, an increase of 4.3 percent from the prior year. Producing wells are estimated to be 7,760, which is an 8.1 percent increase from 2016. The inventory of wells is estimated to be 1,570, a 6.8 percent increase from 2016. Average production per well is estimated to increase by 10.6 percent.



Notes: Producing wells represents the number of wells that produced gas at any point during the year. Average production per well represents 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

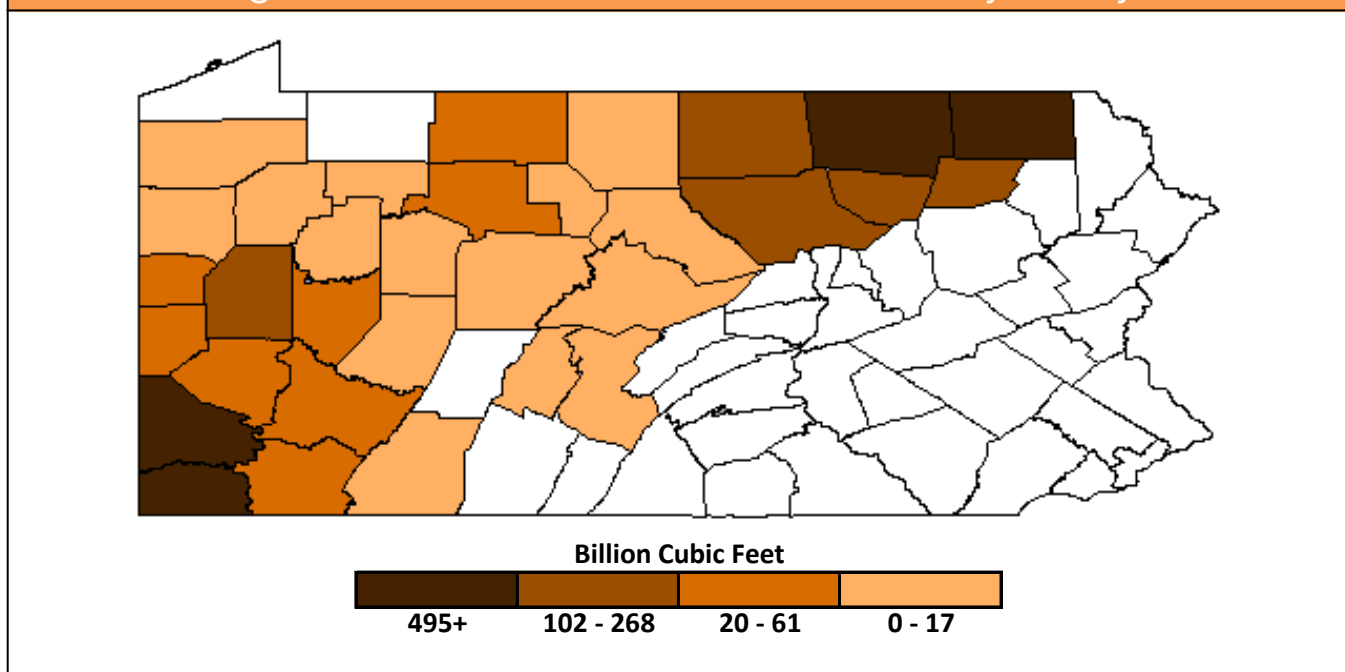
Table 6 shows county-level production volume and producing well counts for the calendar year-to-date. Four counties (Susquehanna, Washington, Bradford and Greene) comprised two thirds of statewide production. All counties except Greene, Lycoming and Fayette registered production gains. Figure 2 displays a geographic map of calendar year-to-date production by county.

Table 6: Calendar Year-to-Date Production, by County

Rank	County	Production Volume (bcf)				Number of Producing Wells			
		Year-to-Date		2017 Metrics		Year-to-Date		2017 Metrics	
		2016	2017	Share	Growth	2016	2017	Share	Growth
1	Susquehanna	902.7	966.1	24.4%	7.0%	1,017	1,151	15.1%	13.2%
2	Washington	619.8	679.2	17.2%	9.6%	1,168	1,302	17.0%	11.5%
3	Bradford	529.4	538.3	13.6%	1.7%	1,041	1,067	14.0%	2.5%
4	Greene	527.6	495.0	12.5%	-6.2%	749	831	10.9%	10.9%
5	Lycoming	322.2	268.3	6.8%	-16.7%	747	757	9.9%	1.3%
6	Wyoming	209.2	252.6	6.4%	20.7%	193	230	3.0%	19.2%
7	Tioga	143.5	154.3	3.9%	7.5%	558	598	7.8%	7.2%
8	Butler	128.3	133.6	3.4%	4.1%	342	385	5.0%	12.6%
9	Sullivan	75.7	101.9	2.6%	34.5%	81	103	1.3%	27.2%
10	Fayette	60.7	60.7	1.5%	0.0%	182	189	2.5%	3.8%
11	All Other	288.6	305.3	7.7%	5.8%	944	1,032	13.5%	9.3%

Note: Horizontal wells only.

Figure 2: Calendar Year-to-Date Production, by County



State Comparison

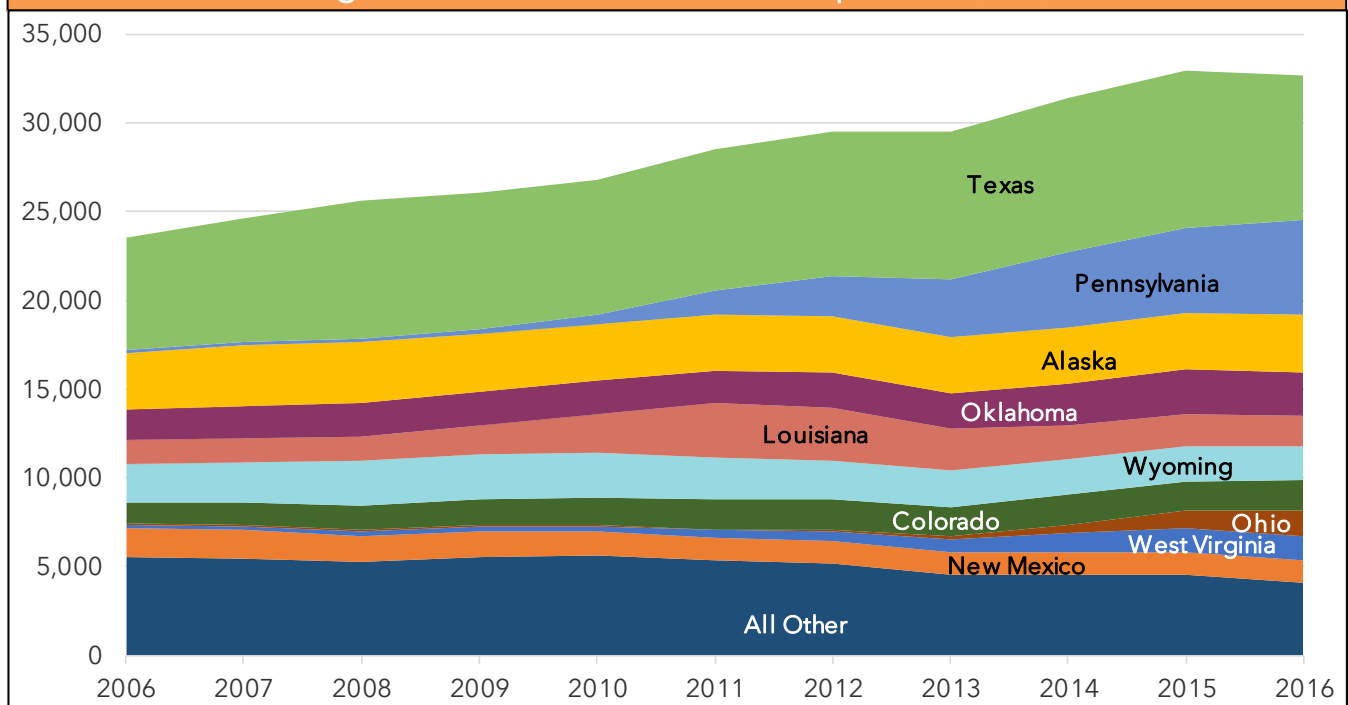
Table 7 displays a state comparison of gross production from all well types. Among the top-ten producing states, Louisiana, Ohio and West Virginia recorded the largest production gains for the first eight months of 2017. Pennsylvania, Alaska and New Mexico recorded modest increases. Four states (Texas, Oklahoma, Wyoming and Colorado) registered declines. Figure 3 displays the composition of total U.S. production by state, over the last decade.

Table 7: State Production Comparison (bcf)

Rank	State	Production Volume			Annual Growth Rate		
		CY 2015	CY 2016	2017	CY 2015	CY 2016	2017
1	Texas	8,799.5	8,133.8	5,178.3	1.6%	-7.6%	-6.4%
2	Pennsylvania	4,813.0	5,313.3	3,595.6	13.0%	10.4%	1.0%
3	Alaska	3,175.3	3,230.0	2,134.4	0.2%	1.7%	1.3%
4	Oklahoma	2,499.6	2,468.3	1,626.9	7.2%	-1.3%	-2.5%
5	Louisiana	1,813.2	1,752.3	1,320.1	-7.9%	-3.4%	11.9%
6	Wyoming	1,995.9	1,848.1	1,128.8	-0.1%	-7.4%	-8.2%
7	Colorado	1,688.7	1,701.7	1,109.2	2.8%	0.8%	-1.9%
8	Ohio	1,007.3	1,439.9	1,107.1	96.6%	43.0%	17.6%
9	West Virginia	1,315.2	1,375.1	1,024.6	23.3%	4.6%	13.4%
10	New Mexico	1,296.8	1,284.7	865.5	2.4%	-0.9%	1.6%
11	All Other	4,510.1	4,088.3	2,585.5	-0.5%	-9.4%	-6.6%

Notes: Production and growth rates for 2017 through August. Data for all other years are for the full calendar year.
Source: U.S. Energy Information Administration. Production does not directly correspond to DEP data.

Figure 3: State Production Comparison (bcf)



Glossary of Natural Gas Terminology

Abandoned	No longer producing, but not plugged, and without an available operator.
Bcf	Billion cubic feet. Used as a measure of production volume.
Completed	Capable of producing. Includes drilling and casing and, in the case of an unconventional well, fracturing the shale formation to release gas.
Mcf	Thousand cubic feet. Used as a measure of production volume.
MMcf	Million cubic feet. Used as a measure of production volume.
Plugged	Permanently sealed with cement or by some similar method.
Production	The natural gas recovered from a well.
Shut-In	Temporary suspension of production activity. Directly corresponds to the term “capped,” as defined in Act 13 of 2012.
Spud	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.
Unconventional	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 December 6, 2017.