

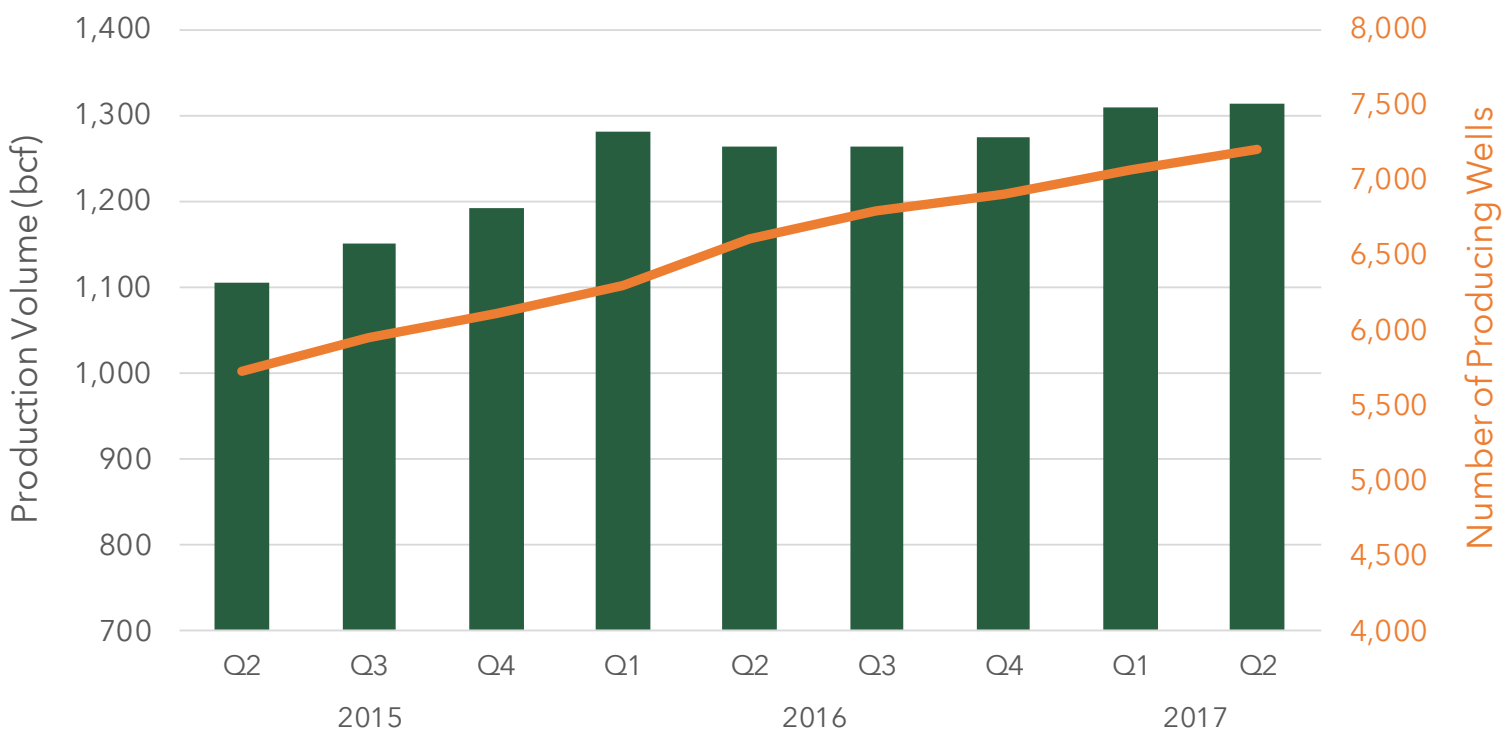
Natural Gas Production Report

APRIL TO JUNE

SECOND QUARTER - 2017

- ▶ **PRODUCTION UP 3.8% FROM PRIOR YEAR**
+3.0% for the calendar year
- ▶ **PRODUCING WELLS UP 7.5% FROM PRIOR YEAR**
+7.6% for the calendar year

Quarterly Production and Well Counts



Natural Gas Production Report

Q2

Quarterly Trends

For the second quarter of 2017, recent data from the Department of Environmental Protection (DEP) show that total natural gas production volume was 1,315.7 billion cubic feet (bcf) and the number of producing wells was 7,853. Compared to the second quarter of 2016, total production grew by 3.8 percent, while the number of producing wells increased by 7.5 percent.

Table 1: Production Volume (bcf)

	Second Quarter			Calendar Year-to-Date		
	2016	2017	Growth	2016	2017	Growth
Horizontal	1,264.4	1,313.1	3.9%	2,544.8	2,622.3	3.0%
Vertical	<u>3.3</u>	<u>2.5</u>	<u>-24.2%</u>	<u>6.5</u>	<u>5.3</u>	<u>-18.5%</u>
Total	1,267.6	1,315.7	3.8%	2,551.3	2,627.5	3.0%

Table 2: Number of Wells

	Second Quarter			Calendar Year-to-Date		
	2016	2017	Growth	2016	2017	Growth
Producing Wells						
Horizontal	6,794	7,347	8.1%	6,847	7,409	8.2%
Vertical	<u>508</u>	<u>506</u>	<u>-0.4%</u>	<u>515</u>	<u>509</u>	<u>-1.2%</u>
Total	7,302	7,853	7.5%	7,362	7,918	7.6%
Non-Producing Wells						
Horizontal	2,009	2,176	8.3%	1,956	2,114	8.1%
Vertical	<u>480</u>	<u>482</u>	<u>0.4%</u>	<u>473</u>	<u>479</u>	<u>1.3%</u>
Total	2,489	2,658	6.8%	2,429	2,593	6.8%
Horizontal Detail						
Shut In	935	908	-2.9%	882	847	-4.0%
Spud, Not Completed	623	762	22.3%	623	762	22.3%
Plugged	434	494	13.8%	434	494	13.8%
Other	<u>17</u>	<u>12</u>	<u>-29.4%</u>	<u>17</u>	<u>11</u>	<u>-35.3%</u>
Total	2,009	2,176	8.3%	1,956	2,114	8.1%

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 second quarter and calendar year-to-date production volume from horizontal wells by spud year. As shown in Tables 3 and 4, nearly all of the production gains in the second 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 second quarter (-17.0 percent) and calendar year-to-date (-16.5 percent), despite small increases in the number of producing wells.

Table 3: Second 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.	1.4	n.a.	n.a.	398	n.a.	n.a.	7	n.a.
2016	0	118.1	n.a.	182	504	176.9%	0	194	n.a.
2015	136.0	257.0	89.0%	783	783	0.0%	346	599	73.1%
2014	381.7	323.0	-15.4%	1,349	1,349	0.0%	1,043	1,160	11.2%
2013	271.4	199.9	-26.3%	1,187	1,187	0.0%	1,071	1,065	-0.6%
2012	174.7	142.9	-18.2%	1,311	1,311	0.0%	1,044	1,059	1.4%
2011	<u>300.5</u>	<u>270.7</u>	<u>-9.9%</u>	<u>3,991</u>	<u>3,991</u>	<u>0.0%</u>	<u>3,290</u>	<u>3,263</u>	<u>-0.8%</u>
Total	1,264.4	1,313.1	3.9%	8,803	9,523	8.2%	6,794	7,347	8.1%

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 second quarter of 2016 and the second 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.	1.4	n.a.	n.a.	398	n.a.	n.a.	7	n.a.
2016	0	163.8	n.a.	182	504	176.9%	0	194	n.a.
2015	223.2	518.6	132.3%	783	783	0.0%	349	599	71.6%
2014	779.2	670.8	-13.9%	1,349	1,349	0.0%	1,049	1,168	11.3%
2013	567.1	418.4	-26.2%	1,187	1,187	0.0%	1,074	1,084	0.9%
2012	358.5	291.8	-18.6%	1,311	1,311	0.0%	1,046	1,066	1.9%
2011	<u>616.9</u>	<u>557.5</u>	<u>-9.6%</u>	<u>3,991</u>	<u>3,991</u>	<u>0.0%</u>	<u>3,329</u>	<u>3,291</u>	<u>-1.1%</u>
Total	2,544.8	2,622.3	3.0%	8,803	9,523	8.2%	6,847	7,409	8.2%

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 second quarter of 2016 and the second quarter 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 decelerated from 14.5 percent in the second quarter of 2016 to 2.2 percent in the first quarter of 2017. During the most recent quarter, production growth accelerated to 3.9 percent. The number of producing wells has grown steadily over the last six quarters.

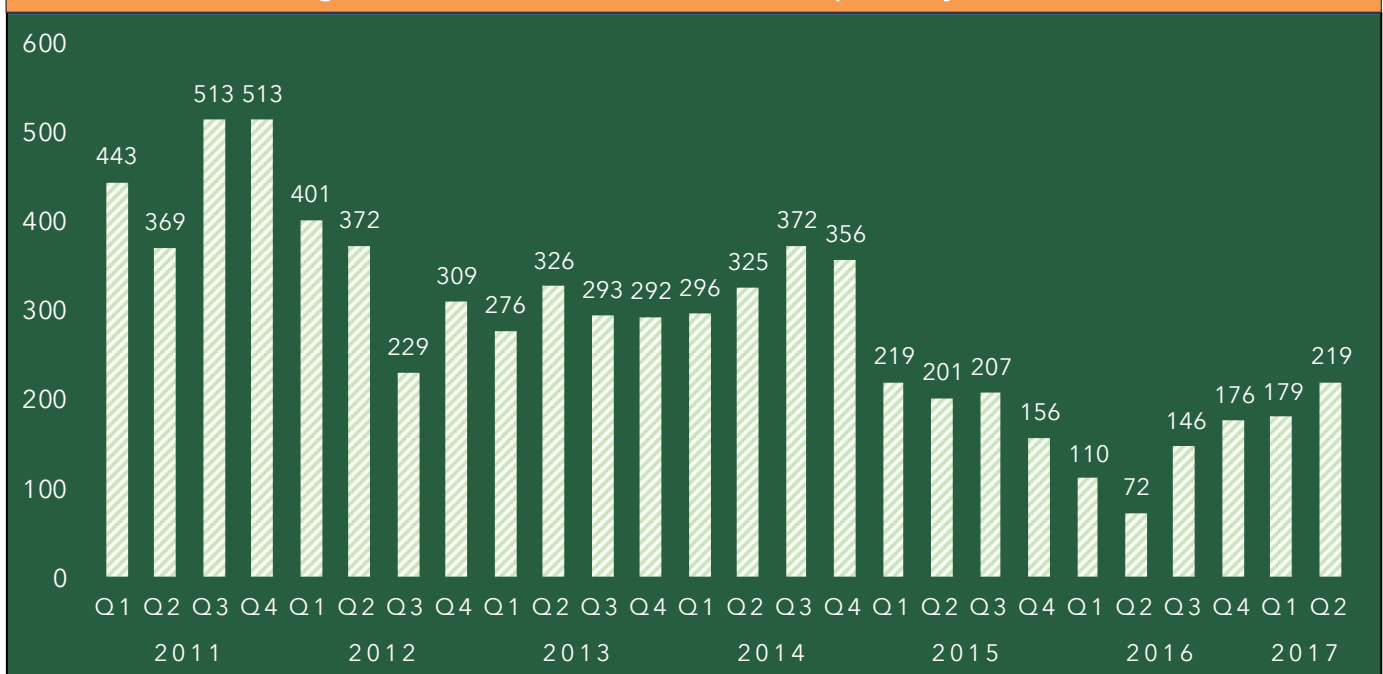
Table 5: Historical Quarterly Production Volume and Well Counts

	2015			2016				2017	
	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Production Volume (bcf)	1,103.9	1,151.3	1,192.1	1,280.5	1,264.4	1,263.0	1,273.7	1,309.1	1,313.1
Annual Growth Rate	n.a.	n.a.	n.a.	12.8%	14.5%	9.7%	6.8%	2.2%	3.9%
Number of Wells	8,258	8,465	8,621	8,731	8,803	8,949	9,125	9,304	9,523
Annual Growth Rate	n.a.	n.a.	n.a.	8.4%	6.6%	5.7%	5.8%	6.6%	8.2%
Producing Wells	5,947	6,104	6,295	6,605	6,794	6,898	7,068	7,205	7,347
Annual Growth Rate	n.a.	n.a.	n.a.	15.4%	14.2%	13.0%	12.3%	9.1%	8.1%
Avg. Prod. per Well (mmcf)	361.9	364.5	345.7	399.2	376.2	362.6	363.5	464.1	471.2
Annual Growth Rate	n.a.	n.a.	n.a.	-1.8%	4.0%	-0.5%	5.1%	16.3%	25.3%

Notes: Horizontal wells only. Average production per well represents wells that produced above the stripper well threshold of 90 mcf per day and were spud during the listed year or the two preceding calendar years.

Figure 1 displays the number of new horizontal wells spud in each quarter since 2011. After declining to its lowest point in the second quarter of 2016, new horizontal wells spud have increased in each of the last four quarters.

Figure 1: New Horizontal Wells Spud, By Quarter

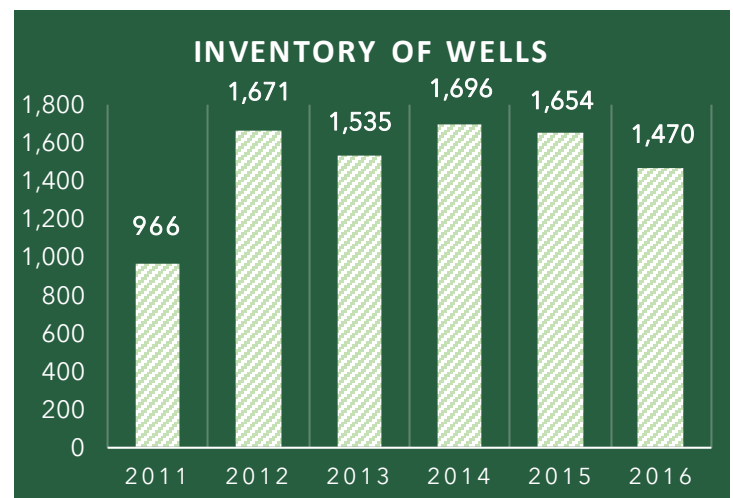
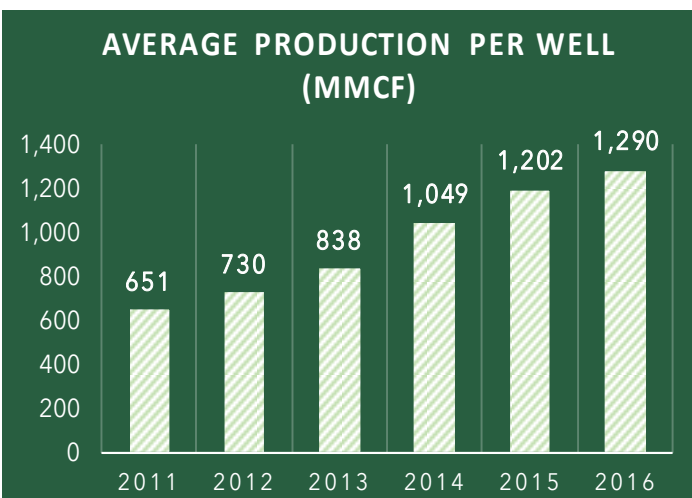
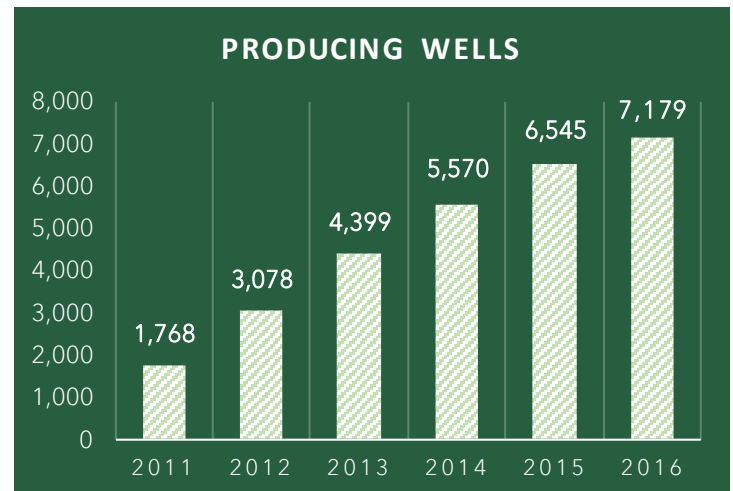
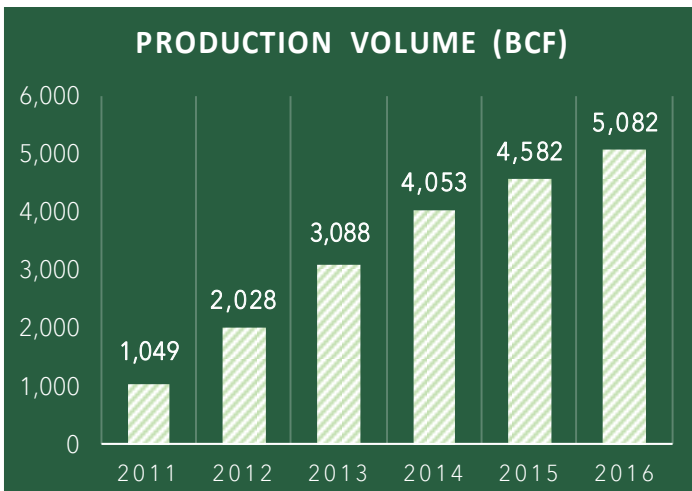


Annual Trends

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. Vertical wells comprised roughly 0.2 percent of production in the second quarter of 2017.

In 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 1,290 mmcf, a cumulative increase of 98.2 percent since 2011. The majority of that growth occurred in 2014 and 2015. This outcome was motivated by improved drilling technologies and efficiencies that allowed average production per well to increase dramatically in recent years. The inventory of wells in 2016 was 1,470, a decline of 11.1 percent from the prior year. These wells have declined each year since 2014 which is likely due to an increase in previously non-producing wells coming into production.



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 during the listed year or the two preceding calendar 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

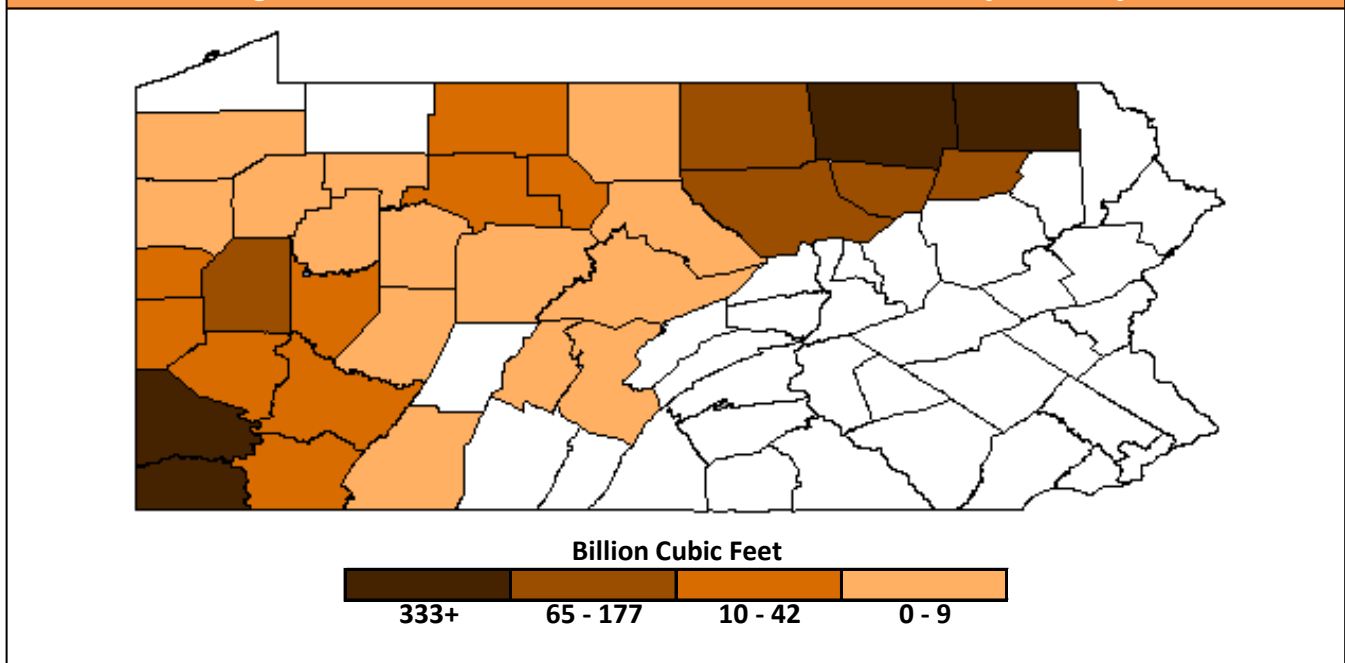
Table 6 shows county-level production volume and producing well counts for the calendar year-to-date. Four counties (Susquehanna, Washington, Bradford and Greene) comprised two thirds of statewide production. All counties except Greene and Lycoming registered production gains. Figure 2 displays a geographic 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	609.7	649.2	24.8%	6.5%	983	1,122	15.1%	14.1%
2	Washington	404.8	433.4	16.5%	7.1%	1,139	1,256	17.0%	10.3%
3	Bradford	353.8	367.7	14.0%	3.9%	1,025	1,043	14.1%	1.8%
4	Greene	355.3	333.0	12.7%	-6.3%	722	801	10.8%	10.9%
5	Lycoming	223.6	177.1	6.8%	-20.8%	745	755	10.2%	1.3%
6	Wyoming	135.4	162.2	6.2%	19.8%	187	209	2.8%	11.8%
7	Tioga	97.5	103.5	3.9%	6.2%	551	578	7.8%	4.9%
8	Butler	85.6	88.3	3.4%	3.2%	333	364	4.9%	9.3%
9	Sullivan	50.1	65.4	2.5%	30.5%	71	97	1.3%	36.6%
10	Fayette	40.9	41.8	1.6%	2.2%	172	189	2.6%	9.9%
11	All Other	188.2	200.7	7.7%	6.6%	919	995	13.4%	8.3%

Note: Horizontal wells only.

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



State Comparison

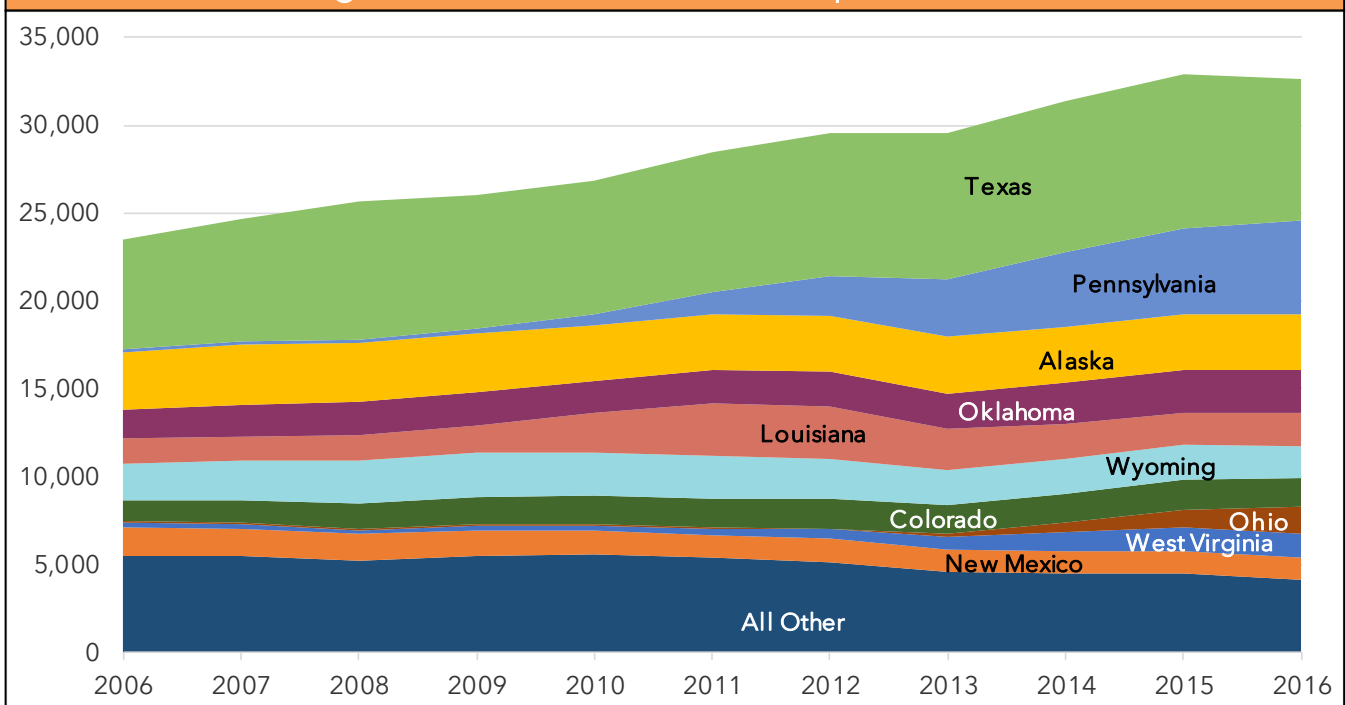
Table 7 displays a state comparison of gross production from all well types. Among the top-ten producing states, Ohio and West Virginia recorded the largest production gains for the first five months of 2017. Pennsylvania, Alaska and New Mexico recorded modest increases. Four states (Texas, Oklahoma, 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	8,801.3	8,099.2	3,184.1	1.6%	-8.0%	-7.8%
2	Pennsylvania	4,813.0	5,264.0	2,245.8	13.0%	9.4%	2.0%
3	Alaska	3,175.3	3,229.9	1,458.3	0.2%	1.7%	5.5%
4	Oklahoma	2,499.6	2,468.3	991.1	7.2%	-1.3%	-5.2%
5	Louisiana	1,784.8	1,869.6	784.2	-9.3%	4.8%	0.6%
6	Wyoming	1,983.7	1,766.8	698.9	-0.7%	-10.9%	-7.4%
7	Colorado	1,704.8	1,703.3	691.5	3.7%	-0.1%	-2.1%
8	Ohio	1,014.9	1,466.9	651.7	98.1%	44.5%	10.4%
9	West Virginia	1,318.8	1,375.1	619.8	23.6%	4.3%	10.6%
10	New Mexico	1,296.5	1,287.0	531.1	2.4%	-0.7%	1.1%
11	All Other	4,502.1	4,117.3	1,618.4	-0.7%	-8.5%	-8.6%

Notes: Production and growth rates for 2017 through May. 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 August 21, 2017.