



Natural Gas Production Report

Fourth Quarter 2016

The Pennsylvania Department of Environmental Protection (DEP) publishes monthly production data submitted 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 for the fourth quarter of 2016 and the calendar year. These data are current as of February 22, 2017 and pertain only to gas produced from unconventional formations, which include the Marcellus and Utica formations. The final page provides definitions of the technical terms used throughout this report.

Table 1: Production Volume

	<u>Fourth Quarter</u>			<u>Calendar Year</u>		
	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>
Volume (bcf)						
Horizontal	1,273.7	1,192.1	6.8%	5,081.5	4,582.8	10.9%
Vertical	<u>3.0</u>	<u>3.9</u>	<u>-22.8%</u>	<u>12.6</u>	<u>14.1</u>	<u>-10.9%</u>
Total	1,276.7	1,196.0	6.7%	5,094.1	4,596.9	10.8%

Table 2: Well Count

	<u>Fourth Quarter</u>			<u>Calendar Year</u>		
	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>
Number of Producing Wells						
Horizontal	7,066	6,295	12.2%	7,177	6,545	9.7%
Vertical	<u>502</u>	<u>502</u>	<u>0.0%</u>	<u>524</u>	<u>519</u>	<u>1.0%</u>
Total	7,568	6,797	11.3%	7,701	7,064	9.0%
Number of Non-Producing Wells						
Horizontal	2,057	2,324	-11.5%	1,946	2,074	-6.2%
Vertical	<u>485</u>	<u>485</u>	<u>0.0%</u>	<u>463</u>	<u>468</u>	<u>-1.1%</u>
Total	2,542	2,809	-9.5%	2,409	2,542	-5.2%
Horizontal Detail						
Shut In	866	1,136	-23.8%	759	892	-14.9%
Spud But Not Completed	812	856	-5.1%	811	851	-4.7%
Plugged	333	301	10.6%	330	301	9.6%
Other	<u>46</u>	<u>31</u>	<u>48.4%</u>	<u>46</u>	<u>30</u>	<u>53.3%</u>
Total	2,057	2,324	-11.5%	1,946	2,074	-6.2%

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

Tables 3 and 4 show fourth quarter and calendar year production volume from horizontal wells by spud year. As shown in Table 3, production gains in the fourth quarter were from wells spud in 2015 and 2016. However, these wells accounted for only 19.8% of production volume. As shown in Table 4, most production gains for the calendar year were from wells spud in 2014 and 2015.

The fourth quarter of 2016 is the first period that production from wells spud in 2014 declined (-1.7%). That occurred despite an increase in the number of producing wells from that spud year (26.3%). For wells spud in 2013 and earlier, production declined in the fourth quarter and calendar year (-13.8% and -12.3%), even though the number of producing wells increased (2.9% and 0.3%).

Table 4 also shows that, in calendar year 2016, only 41 of the 504 new wells spud in that year produced gas (8.1%), while in calendar year 2015, 156 of the 783 wells spud in that year produced gas (19.9%).

Table 3: Fourth Quarter Production, by Spud Year

<u>Spud Year</u>	<u>Production Volume (bcf)</u>			<u>Number of Wells</u>			<u>Producing Wells</u>		
	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>
2016	22.7	n.a.	n.a.	504	n.a.	n.a.	41	n.a.	n.a.
2015	230.1	58.1	296.4%	783	783	0.0%	500	156	220.5%
2014	352.7	358.8	-1.7%	1,350	1,350	0.0%	1,130	895	26.3%
2013	231.6	293.9	-21.2%	1,186	1,186	0.0%	1,068	1,024	4.3%
2012	152.3	179.4	-15.1%	1,312	1,312	0.0%	1,057	1,019	3.7%
2011	<u>284.2</u>	<u>302.0</u>	<u>-5.9%</u>	<u>3,988</u>	<u>3,988</u>	<u>0.0%</u>	<u>3,270</u>	<u>3,201</u>	<u>2.2%</u>
Total	1,273.7	1,192.1	6.8%	9,123	8,619	5.8%	7,066	6,295	12.2%

Notes: Horizontal wells only. This table displays 2016 and 2015 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 2016 and the fourth quarter of 2015. Spud year 2011 includes all wells spud in 2011 or earlier.

Table 4: Calendar Year Production, by Spud Year

<u>Spud Year</u>	<u>Production Volume (bcf)</u>			<u>Number of Wells</u>			<u>Producing Wells</u>		
	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>
2016	24.0	n.a.	n.a.	504	n.a.	n.a.	41	n.a.	n.a.
2015	639.3	77.1	729.1%	783	783	0.0%	504	156	223.1%
2014	1,498.1	1,174.2	27.6%	1,350	1,350	0.0%	1,136	911	24.7%
2013	1,050.0	1,283.1	-18.2%	1,186	1,186	0.0%	1,084	1,066	1.7%
2012	676.2	768.5	-12.0%	1,312	1,312	0.0%	1,064	1,058	0.6%
2011	<u>1,194.1</u>	<u>1,279.9</u>	<u>-6.7%</u>	<u>3,988</u>	<u>3,988</u>	<u>0.0%</u>	<u>3,348</u>	<u>3,354</u>	<u>-0.2%</u>
Total	5,081.5	4,582.8	10.9%	9,123	8,619	5.8%	7,177	6,545	9.7%

Notes: Horizontal wells only. This table displays 2016 and 2015 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 calendar year 2016 and calendar year 2015. Spud year 2011 includes all wells spud in 2011 or earlier.

Figure 1: Number of Producing, Non-Producing and New Wells by Calendar Year

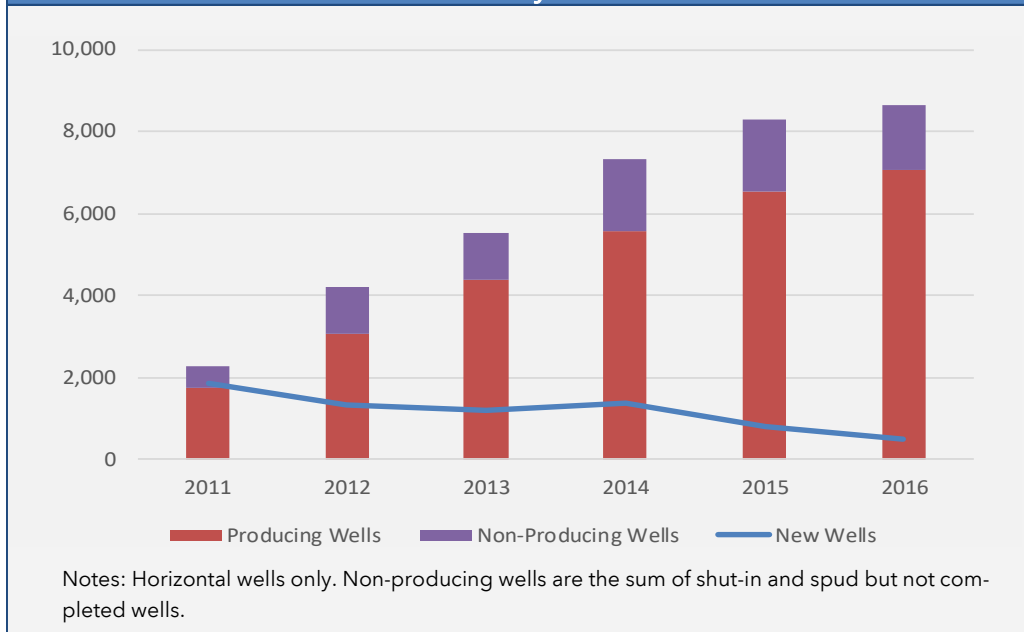


Table 5 shows county-level tabulations for the calendar year. Susquehanna County was the highest-producing county in the state, representing nearly one quarter of all horizontal well production (23.8%). The largest increases in production among top-ten counties occurred in the southwest region of the state (Greene, Washington and Butler). All declines in production occurred in the northeast region (Lycoming, Tioga, Bradford and Sullivan).

Table 5: Calendar Year Production, by County

Rank	County	Production Volume (bcf)				Number of Producing Wells			
		Calendar Year		2016 Metrics		Calendar Year		2016 Metrics	
		2016	2015	Share	Growth	2016	2015	Share	Growth
1	Susquehanna	1,210.8	1,127.2	23.8%	7.4%	1,049	958	14.6%	9.5%
2	Washington	838.7	662.9	16.5%	26.5%	1,200	1,059	16.7%	13.3%
3	Bradford	709.3	724.6	14.0%	-2.1%	1,055	1,020	14.7%	3.4%
4	Greene	691.4	529.3	13.6%	30.6%	764	662	10.6%	15.4%
5	Lycoming	418.7	449.0	8.2%	-6.8%	754	737	10.5%	2.3%
6	Wyoming	278.0	264.7	5.5%	5.0%	195	185	2.7%	5.4%
7	Tioga	194.1	198.8	3.8%	-2.4%	573	548	8.0%	4.6%
8	Butler	169.8	141.5	3.3%	20.0%	350	293	4.9%	19.5%
9	Sullivan	106.1	106.1	2.1%	-0.1%	87	73	1.2%	19.2%
10	Fayette	79.0	75.1	1.6%	5.2%	186	172	2.6%	8.1%
11	All Other Counties	385.6	303.4	7.6%	27.1%	964	838	13.4%	15.0%

Note: Horizontal wells only.

Tables 6 through 9 show historical production and well counts. From 2015 to 2016, the number of producing wells increased by 9.7% (see Table 7) and production volume increased by 10.9% (see Table 6). These are down from the prior year's growth rates, which were 17.5% and 13.1%, respectively. Despite the 2016 production gain, quarterly volume fluctuated within a narrow range.

Figure 2 shows that 176 new wells were spud in the fourth quarter of 2016, which is the first year-over-year increase in quarterly counts since 2014. This was an increase of 30 wells over the prior quarter and continues the acceleration of drilling activity that began in the second half of the year. However, as shown in Figure 1 (previous page), new wells for calendar year 2016 are still down from the prior year.

Calendar Year	Q1	Q2	Q3	Q4	Total
2016	1,280.5	1,264.4	1,263.0	1,273.7	5,081.5
2015	1,135.4	1,103.9	1,151.3	1,192.1	4,582.8
2014	n.a.	1,931.6	n.a.	2,121.1	4,052.7
2013	n.a.	1,398.1	n.a.	1,689.8	3,088.0
2012	n.a.	888.3	n.a.	1,139.4	2,027.6
2011	n.a.	426.7	n.a.	621.9	1,048.6

Notes: Horizontal wells only. Vertical wells comprised roughly 0.2% of production in the fourth quarter of 2016. Data through 2014 were reported on a half-year basis, and the half-year values are shown as Q2 and Q4. Starting in 2015, data are reported on a monthly basis.

Calendar Year	Q1	Q2	Q3	Q4	Full-Year Count
2016	6,605	6,794	6,898	7,066	7,177
2015	5,726	5,947	6,104	6,295	6,545
2014	n.a.	4,888	n.a.	5,541	5,570
2013	n.a.	3,708	n.a.	4,391	4,399
2012	n.a.	2,382	n.a.	3,046	3,078
2011	n.a.	1,162	n.a.	1,754	1,768

Notes: Horizontal wells only. Data through 2014 were reported on a half-year basis, and the half-year values are shown as Q2 and Q4. Starting in 2015, data are reported on a monthly basis. The full-year count of wells represents the number of wells that produced in any period of that year.

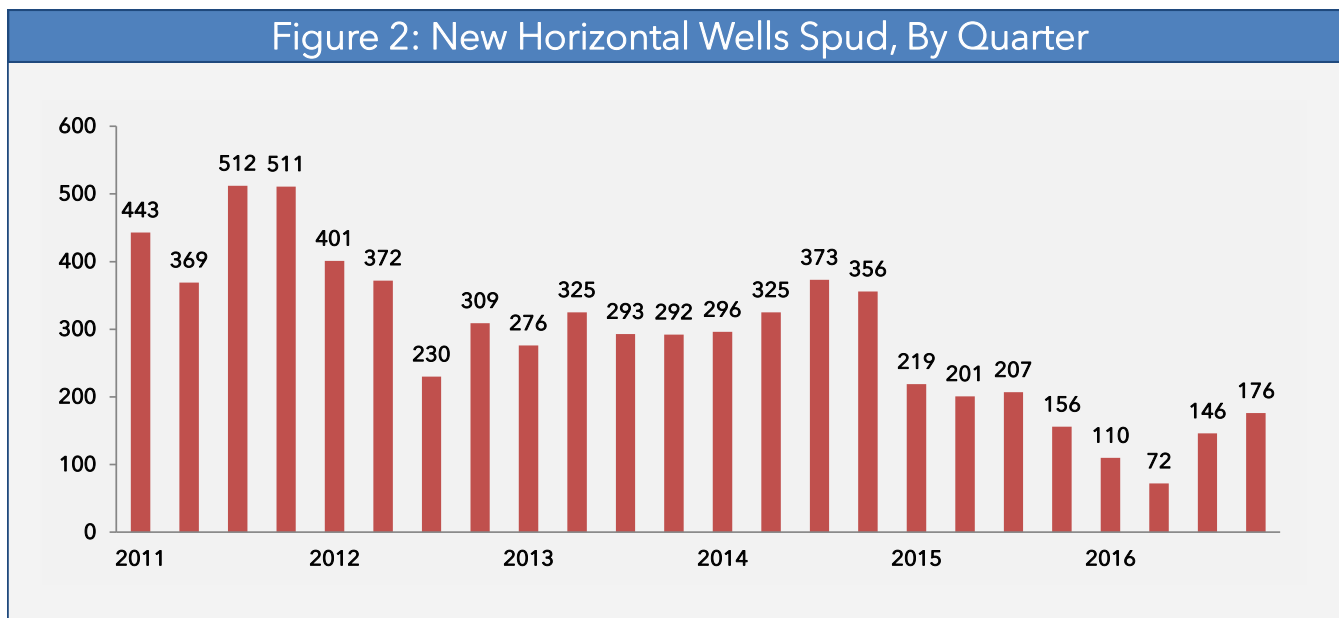


Table 8 shows that the full-year count of shut-in wells declined by 8.2% from 2015 to 2016. In contrast, shut-in wells increased by 15.6% from 2014 to 2015. Table 9 shows that the full-year count of spud but not completed wells has declined since 2014. However, the quarterly count of those wells has grown since the second quarter of 2016. Since there is a lag between a well's spud date and the extraction of gas, that trend is assumed to be related to the pick-up in the number of new wells spud (shown in Figure 2) during the same period.

Table 8: Number of Shut-In Wells					
<u>Calendar Year</u>	<u>Q1</u>	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	<u>Full-Year Count</u>
2016	943	1,019	970	866	759
2015	983	1,074	1,145	1,136	892
2014	n.a.	777	n.a.	808	780
2013	n.a.	736	n.a.	535	535
2012	n.a.	508	n.a.	347	333
2011	n.a.	116	n.a.	127	126

Notes: Horizontal wells only. The full-year count of wells represents the number of wells that produced no gas in each period of that year. Data through 2014 are reported on a half-year basis.

Table 9: Number of Spud But Not Completed Wells					
<u>Calendar Year</u>	<u>Q1</u>	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	<u>Full-Year Count</u>
2016	654	612	704	812	811
2015	952	948	900	856	851
2014	n.a.	903	n.a.	973	972
2013	n.a.	818	n.a.	588	586
2012	n.a.	950	n.a.	790	786
2011	n.a.	473	n.a.	387	385

Notes: Horizontal wells only. The full-year count of wells represents the number of wells that produced no gas in each period of that year. Data through 2014 are reported on a half-year basis.

Table 10 displays a state comparison of natural gas gross production from all well types. For 2016, Pennsylvania and Ohio recorded the largest year-over-year gains (9.7% and 48.5%, respectively). Five states (Texas, Oklahoma, Wyoming, Colorado and New Mexico) registered declines.

Table 10: State Production Comparison (bcf)							
<u>Rank</u>	<u>State</u>	<u>2012</u>	<u>2013</u>	<u>2014</u>	<u>2015</u>	<u>2016</u>	<u>2016 Growth</u>
1	Texas	8,143.5	8,299.5	8,659.2	8,801.3	8,120.0	-7.7%
2	Pennsylvania	2,256.7	3,259.0	4,257.7	4,813.0	5,278.1	9.7%
3	Alaska	3,164.8	3,215.4	3,168.6	3,175.3	3,233.1	1.8%
4	Oklahoma	2,023.5	1,993.8	2,331.1	2,499.6	2,482.2	-0.7%
5	Louisiana	2,955.4	2,366.9	1,968.6	1,784.8	1,862.7	4.4%
6	Wyoming	2,225.6	2,047.8	1,998.5	1,983.7	1,767.0	-10.9%
7	Colorado	1,709.4	1,604.9	1,643.5	1,704.8	1,702.7	-0.1%
8	Ohio	84.5	166.0	512.4	1,014.9	1,506.8	48.5%
9	West Virginia	539.9	741.9	1,067.1	1,318.8	1,361.5	3.2%
10	New Mexico	1,276.3	1,247.4	1,266.4	1,296.5	1,282.4	-1.1%

Notes: Data for 2016 through November. December estimated by IFO.
Source: U.S. Energy Information Administration. Production does not directly correspond to DEP data.

Glossary of Natural Gas Terminology

<u>Term</u>	<u>Definition</u>
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.
Observational	For the purpose of exploring the geology of an area. Wells that are “observational” produce gas only to test for productivity.
Plugged	Permanently sealed with cement or by some similar method.
Production	The natural gas recovered from a well.
Regulatory Inactive	Designated by the Department of Environmental Protection as inactive, after the operator properly filed for inactive status pursuant to Section 3214 of Act 13 of 2012.
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.