



Natural Gas Production Report

Second Quarter 2016

The Pennsylvania Department of Environmental Protection (DEP) publishes monthly production data submitted by natural gas extractors that operate in the state. Except as 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 second quarter of 2016 and the calendar year-to-date. These data are current as of August 23, 2016 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>Second Quarter</u>			<u>Calendar Year-to-Date</u>		
	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>
Volume (bcf)						
Horizontal	1,262.5	1,103.9	14.4%	2,542.6	2,239.4	13.5%
Vertical	<u>3.3</u>	<u>3.1</u>	<u>6.9%</u>	<u>6.5</u>	<u>6.4</u>	<u>1.9%</u>
Total	1,265.8	1,107.0	14.3%	2,549.1	2,245.7	13.5%

Table 2: Well Count

	<u>Second Quarter</u>			<u>Calendar Year-to-Date</u>		
	<u>2016</u>	<u>2015</u>	<u>Growth</u>	<u>2016</u>	<u>2015</u>	<u>Growth</u>
Number of Producing Wells						
Horizontal	6,793	5,947	14.2%	6,846	6,061	13.0%
Vertical	<u>510</u>	<u>510</u>	<u>0.0%</u>	<u>517</u>	<u>514</u>	<u>0.6%</u>
Total	7,303	6,457	13.1%	7,363	6,575	12.0%
Number of Non-Producing Wells						
Horizontal	2,007	2,308	-13.0%	1,954	2,194	-10.9%
Vertical	<u>480</u>	<u>480</u>	<u>0.0%</u>	<u>473</u>	<u>476</u>	<u>-0.6%</u>
Total	2,487	2,788	-10.8%	2,427	2,670	-9.1%
Horizontal Detail						
Shut In	950	1,073	-11.5%	899	961	-6.5%
Spud But Not Completed	701	950	-26.2%	699	948	-26.3%
Plugged	320	258	24.0%	320	258	24.0%
Other	<u>36</u>	<u>27</u>	<u>33.3%</u>	<u>36</u>	<u>27</u>	<u>33.3%</u>
Total	2,007	2,308	-13.0%	1,954	2,194	-10.9%

Notes: The number of producing wells in each quarter does not directly correspond to the year-to-date total because some wells are not producing 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.

Tables 3 and 4 show production for the second quarter and calendar year-to-date by spud year. During the first half of 2016, year-over-year production volume from horizontal wells increased 13.5 percent (see Table 4), driven mainly by wells spud in 2014 and 2015. The increase in production from such wells (110.1 percent) corresponds to the increase in the number of producing wells (112.3 percent). Conversely, wells spud in 2012 and 2013 showed declines in production despite small increases in the number of producing wells, and the decline in production from wells spud in 2011 or earlier outpaced the decline in the number of producing wells. These trends are consistent with the general decline in productivity of wells as they age (see Figure 1 next page).

Table 3: Second Quarter Production, by Spud Year

Spud Year	Production Volume (bcf)			Number of Wells			Producing Wells		
	2016	2015	Growth	2016	2015	Growth	2016	2015	Growth
2016	0.0	n.a.	n.a.	182	n.a.	n.a.	0	n.a.	n.a.
2015	136.0	1.1	n.a.	783	420	86.4%	346	8	n.a.
2014	380.8	277.7	37.1%	1,350	1,350	0.0%	1,042	639	63.1%
2013	271.2	313.2	-13.4%	1,189	1,189	0.0%	1,071	1,003	6.8%
2012	174.8	188.1	-7.0%	1,309	1,309	0.0%	1,045	1,020	2.5%
2011	<u>299.7</u>	<u>323.8</u>	<u>-7.4%</u>	<u>3,987</u>	<u>3,987</u>	<u>0.0%</u>	<u>3,289</u>	<u>3,277</u>	<u>0.4%</u>
Total	1,262.5	1,103.9	14.4%	8,800	8,255	6.6%	6,793	5,947	14.2%

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 second quarter of 2016 and the second quarter of 2015. 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	2015	Growth	2016	2015	Growth	2016	2015	Growth
2016	0.0	n.a.	n.a.	182	n.a.	n.a.	0	n.a.	n.a.
2015	233.2	1.1	n.a.	783	420	86.4%	349	8	n.a.
2014	777.9	480.2	62.0%	1,350	1,350	0.0%	1,048	650	61.2%
2013	566.8	674.0	-15.9%	1,189	1,189	0.0%	1,074	1,022	5.1%
2012	358.7	402.7	-10.9%	1,309	1,309	0.0%	1,047	1,040	0.7%
2011	<u>616.0</u>	<u>681.3</u>	<u>-9.6%</u>	<u>3,987</u>	<u>3,987</u>	<u>0.0%</u>	<u>3,328</u>	<u>3,341</u>	<u>-0.4%</u>
Total	2,542.6	2,239.4	13.5%	8,800	8,255	6.6%	6,846	6,061	13.0%

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 first two quarters of 2016 and the first two quarters of 2015. Spud year 2011 includes all wells spud in 2011 or earlier.

**Figure 1: Production Per Well (bcf), Second Quarter 2016
By Spud Year**

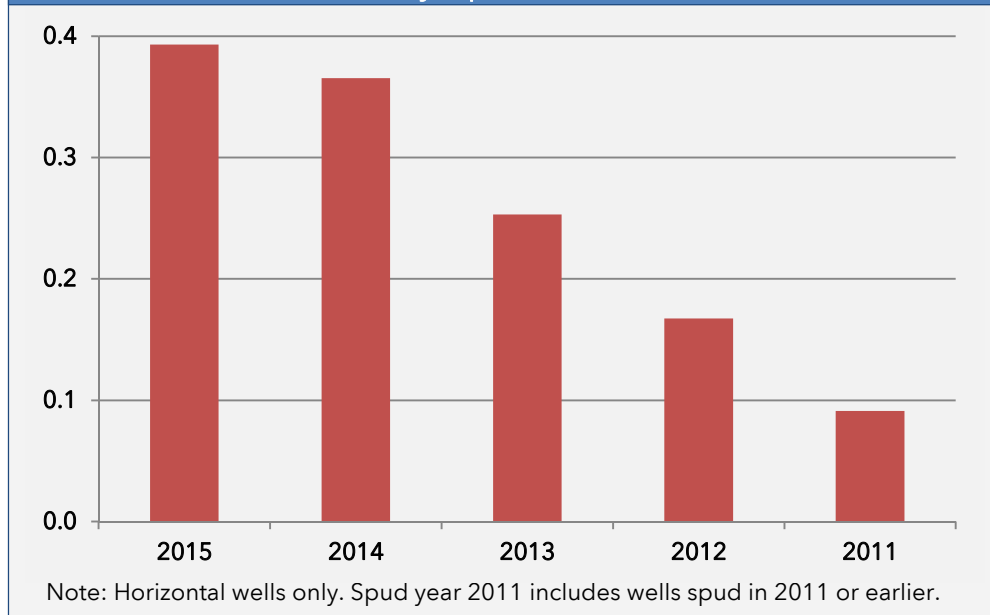


Table 5 shows county-level tabulations for the calendar year-to-date. Susquehanna County was the highest-producing county in the state, representing nearly one quarter of all horizontal well production (24.0 percent). The largest increases in production among top-ten counties occurred in the southwest region of the state (Greene, Washington, Fayette and Butler). All declines in production occurred in the northeast region of the state (Bradford, Lycoming, Tioga and Sullivan).

Table 5: Calendar Year-to-Date Production, by County

Rank	County	Production Volume (bcf)				Number of Producing Wells			
		Year-to-Date		2016 Metrics		Year-to-Date		2016 Metrics	
		2016	2015	Share	Growth	2016	2015	Share	Growth
1	Susquehanna	609.7	555.0	24.0%	9.8%	983	875	14.4%	12.3%
2	Washington	404.9	292.9	15.9%	38.2%	1,139	980	16.6%	16.2%
3	Greene	354.4	253.1	13.9%	40.1%	722	556	10.5%	29.9%
4	Bradford	353.8	367.5	13.9%	-3.7%	1,025	993	15.0%	3.2%
5	Lycoming	223.6	248.5	8.8%	-10.0%	745	721	10.9%	3.3%
6	Wyoming	135.4	126.0	5.3%	7.5%	187	179	2.7%	4.5%
7	Tioga	97.5	102.1	3.8%	-4.5%	551	533	8.0%	3.4%
8	Butler	85.6	68.3	3.4%	25.5%	333	250	4.9%	33.2%
9	Sullivan	50.1	51.2	2.0%	-2.2%	71	67	1.0%	6.0%
10	Fayette	40.9	32.5	1.6%	25.8%	172	150	2.5%	14.7%
11	All Other Counties	186.7	142.4	7.3%	31.1%	918	757	13.4%	21.3%

Note: Horizontal wells only.

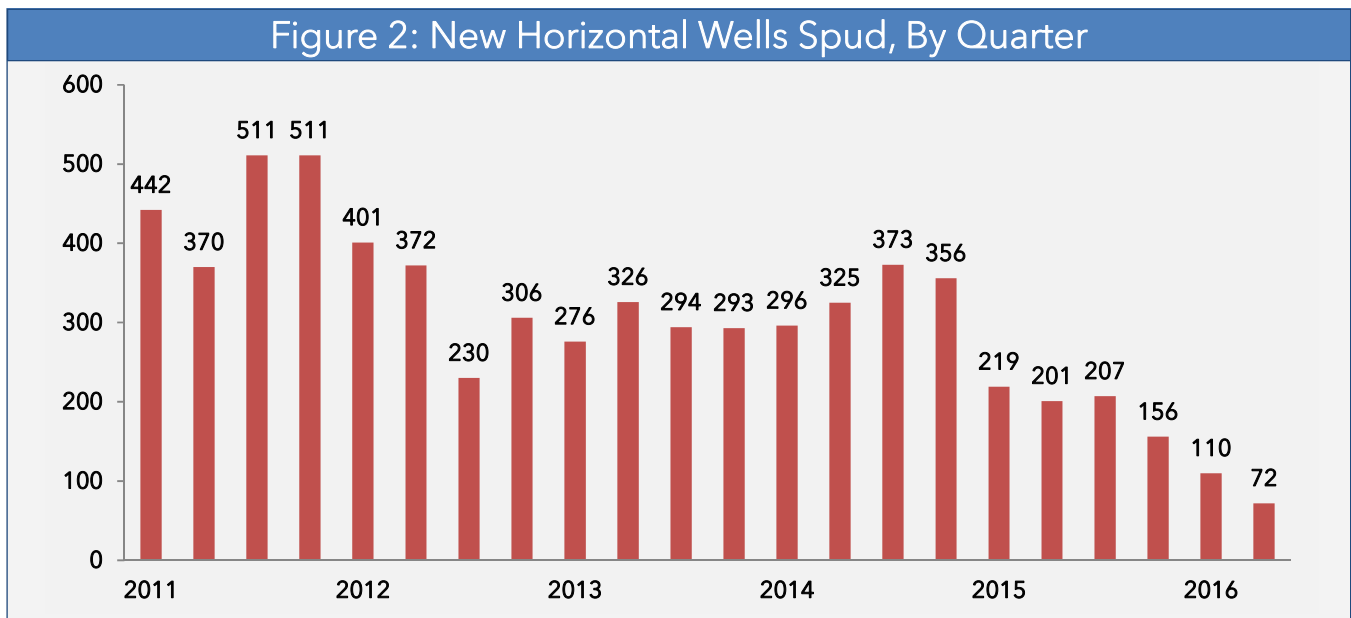
Tables 6 through 9 show historical production and well counts. Between 2011 and 2015, annual production grew at an average rate of 44.6 percent per annum (see Table 6). Since the first quarter of 2015, the number of producing wells has grown every quarter (see Table 7). However, the number of new wells spud declined during that same time, as shown in Figure 2. The term “spud” denotes the beginning of the drilling process, and there is often a substantial lag before a well produces output.

Table 6: Annual and Quarterly Production Volume (bcf)					
Calendar Year	Q1	Q2	Q3	Q4	Total
2016	1,280.1	1,262.5	n.a.	n.a.	2,542.6
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.	888.1	n.a.	1,139.4	2,027.5
2011	n.a.	426.7	n.a.	621.9	1,048.6

Notes: Horizontal wells only. Vertical wells comprised roughly 0.3 percent of production in the second 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.

Table 7: Number of Producing Wells					
Calendar Year	Q1	Q2	Q3	Q4	Full-Year Count
2016	6,605	6,793	n.a.	n.a.	6,846
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.	2,381	n.a.	3,046	3,077
2011	n.a.	1,162	n.a.	1,753	1,767

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.



Tables 8 and 9 show that shut-in wells and spud but not completed wells peaked in the third and first quarters of 2015, respectively, and began to decline after those periods. The full-year count of shut-in wells remains slightly higher in 2016 than the prior year, while the full-year count of spud but not completed wells has declined by 18.0 percent from the prior year.

<u>Calendar Year</u>	<u>Q1</u>	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	<u>Full-Year Count</u>
2016	943	950	n.a.	n.a.	899
2015	982	1,073	1,145	1,136	892
2014	n.a.	780	n.a.	806	778
2013	n.a.	732	n.a.	528	528
2012	n.a.	509	n.a.	345	331
2011	n.a.	115	n.a.	127	126

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

<u>Calendar Year</u>	<u>Q1</u>	<u>Q2</u>	<u>Q3</u>	<u>Q4</u>	<u>Full-Year Count</u>
2016	725	701	n.a.	n.a.	699
2015	954	950	901	857	852
2014	n.a.	904	n.a.	974	973
2013	n.a.	818	n.a.	588	586
2012	n.a.	950	n.a.	790	786
2011	n.a.	474	n.a.	388	386

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

Table 10 displays a state comparison of gross production from all well types through May 2016. Pennsylvania and Ohio recorded the largest year-over-year gains (12.8 and 72.3 percent, respectively). Five states (Texas, Alaska, Louisiana, Wyoming and New Mexico) registered modest declines in production.

<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	8,663.3	8,763.4	3,453.2	-4.7%
2	Pennsylvania	2,256.7	3,259.0	4,214.6	4,768.9	2,201.5	12.8%
3	Alaska	3,164.8	3,215.4	3,168.6	3,175.2	1,382.7	-0.7%
4	Oklahoma	2,023.5	1,993.8	2,310.1	2,499.6	1,047.3	1.3%
5	Louisiana	2,955.4	2,366.9	1,987.6	1,941.7	775.8	-3.9%
6	Wyoming	2,225.6	2,047.8	1,997.7	1,979.1	754.5	-5.0%
7	Colorado	1,709.4	1,604.9	1,631.4	1,671.8	705.7	2.7%
8	Ohio	84.5	166.0	518.8	1,014.9	590.1	72.3%
9	West Virginia	539.9	741.9	1,040.2	1,318.8	559.2	1.3%
10	New Mexico	1,276.3	1,247.4	1,265.6	1,289.9	524.7	-1.0%

Notes: 2016 production and growth 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.

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.