



# Natural Gas Production Report

Third 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 third quarter of 2016 and the calendar year-to-date. These data are current as of November 21, 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

|              | Third Quarter |            |               | Calendar Year-to-Date |             |              |
|--------------|---------------|------------|---------------|-----------------------|-------------|--------------|
|              | 2016          | 2015       | Growth        | 2016                  | 2015        | Growth       |
| Volume (bcf) |               |            |               |                       |             |              |
| Horizontal   | 1,262.8       | 1,151.3    | 9.7%          | 3,807.3               | 3,390.7     | 12.3%        |
| Vertical     | <u>3.1</u>    | <u>3.9</u> | <u>-20.1%</u> | <u>9.6</u>            | <u>10.2</u> | <u>-6.4%</u> |
| Total        | 1,265.9       | 1,155.2    | 9.6%          | 3,816.9               | 3,400.9     | 12.2%        |

Table 2: Well Count

|                               | Third Quarter |            |              | Calendar Year-to-Date |            |              |
|-------------------------------|---------------|------------|--------------|-----------------------|------------|--------------|
|                               | 2016          | 2015       | Growth       | 2016                  | 2015       | Growth       |
| Number of Producing Wells     |               |            |              |                       |            |              |
| Horizontal                    | 6,897         | 6,104      | 13.0%        | 7,021                 | 6,296      | 11.5%        |
| Vertical                      | <u>495</u>    | <u>503</u> | <u>-1.6%</u> | <u>518</u>            | <u>518</u> | <u>0.0%</u>  |
| Total                         | 7,392         | 6,607      | 11.9%        | 7,539                 | 6,814      | 10.6%        |
| Number of Non-Producing Wells |               |            |              |                       |            |              |
| Horizontal                    | 2,049         | 2,359      | -13.1%       | 1,925                 | 2,167      | -11.2%       |
| Vertical                      | <u>495</u>    | <u>487</u> | <u>1.6%</u>  | <u>472</u>            | <u>472</u> | <u>0.0%</u>  |
| Total                         | 2,544         | 2,846      | -10.6%       | 2,397                 | 2,639      | -9.2%        |
| Horizontal Detail             |               |            |              |                       |            |              |
| Shut In                       | 920           | 1,144      | -19.6%       | 796                   | 956        | -16.7%       |
| Spud But Not Completed        | 770           | 902        | -14.6%       | 770                   | 898        | -14.3%       |
| Plugged                       | 325           | 288        | 12.8%        | 325                   | 288        | 12.8%        |
| Other                         | <u>34</u>     | <u>25</u>  | <u>36.0%</u> | <u>34</u>             | <u>25</u>  | <u>36.0%</u> |
| Total                         | 2,049         | 2,359      | -13.1%       | 1,925                 | 2,167      | -11.2%       |

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 third quarter and calendar year-to-date by spud year. In each table, year-over-year growth in production from horizontal wells was driven by wells spud in 2015 and 2014. These wells accounted for 43.7 percent of production in the third quarter of 2016, but only 72 percent of wells drilled in 2015 and 2014 produced gas during that period. (See Figure 1 on the next page.)

Wells spud in 2013 and earlier recorded declines in production (-11.1 percent), despite a small increase in the number of producing wells (1.5 percent). This is consistent with the general decline in productivity of wells as they age. Despite their lower productivity, Figure 1 shows that wells spud in 2013 and earlier remain active with at least 80 percent of those wells producing gas in the third quarter of 2016.

**Table 3: Third 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             | 1.3                            | n.a.         | n.a.          | 327                    | n.a.         | n.a.          | 6                      | n.a.         | n.a.          |
| 2015             | 185.9                          | 17.9         | n.a.          | 783                    | 627          | 24.9%         | 437                    | 56           | n.a.          |
| 2014             | 365.8                          | 335.2        | 9.1%          | 1,350                  | 1,350        | 0.0%          | 1,091                  | 765          | 42.6%         |
| 2013             | 251.3                          | 315.1        | -20.2%        | 1,187                  | 1,187        | 0.0%          | 1,074                  | 1,028        | 4.5%          |
| 2012             | 165.2                          | 186.4        | -11.4%        | 1,312                  | 1,312        | 0.0%          | 1,046                  | 1,026        | 1.9%          |
| 2011             | <u>293.3</u>                   | <u>296.6</u> | <u>-1.1%</u>  | <u>3,987</u>           | <u>3,987</u> | <u>0.0%</u>   | <u>3,243</u>           | <u>3,229</u> | <u>0.4%</u>   |
| Total            | 1,262.8                        | 1,151.3      | 9.7%          | 8,946                  | 8,463        | 5.7%          | 6,897                  | 6,104        | 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 third quarter of 2016 and the third quarter of 2015. Spud year 2011 includes all wells spud in 2011 or earlier.

**Table 4: Calendar Year-to-Date 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             | 1.3                            | n.a.         | n.a.          | 327                    | n.a.         | n.a.          | 6                      | n.a.         | n.a.          |
| 2015             | 409.1                          | 19.1         | n.a.          | 783                    | 627          | 24.9%         | 440                    | 56           | n.a.          |
| 2014             | 1,144.6                        | 815.4        | 40.4%         | 1,350                  | 1,350        | 0.0%          | 1,098                  | 784          | 40.1%         |
| 2013             | 818.4                          | 989.2        | -17.3%        | 1,187                  | 1,187        | 0.0%          | 1,081                  | 1,055        | 2.5%          |
| 2012             | 524.0                          | 589.2        | -11.1%        | 1,312                  | 1,312        | 0.0%          | 1,055                  | 1,054        | 0.1%          |
| 2011             | <u>909.9</u>                   | <u>977.9</u> | <u>-7.0%</u>  | <u>3,987</u>           | <u>3,987</u> | <u>0.0%</u>   | <u>3,341</u>           | <u>3,347</u> | <u>-0.2%</u>  |
| Total            | 3,807.3                        | 3,390.7      | 12.3%         | 8,946                  | 8,463        | 5.7%          | 7,021                  | 6,296        | 11.5%         |

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

Figure 1: Percent of Wells Producing  
Third Quarter 2016 by Spud Year

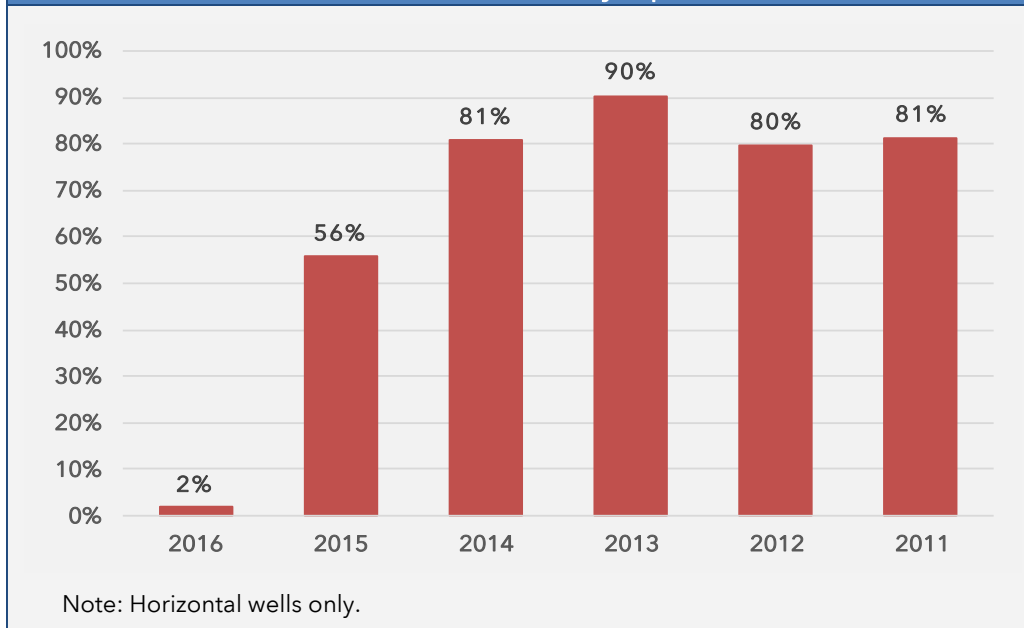


Table 5 shows county-level tabulations for the calendar year-to-date. Susquehanna County was the highest-producing county in the state, representing nearly one quarter of all horizontal well production (23.7 percent). The largest increases in production among top-ten counties occurred in the southwest region of the state (Washington, Greene, Butler and Fayette). All declines in production occurred in the northeast region (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        | 902.8                   | 832.0 | 23.7%        | 8.5%   | 1,017                     | 916   | 14.5%        | 11.0%  |
| 2    | Washington         | 619.9                   | 469.0 | 16.3%        | 32.2%  | 1,168                     | 1,028 | 16.6%        | 13.6%  |
| 3    | Bradford           | 529.4                   | 544.1 | 13.9%        | -2.7%  | 1,041                     | 1,017 | 14.8%        | 2.4%   |
| 4    | Greene             | 527.6                   | 381.5 | 13.9%        | 38.3%  | 749                       | 590   | 10.7%        | 26.9%  |
| 5    | Lycoming           | 322.2                   | 356.2 | 8.5%         | -9.5%  | 747                       | 733   | 10.6%        | 1.9%   |
| 6    | Wyoming            | 209.2                   | 195.8 | 5.5%         | 6.8%   | 193                       | 182   | 2.7%         | 6.0%   |
| 7    | Tioga              | 143.5                   | 153.1 | 3.8%         | -6.3%  | 558                       | 541   | 7.9%         | 3.1%   |
| 8    | Butler             | 128.3                   | 104.1 | 3.4%         | 23.3%  | 342                       | 269   | 4.9%         | 27.1%  |
| 9    | Sullivan           | 75.7                    | 80.1  | 2.0%         | -5.5%  | 81                        | 67    | 1.2%         | 20.9%  |
| 10   | Fayette            | 60.7                    | 53.0  | 1.6%         | 14.6%  | 182                       | 164   | 2.6%         | 11.0%  |
| 11   | All Other Counties | 287.9                   | 221.8 | 7.6%         | 29.8%  | 943                       | 789   | 13.4%        | 19.5%  |

Note: Horizontal wells only.

Tables 6 through 9 show historical production and well counts. Production volume has declined slightly since the first quarter of 2016 (see Table 6), even though the number of producing wells increased during that period (see Table 7). This is due to the large number of wells spud in 2013 and earlier, which have become less productive as they age (see Tables 3 and 4).

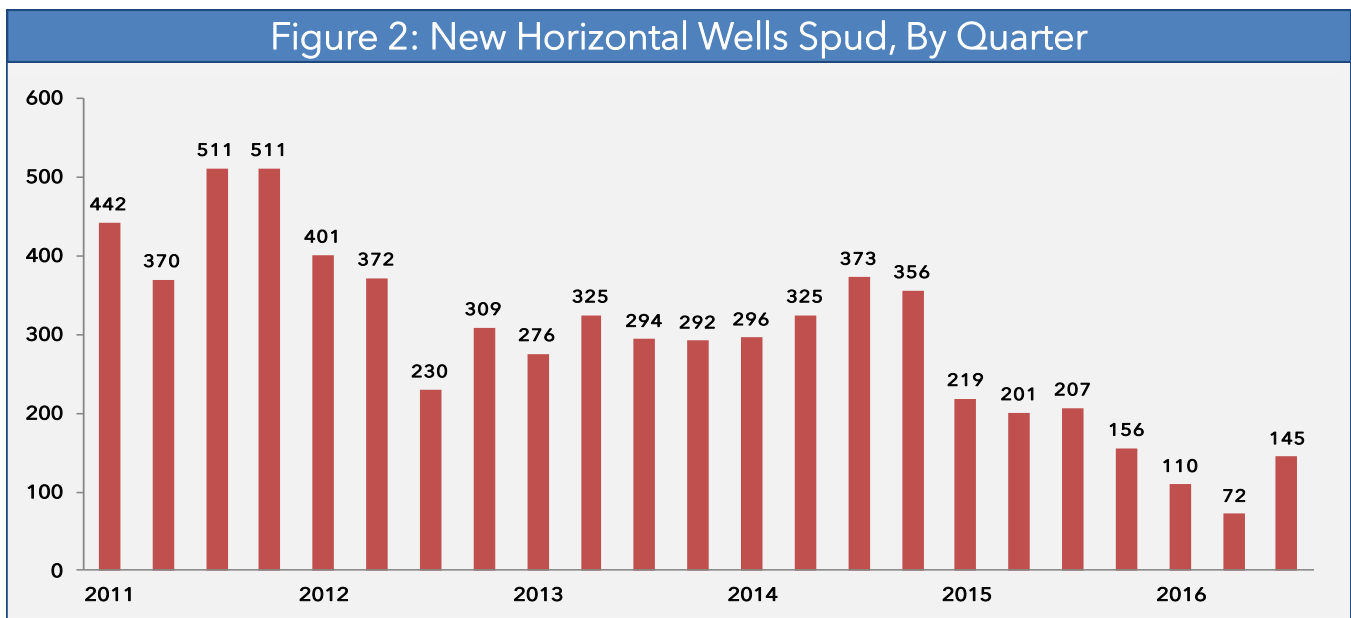
Figure 2 shows that 145 new wells were spud in the third quarter of 2016. This was an increase of 73 wells over the prior quarter, which is the largest quarterly increase since 2012. However, the 145 new wells spud is still one of the lowest totals on record.

| Calendar Year | Q1      | Q2      | Q3      | Q4      | Total   |
|---------------|---------|---------|---------|---------|---------|
| 2016          | 1,280.5 | 1,264.0 | 1,262.8 | n.a.    | 3,807.3 |
| 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 0.2 percent of production in the third 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 | 6,793 | 6,897 | n.a.  | 7,021           |
| 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 (unfinished) wells peaked in the third quarter of 2015 and the second half of 2014, respectively, and began to decline after those periods. Shut-in wells declined by 7.1 percent from the second quarter to the third quarter of 2016 (see Table 8), while spud but not completed wells increased by 12.3 percent (see Table 9).

**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                 | 942       | 983       | 920       | n.a.      | 796                    |
| 2015                 | 982       | 1,073     | 1,144     | 1,137     | 893                    |
| 2014                 | n.a.      | 776       | n.a.      | 804       | 776                    |
| 2013                 | n.a.      | 735       | n.a.      | 535       | 535                    |
| 2012                 | n.a.      | 509       | n.a.      | 348       | 334                    |
| 2011                 | n.a.      | 116       | n.a.      | 128       | 127                    |

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 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                 | 698       | 665       | 770       | n.a.      | 770                    |
| 2015                 | 954       | 950       | 902       | 856       | 851                    |
| 2014                 | n.a.      | 905       | n.a.      | 975       | 974                    |
| 2013                 | n.a.      | 819       | n.a.      | 589       | 587                    |
| 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 August 2016. Pennsylvania and Ohio recorded the largest year-over-year gains (11.4 and 58.4 percent, respectively). Five states (Texas, Oklahoma, Wyoming, Colorado and New Mexico) registered declines in production.

**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     | 5,493.8     | -6.8%              |
| 2           | Pennsylvania  | 2,256.7     | 3,259.0     | 4,257.7     | 4,813.0     | 3,524.2     | 11.4%              |
| 3           | Alaska        | 3,164.8     | 3,215.4     | 3,168.6     | 3,175.3     | 2,106.3     | 3.2%               |
| 4           | Oklahoma      | 2,023.5     | 1,993.8     | 2,331.1     | 2,499.6     | 1,670.0     | -0.4%              |
| 5           | Louisiana     | 2,955.4     | 2,366.9     | 1,968.6     | 1,784.8     | 1,251.0     | 4.3%               |
| 6           | Wyoming       | 2,225.6     | 2,047.8     | 1,998.5     | 1,983.7     | 1,176.0     | -11.0%             |
| 7           | Colorado      | 1,709.4     | 1,604.9     | 1,643.5     | 1,704.8     | 1,131.5     | -0.3%              |
| 8           | Ohio          | 84.5        | 166.0       | 512.4       | 1,014.8     | 955.6       | 58.4%              |
| 9           | West Virginia | 539.9       | 741.9       | 1,067.1     | 1,318.8     | 903.1       | 0.8%               |
| 10          | New Mexico    | 1,276.3     | 1,247.4     | 1,266.4     | 1,296.5     | 853.1       | -0.9%              |

Notes: 2016 production and growth 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.

## 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.   |