



## Severance Tax Ticker Methodology

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**Purpose:** To estimate the amount of severance tax lost since October 2009 due to the lack of enactment of a severance tax by the Commonwealth of Pennsylvania. The amount of the lost tax would be updated on a monthly basis using the most recent price and production data available. Calculated tax losses would be displayed on the Pennsylvania Budget and Policy Center's website as a continuously accruing running total.

**Data Sources:** Most natural gas producing states require well operators to report production on a monthly basis for severance tax purposes. The production data is commonly made available to the public. As Pennsylvania has no severance tax, it only requires annual production statements from natural gas producers. However, there is little to no penalty administered for failing to file.

1. The Pennsylvania Department of Environmental Protection (DEP) requires natural gas well operators to submit annual production figures. These production figures are reported by county on the DEP website (<http://www.dep.state.pa.us/dep/deputate/minres/OILGAS/Prod%20by%20County%20since%201991-Public.xls>).

The latest reported figures are from 2005. While this does not assist in determining current production levels, it does provide evidence of average well activity for shallow wells – which is the type of well that has traditionally been drilled in Pennsylvania and still makes up the vast majority of active wells in the state. This is the primary source for production per well data for shallow wells.

2. DEP produces a report that lists wells that are permitted to begin drilling each week. This report, called the “Spud Report,” also differentiates between the traditional, shallow wells, and the deeper, more productive Marcellus Shale wells. While the report is updated weekly, it is presented on the website as a monthly document (see <http://www.dep.state.pa.us/dep/deputate/minres/oilgas/z1Jan2010.htm>). The Spud Report will be the primary source of wells added to the model and will be accessed on a monthly basis. Please note: the Spud Report includes dates that drillers are permitted to drill. Delays from this opening drill date to either drill or to produce natural gas cannot be determined from this report, but is currently the best available public information.
3. The price of natural gas will be updated monthly using Henry Hub price data reported by the Federal Reserve Bank of St. Louis (<http://research.stlouisfed.org/fred2/series/GASPRICE>).
4. The estimate uses the same well depletion schedule as used in the Department of Revenue's severance tax estimate in the 2009-10 Governor's Executive Budget.

**Methodology:** The monthly severance tax estimate is essentially a natural gas production estimate from which severance tax is derived at a level of 5% of sales price and \$0.047 per thousand cubic foot (MCF) – as was proposed in the 2009-10 Governor’s Executive Budget. The process of estimating monthly production is being done in two components: one for Marcellus Shale wells and a separate calculation for shallow wells.

**Estimated production for Marcellus Shale wells**

The monthly production estimate for Marcellus Shale wells is calculated by grouping the number of active wells by the month and year they were placed into service. Marcellus Shale wells began being reported in 2008. All Marcellus Shale wells reported on Spud Reports are assumed to be active and productive. Within each group, all wells are assumed to have the same production. Each month, the estimate adds the number of Marcellus Shale wells drilled according to the latest Spud Report.

In the first year of production, all Marcellus Shale wells are estimated to produce 200 million cubic feet (MMCF) of natural gas.<sup>1</sup> This amount declines each year. Using the production decline curve used in the Pennsylvania Department of Revenue’s original severance tax estimate, the estimated natural gas production of each Marcellus Shale well is as follows<sup>2</sup>:

Year of Production	Yearly Production per Marcellus Shale Well (MCF)	Monthly Production per Marcellus Shale Well (MCF)
1	200,000	16,667
2	135,200	11,267
3	113,568	9,464
4	101,416	8,451

According to the DEP’s Spud Reports, 196 Marcellus Shale wells were drilled in 2008. From January through July 2009, 298 additional Marcellus Shale wells were drilled. For the estimate, all wells drilled in 2008 produce the same amount of natural gas per month. As the estimate begins in October 2009, the 2008 wells are estimated to produce 11,267 MCF per month for October through December 2009. Their production declines to 9,464 MCF per month per month in 2010.

Wells drilled from January to July 2009 are assumed to be fully productive by October 2009. Like 2008 wells, all wells drilled in this period are assumed to have the same per well production. From October to

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<sup>1</sup> This figure came from the original Department of Revenue tax estimate and was made in consultation with the Department of Environmental Protection (DEP). DEP is verifying the validity of this estimate.

<sup>2</sup> Marcellus Shale wells are assumed to be productive over 50 years, declining steeply in the initial years. As Marcellus Shale wells were first drilled in 2008, only four years of production declines are presented above (and have been included in the estimate).

December 2009, each well drilled in early 2009 is estimated to produce 16,667 MCF per month. Beginning in January 2010, this production drops to 11,267 MCF.

The estimate groups Marcellus Shale wells drilled by month beginning in August 2009 to simulate new wells coming on-line after the beginning of the taxing period (October 2009). In the estimate, all Marcellus Shale wells drilled in a month are estimated to become productive two months later.<sup>3</sup> For example, wells drilled in August 2009 would be productive October 1, 2009. For the first 12 months, these wells produce 16,667 MCF per well. In month 13, the production drops to 11,267 MCF per well for the next 12 months, dropping to 9,464 in year three, etc.

Once natural gas production is estimated for each cohort of wells, it is multiplied by the monthly Henry Hub price as reported by the Federal Reserve Bank of St. Louis. Each month, the lost tax is calculated using 5% of the estimated gross proceeds of all producing Marcellus Shale wells. To this is added the charge of \$0.047 per MCF.

The Lost Severance Tax Ticker is slated to commence operation on June 1, 2010. The beginning dollar amount listed on the ticker due to Marcellus Shale wells will be **\$27,663,398**. This represents the cumulative tax foregone from October 2009 through May 2010.

In June, 77 new wells (from the April 2010 Spud Report) will be added to the production estimate. Foregone severance tax for June will be calculated based on the average May 2010 Henry Hub price.

### **Estimated production for shallow wells**

As the number of producing shallow wells and per well production averages have remained relatively constant in the past 10 years, a more simplistic method is used to estimate the tax lost from shallow well activity.

Rather than calculating well production based on when wells were initially drilled, the estimate for shallow wells is based on the number of actively producing wells in a given month multiplied by an average amount of well production, which is held constant at 3,840 MCF per year or 320 MCF per month.<sup>4</sup> The number of active wells is estimated using 90% of active wells from the previous year plus any newly drilled wells.<sup>5</sup>

According to the DEP's Production by County report, 43,258 shallow wells produced 168 billion cubic feet (BCF) of natural gas in 2005. From 2006 to 2008, roughly 4,000 new shallow wells were drilled, according to DEP reports. Using our estimate methodology, these wells would produce between 165 BCF

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<sup>3</sup> According to Barnett Shale Education Council, the time from the start of drilling a shale well to production can range from 45 to 61 days. <http://www.fwlina.org/Gas%20Wells/FWLNA%20Gas%20Well%20Drilling101.pdf>

<sup>4</sup> The average shallow well production figures were calculated using reported well activity from 2001 to 2005.

<sup>5</sup> The decline of active wells by 10% from the previous year is an estimate. It was determined by comparing the number of total active wells reported each year to the new wells drilled. An aggressive decline of existing wells is used in the estimate to reflect that many shallow wells drilled are not productive and to help avoid overstating shallow well production.

and 170 BCF of natural gas in those years. In 2009, the number of shallow wells drilled decreased markedly (to 1,761) – likely due to interest in developing the Marcellus Shale. As the number of new shallow wells drilled declines, so, too, will total shallow well production. For 2009, the estimated 40,149 active shallow wells produced 154 BCF of natural gas.

Beginning in 2010, new wells reported on the Spud Report will be added to the active well total on a monthly basis.

As was the case with Marcellus Shale wells, the estimated monthly tax is calculated using estimated monthly production figures and the Henry Hub market price for natural gas. From October 2009 through May 2010, the estimated Severance Tax foregone from shallow wells totals **\$26,514,492**.

### **Calibrating the Ticker**

The ticker will start at the calculated amount of tax lost (including both Marcellus Shale wells and shallow wells) from October 1, 2009 to May 31, 2010. The beginning total is **\$54,177,890**.

Each month, the ticker will be programmed with the estimated severance tax lost per minute during the coming month – based on new wells drilled (per the DEP spud report), estimated monthly production from each new well, and the previous month's average Henry Hub prices for natural gas.