

EIA-914 Sample and Model Issues

Summary

Our comprehensive review of the EIA 914 has confirmed that discrepancies can arise between estimates for December of one year and January of the next. These are most evident for Texas estimates between December 2008 and January 2009. Reports now available from HPDI show that production for all the companies we sampled in both 2008 and 2009 rose by about 60 million cubic feet per day (MMcf/d) in January and that total production in Texas rose by a similar amount. Our estimate was a decrease of 360 MMcf/d.

Why the difference? Computationally, EIA-914 estimates depend on two factors:

- Reports from the companies in the survey sample
- An expansion factor to estimate total production from the sample's reported volumes. The expansion factor depends on historical data for earlier years (2002 through 2006 for the 2008 sample and 2003 through 2007 for the 2009 sample).

We update both the sample and the information base for the expansion factor every January. In January 2009, we added 15 companies that produced in Texas and had grown large enough to be included in the sample and dropped 9 others whose production had fallen below the threshold for sampling. Without the simultaneous update of the expansion factor, this would have led to an apparent jump in January production volumes.

The updated expansion factor for January was 1.15, compared to 1.19 in December, a change that fully reflects our documented procedure (see http://www.eia.doe.gov/oil_gas/natural_gas/data_publications/eia914/eia914meth.pdf). Combining the changes in the sample and the expansion factor led to the overall decrease in January production estimates noted above.

What happened? The natural gas industry has been highly dynamic in the last two to three years, especially in Texas with the rapid growth in Barnett shale production. Rapid growth of Barnett shale production is likely to have changed historical patterns in the industry substantially. It would not be surprising if historical patterns of sample coverage had become obsolete and no longer reflect the current nature of the industry in Texas. Rapid oscillations in price in 2008 may also have changed historical patterns.

Our overall review continues. We anticipate that it will be complete by the end of the year and that it will lead to improved methods of estimating production. At that time, we will update our estimates for 2008 and 2009. In addition to reviewing sampling and estimation issues, the comprehensive review has shown a number of additional areas that we will also review, including the following:

- A major source of difficulty in estimating total production from sample results arises from changes in ownership, either from mergers or acquisitions of entire companies or from sales of significant amounts of property.
- In at least one case, a non-sampled company began producing large volumes of gas from a new field in the middle of 2008, and was not included in either EIA Form 914 reports or in estimates of state or national totals.

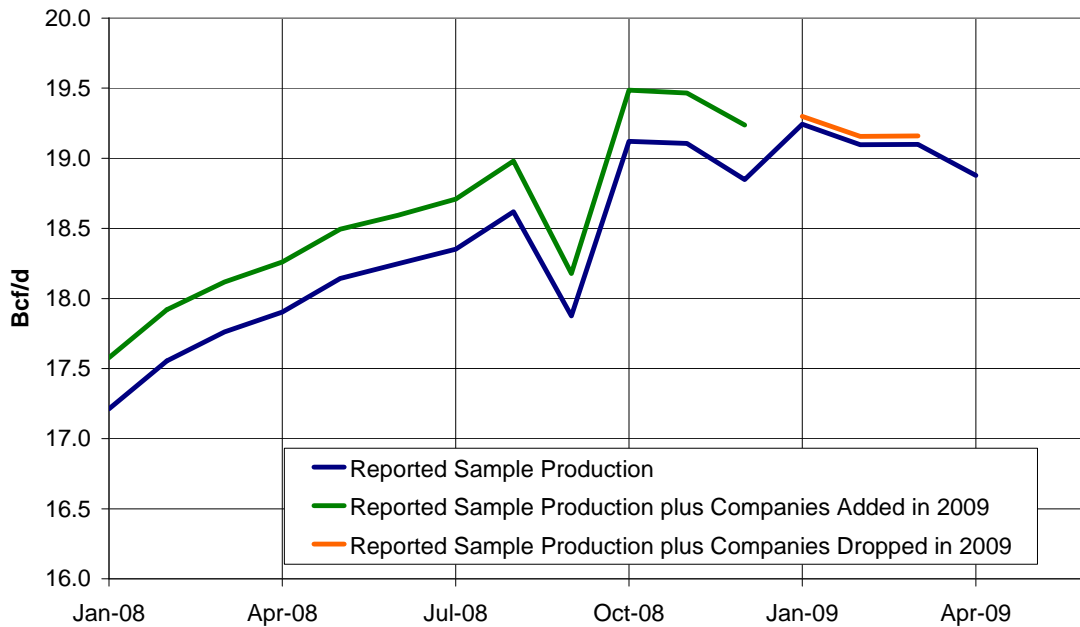
A more detailed discussion of the problems highlighted above follows.

Discussion of Issues

Reported Sample Volumes

EIA-914 uses a cutoff sample of about 225 companies, which yields about 90 percent production coverage for the lower-48 States. About 13,000 companies comprise the remaining 10 percent. Roughly 10 percent of the sampled operators change every year in January. Companies that have grown large enough to meet the production cutoff join the sample in January and companies that have declined to a rate below the cutoff are dropped from the sample. This annual change in the sample can affect the apparent change in production estimates from December to January. Figure 1 shows the effects of the sample change between 2008 and 2009 in Texas. It shows what the sample production would have been if new companies for 2009 had been included in 2008, based on data now available from HPDI. It also shows what the sample production would have been in the early months of 2009 if the companies dropped in 2009 had been included, also based on current HPDI information.

Figure 1. Texas Companies Added to and Dropped from the EIA-914 Sample in 2009, 2008-2009

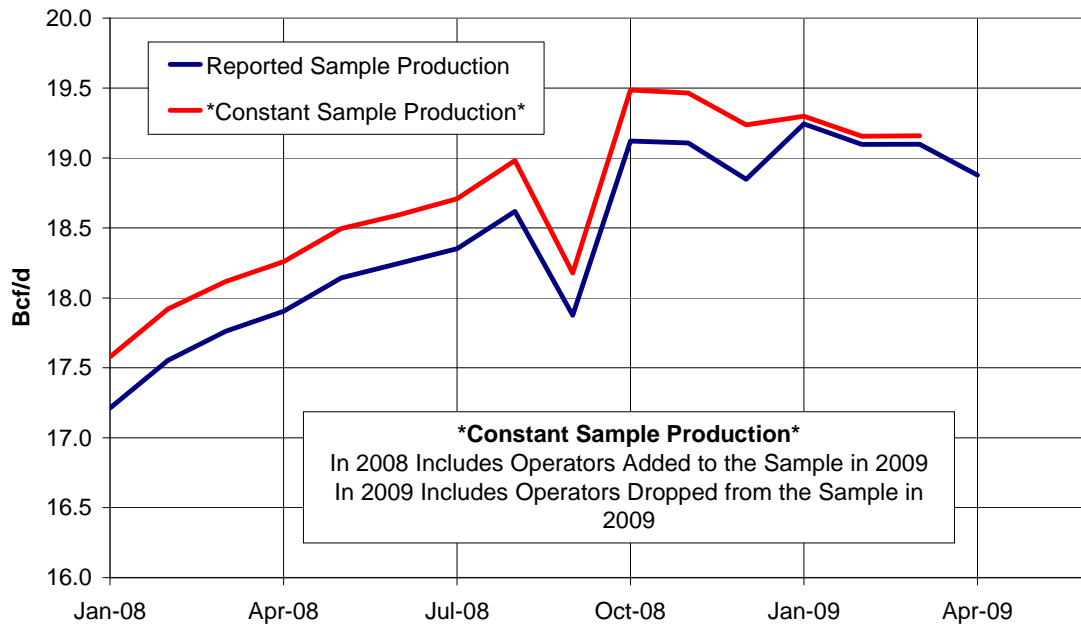


Source: EIA-914 Survey and HPDI.

Figure 2 shows how this could change apparent production. The blue line shows the reported sample production as it would normally be reported under the current process for 2008 and 2009 (Reported Sample Production) with different samples for 2008 and 2009. The red line shows what would have been reported if there were no change in the sampled companies from 2008 to 2009 (Constant Sample Production). The Constant Sample Production line adds the 2008 production for the companies that were added to the sample in 2009 and the early months of 2009 production for companies that were dropped in 2009 to the 2009 Reported Sample Production.

The Reported Sample Production shows an increase from December 2008 to January 2009 of 400 MMcf/d. Whereas, the Constant Sample Production shows an increase of only 60 MMcf/d. All else being the same, the change from December 2008 to January 2009 would be 340 MMcf/d higher, as estimated from the Reported Sample Production compared with the Constant Sample Production. To some degree, this sort of difference is likely in any year, in any State. We have sought to correct for this difference by updating the expansion factor at the same time we update the sample.

Figure 2. Texas Sample Production Changes, 2008 - 2009



Source: EIA-914 Survey and HPDI.

Estimation Model Parameters

Each year in January, we update the base time period used in the model that estimates the expansion factor. The model includes two parameters as follows:

$$\text{ExpansionFactor} = B_0 + B_1(\text{time})$$

The first term (B_0) is the inverse of the proportion of total production that the sample covered during the base year. In December 2008, it reflected the proportion of total production accounted for by the 2008 sample in 2006 (the year used to draw the sample initially). In January 2009, it reflected the proportion of total production accounted for by the 2009 sample in 2007.

The second term (B_1) attempts to account for a phenomenon observed in earlier years - a tendency of the sample coverage to drop over time. For December 2008, the period used to set the model parameters was 2002 through 2006. In January 2009, we shifted this period ahead one year to be 2003 through 2007.

Using the whole model, the expansion factor applied to the sample production for Texas for the December 2008 estimate was 1.19. The January expansion factor was 1.15. As a result, the January estimate was 3.4 percent lower than it would have been if we had not updated the model. Of the 3.4 percent total change in the expansion factor from December 2008 to January 2009, about 2.3 percent is due to the B_0 change and 1.1 percent is due to the B_1 change in the model parameters.

Using this model appears to have over-corrected for the change in sample between December 2008 and January 2009. As a result, we estimated a decrease of 360 MMcf/d instead of the slight increase suggested by looking at the same companies across the two months.

Ownership Changes

Oil and gas companies buy and sell thousands of properties every month. Companies also acquire other companies through mergers. When either of these happens between companies that are not in the sample group of companies, there is no effect on the estimating process. When two companies that are both in the sample group merge, the historical data must be merged to match the reported sample data. Other than handling the bookkeeping chore, there is no effect on the estimating process. The goal is to make sure that all the production is accounted for but not double counted.

When one company in the sample sells a few properties to another company in the sample, it's not always obvious. Since most companies' production fluctuates some from month to month, a change due to a property sale may go un-noticed. Larger fluctuations are always checked with a call to the operator. When a sale is discovered, both the buying and the selling companies are contacted to make sure the transferred properties are accounted for but not double counted. Not all sales are known, especially smaller ones.

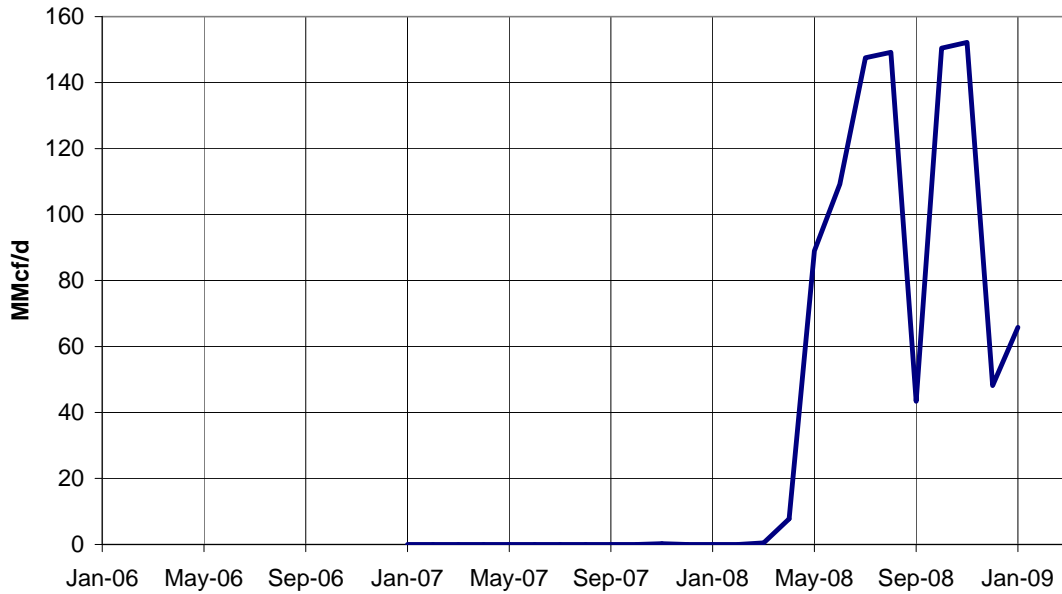
When a merger or acquisition occurs between companies with one in the sample and the other not, significant changes can occur. In the case of a merger with the surviving company in the sample, the purchased company is automatically in the sample and sample coverage increases after creating the merger in the historical data. If the surviving company is not in the sample, they may be added to the sample and asked to report if the volume is significant. Or, the purchased company may be dropped from the sample and the sample coverage reduced if the volume is small.

When properties are traded between sampled and non-sampled companies and the trade is known or discovered, and the volume is sufficient to raise a non-sampled company to a level above the cutoff rate, or drop a sampled company to below the cutoff rate, then an attempt is made to add and/or delete the companies to/from the sample as appropriate. In all other instances there's likely to be no action taken and the effect on the estimates is not known.

Significant Changes in Company Production

Occasionally a company not in the sample discovers a large field. This could be an existing company, a new company, a large company, a small company, or a foreign company just entering the U.S. industry. Any company, sampled or non-sampled, can find a new field that makes a sudden difference at the State level. This situation is more likely to occur offshore, but can happen onshore as well. The change can be gradual as each well is drilled and brought online, or it could be more dramatic if, for example, an offshore platform with multiple wells is brought online. The following example is from a new field in Louisiana State waters that came on suddenly. This was a small non-sampled company that started production from a new field in 2008. This company was not discovered and added to the sample until 2009. Because this company was missed, the estimate for Louisiana was off by nearly 4 percent for much of 2008.

Production from a New Field and Non-Sampled Company in Louisiana, 2006 - 2009



Source: HPDI

Comprehensive Review

These sample and model issues prompted EIA to undertake a comprehensive review of the EIA-914 production estimating system. A team of outside oil and gas experts have been tasked to complete this review. This review will be conducted in three phases. The first phase will provide a brief explanation of the potential sources of error in the system (this document) and show other sources of data and how they compare with the EIA-914 production estimates. In the second phase, the review will investigate alternative sampling and estimating processes to address these issues and evaluate other data sources for use in the EIA-914 production estimating system. The third phase will take a wider look at the business processes surrounding the EIA-914 system, assess the information technology systems being used, assess the dissemination of the EIA-914 data and

estimates, and make recommendations for expanding the EIA-914 survey to include 6 or 7 more States and adding oil and condensate. We plan to discuss recommendations suggested in the second phase of the review process at the American Statistics Association, Committee on Energy Statistics meeting in October 2009.