Future Water Needs of the Oil and Gas Industry in Texas*

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Abstract

The Barnett Shale gas play, located in North Texas, has seen a quick growth in the past decade with the development of new “frac” technologies able to create pathways to produce gas from the very low permeability shales. More plays such as the Haynesville, Woodford, and Eagle Ford are coming online at a steeper rate than the Barnett did. A typical horizontal well completion consumes more than 3 millions gallons of fresh water in a very short time (days). The trend in the industry is to increase the length of laterals with an increased water use. There are currently over 14,000 completed shale gas wells in the State of Texas and many more will be drilled in the next decades. If tight-gas completions are included, the volume of water used is even larger. Adding fresh-water make-up for water and WAG-CO\textsubscript{2} floods, mostly in the Permian Basin, increases even more the overall industry water use. However, the volume remains low on average compared to irrigation and municipal demand. Locally, competition for water resources can lead to conflicts, raising some concerns among local communities and other groundwater stakeholders. Nevertheless, the industry is improving its water footprint by increased recycling, developing alternative sources of water (brackish, treatment plants) and by using more efficient additives, and other innovative strategies. This paper presents industry water use in Texas compiled from various sources as well as water use projections for the next decades.
1- Summary

The Barnett Shale gas play, located in North Texas, has seen a quick growth in the past decade with the development of new "frack" technologies that allow producers to extract gas from the very low permeability shale. Major plays such as the Haynesville, Woodford, and Eagle Ford (Figure 1) are coming online at a deeper rate than the Barnett did. Figure 2. Typical horizontal well completion consumes more than 3 billion gallons of fresh water in very short time, the trend is the industry is to increase the length of wells with an increased water use. There are currently over 30,000 completed shale gas wells, in the state of Texas and many more will be drilled in the next decades. If tight gas completions are included, the volume of water used is even larger (Figure 3). Adding field water make up for water and WCTO, fresh, mostly in the Permian basin, increases more than the overall industry water use. However, the majority remains low in average compared to irrigation and municipal demand. Figure 4. The data were not without benign, but they and other issues were resolved by ensuring consistency between amount of water, number of stages, and proppant loading. The assigned median values to these wells with no datafile. The split between surface water, groundwater, and other sources (source water) was much harder to determine. It seems that neither groundwater nor surface water dominates in most cases, and both are almost across the basin. To the best of our knowledge, alternative sources are still ongoing in Texas. The amount of reusing water was also difficult to discern. We estimated at ~10% of the amount supplied for shale gas play. We are mean街on about water use for drilling and waterfloods, although it is clearly nonnegligible. Completion includes acid treatment and other treatments but hydraulic fracturing requires the largest water volume of all. Completion: ~60,000 AF; 2010 and (likely) key to grow in the next five years (on average). ~10% is also a large-scale water consumer, although the bulk of fresh water is the total of ~60,000 AF; just a few percent (~10,000 AF in 2010, latest survey in 1999 projected a number close to 10,000 AF.

2- Current Water Use in the Oil and Gas Industry

We were able to gather relatively accurate data from the completion / drainage stage (HP), as so is tending to be mandated for production. Figure 5. Operators have to report the amount of water used in their process, and this data were collected. We assigned median values to these wells with no datafile. The split between surface water, groundwater, and other sources (source water) was much harder to determine. It seems that neither groundwater nor surface water dominates in most cases, and both are almost across the basin. To the best of our knowledge, alternative sources are still ongoing in Texas. The amount of reusing water was also difficult to discern. We estimated at ~10% of the amount supplied for shale gas play. We are mean street on about water use for drilling and waterfloods, although it is clearly nonnegligible. Completion includes acid treatment and other treatments but hydraulic fracturing requires the largest water volume of all. Completion: ~60,000 AF; 2010 and (likely) key to grow in the next five years (on average). ~10% is also a large-scale water consumer, although the bulk of fresh water is the total of ~60,000 AF; just a few percent (~10,000 AF in 2010, latest survey in 1999 projected a number close to 10,000 AF.

3- Projection Methodology for Completion Water Use

Completion water use projections were done according to 2 methodologies: "resource-based" and "production-based". The former assumes that the water footprint of the formation is constant. (2) assume water per well is (1) assume water per well, (2) assume water per well, (3) assume water per well. The production-based methodology assumes (1) reasonable reserves and (2) some degree of curve for example. Figure 6. Values from both methodologies are compared and adjusted for consistency to produce the first projection values. Drilling and 2010 water use (Figure 8). It is important to note that 2010 water use was rather overestimated compared to expected usage.

4- Conclusions

Overall, in 2010, we estimate that the oil and gas industry used approximately 18,000 ac-ft/year (AF) for drilling and ~18,000 AF for other purposes. If we put these three numbers in perspective, Texas has been projected to have consumed ~18-20 million AF of water in 2010, according to the most recent 2007 data water plan, including ~10 and ~0.5 million AF for irrigation and municipal use, respectively. Projections were made with the help of various sources to reestimate the amount of oil and gas and other data to be produced in the state in the next five decades and by obfuscating it through time. Given the usability of the price of oil and gas, the future projection, however, they provide clearly indicate a possible future. The projected 2010 (Figure 8) that the cost of water use in the oil and gas industry would peak in the 2020-2030 decade ~10-15,000 AF, thanks to the final and gas carbon-based resources that "will start" to decrease in terms of water use around that time.

References

The authors would like to thank TWDB for funding this project, vendors IHS and others. The data were collected. We assigned median values to these wells with no datafile. The split between surface water, groundwater, and other sources (source water) was much harder to determine. It seems that neither groundwater nor surface water dominates in most cases, and both are almost across the basin. To the best of our knowledge, alternative sources are still ongoing in Texas. The amount of reusing water was also difficult to discern. We estimated at ~10% of the amount supplied for shale gas play. We are mean street on about water use for drilling and waterfloods, although it is clearly nonnegligible. Completion includes acid treatment and other treatments but hydraulic fracturing requires the largest water volume of all. Completion: ~60,000 AF; 2010 and (likely) key to grow in the next five years (on average). ~10% is also a large-scale water consumer, although the bulk of fresh water is the total of ~60,000 AF; just a few percent (~10,000 AF in 2010, latest survey in 1999 projected a number close to 10,000 AF.

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Figure 10: Comparison of 3404 projections (Nicot and Potter, 2007) and actual water use in the Barnett play (left). It is used to extract median for projections (Courtes of Peter Geikie, Texas). Figure 10 suggests good fit of data to the resource-based approach.