

WATER USE IN FAYETTEVILLE DEEP SHALE GAS EXPLORATION



FACT SHEET

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How much water is used in Fayetteville deep shale gas development?

Water is an essential component of Chesapeake Energy's (Chesapeake) deep shale gas development. Chesapeake uses water for drilling, where a mixture of clay and water is used to carry rock cuttings to the surface, as well as to cool and lubricate the drillbit. Drilling a typical Chesapeake Fayetteville deep shale gas well requires approximately 65,000 gallons of water.

Water is also used in hydraulic fracturing, where a mixture of water and sand is injected into the deep shale at a high pressure to create small cracks in the rock which allows gas to flow. Hydraulically fracturing a typical Chesapeake Fayetteville horizontal deep shale gas well requires an average of 4.9 million gallons per well.

How does Fayetteville deep shale gas water use compare to regional uses?

The volume of water necessary to drill and fracture Fayetteville deep shale gas wells represents a very small percentage of the total water resources used in the Fayetteville geographic area. This area includes 19 counties in East-central, central and West-central Arkansas. The total water use in the Fayetteville Shale area in 2005 was approximately 1.3 trillion gallons. The natural gas industry is expected to increase the amount used by less than 0.2%, and is well within available resources in the region. Again, this volume is very small in terms of the overall water budget for the area. The

How much is five million gallons?

The four million gallons of water needed to drill and fracture a Fayetteville deep shale gas well is equivalent to the amount of water:

- Flowing past **Little Rock, Arkansas**, in the **Arkansas River** every **14 seconds**
- Used by a 1,000 megawatt coal-fired **power plant** in **12.5 hours**
- Used by **golf course** in **25 days**
- Consumed by **7.5 acres of corn** in a **season**

While these represent continuing consumption, the water used for a shale gas well is a one-time use.

KEY POINTS

- Water resources are protected through stringent federal, state and local permitting processes.
- Natural gas production uses significantly less water per BTU of energy produced than other fuel sources such as coal, oil or ethanol.
- Water is essential for Fayetteville deep shale gas development.
- Fayetteville deep shale gas drilling and hydraulic fracturing uses a small amount of water compared to other uses within the geographic area, and does not represent a long-term commitment of the resource.

largest water users in the Fayetteville Shale area are irrigation (approximately 63%), power generation (approximately 33%), municipal/public water supply (approximately 2%), industrial and mining (approximately 1%), and livestock (less than 0.5%). Water used in Chesapeake Fayetteville deep shale gas wells differs most notably from all other uses because it is temporary, occurring only once during the drilling and completion phases of each well. Use of this water does not represent a long-term commitment of the resource in the Fayetteville Shale geographic area.

How much water is used in Fayetteville deep shale gas development compared with other energy sources?

Water and energy are interdependent. Water is essential to energy resource development. Conversely, energy resources are needed for producing, processing, distributing and using water resources. A typical Fayetteville deep shale gas well will produce approximately 2.4 Bcf (billion cubic feet) of gas over its lifetime, the amount of water used to produce the gas equates to about two gallons for every one million British thermal units (MMBTU - one MMBTU equals about a thousand cubic feet of gas). To put this in perspective, this is approximately 20% of the water needed to produce one MMBTU of coal that is ready to burn in a power plant, or 0.08% of the water needed to produce the same energy equivalent of ethanol for fuel. The table on the following page compares water use per unit of energy for several energy sources.

Water requirements for various energy resources

Energy Resource	Range of Gallons of Water Used per MMBTU of Energy Produced
Fayetteville Shale Natural Gas ¹	2.0 ²
Coal (no slurry transport)	2 – 8
Coal (with slurry transport)	13 – 32
Nuclear (uranium ready to use in a power plant)	8 – 14
Conventional Oil	8 – 20
Synfuel - Coal Gasification	11 – 26
Oil Shale	22 – 56
Tar Sands	27 – 68
Synfuel - Fisher Tropsch (from coal)	41 – 60
Enhanced Oil Recovery (EOR)	21 – 2,500
Biofuels (Irrigated Corn Ethanol, Irrigated Soy Biodiesel)	> 2,500

¹Source: GWPC Report

²The transport of natural gas can add between zero and two gallons per MMBTU.

Other Sources: DOE

Where does the water come from?

Chesapeake utilizes several sources of water in Fayetteville deep shale gas exploration including rivers, ponds, lakes and to a limited extent, groundwater wells. Due to the abundance of surface water in the Fayetteville Shale area, it is preferred by the state for non-domestic use. As a result, Chesapeake has committed to using surface water with the construction of a 500-acre-foot capacity reservoir filled with surplus diverted water from the Little Red River. This reservoir can supply water during the drilling and fracturing of 1,200 to 2,000 wells. Chesapeake is also reviewing the use of a variety of other water resources, such as discharge water from industrial or city wastewater treatment plants, power plant cooling water and the reuse of fracturing water. In addition, Chesapeake is looking into working with local officials to arrange water purchases from municipalities and rural water systems when drilling in their areas. Water is typically transported by temporary pipelines to drilling locations for storage in tanks or impoundments prior to use. In some cases, Chesapeake also uses trucks to transport water supplies. Due to the diverse geographic

area overlying the Fayetteville Shale, the overall mix of water sources used depends on the region and the availability of sources near drilling sites.

Are water resources protected and regulated?

Regardless of the source, water used in the drilling and fracturing process by Chesapeake is purchased and, as required, properly permitted. This permitting ensures that water used for drilling and hydraulic fracturing does not interfere with the available supply for other users.

Chesapeake works collaboratively with federal, state and local agencies to ensure that water used for deep shale gas development is consistent with water use plans and does not adversely affect other users.

In the Fayetteville Shale area, Chesapeake coordinates closely with entities such as the U.S. Army Corps of Engineers, Arkansas Natural Resources Commission, Arkansas Department of Environmental Quality and others on its water use.

Chesapeake's deep shale gas development, with its comparatively small water use per unit of energy, is consistent with the nation's energy/water strategy by making a positive energy and economic contribution at a relatively low cost to the overall water supply. Chesapeake's deep shale gas has the potential to supply decades of natural gas for the U.S., while using less water than other currently available viable energy sources.

Information Sources

- Argonne National Laboratory
- Environmental Resources Management
- Ground Water Protection Council (GWPC)
- Sandia National Laboratory
- U.S. Department of Energy (DOE)
- U.S. Geological Survey

About Chesapeake

Chesapeake Energy Corporation is the second-largest producer of natural gas in the U.S. Headquartered in Oklahoma City, the company's operations are focused on the development of onshore unconventional and conventional natural gas in the U.S. in the Barnett Shale, Haynesville Shale, Fayetteville Shale, Marcellus Shale, Anadarko Basin, Arkoma Basin, Appalachian Basin, Permian Basin, Delaware Basin, South Texas, Texas Gulf Coast and East Texas regions of the United States. If you have questions about water use in deep shale gas exploration or other facets of our operations, visit www.chk.com or email us at fayettevilleshale@askchesapeake.com.