

WATER USE IN HAYNESVILLE DEEP SHALE GAS EXPLORATION



FACT SHEET

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Haynesville Deep Shale Water Use

Water is an essential component of Chesapeake Energy Corporation's 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 Haynesville deep shale gas well requires approximately 600,000 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 allow gas flow. Fracturing a typical Chesapeake Haynesville horizontal deep shale gas well requires an average of 5 million gallons per well.

Water use Comparisons

The volume of water necessary to drill and fracture Haynesville deep shale gas wells represents a very small percentage of the total water resources used in the Haynesville Shale area Northwest Louisiana and Northeast Texas. The total water used in the Haynesville Shale area in 2005 was approximately 90 billion gallons. The natural gas industry is expected to increase the amount used by less than 1.5%, and is well within available resources in the region. Again, this volume is very small in terms of the overall water budget for this area. The largest water

How much is 5.6 million gallons?

The 5.6 million gallons of water needed to drill and fracture a Haynesville deep shale gas well is equivalent to the amount of water:

- Flowing past **Shreveport, Louisiana**, in the **Red River** every **57 seconds**
- Used by a 1,000 megawatt coal-fired **power plant** in **13 hours**
- Used by a **golf course** in **28 days**
- Consumed by **nine 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 state, regional 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 Haynesville deep shale gas development.
- Haynesville 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.

users in the Haynesville Shale area are municipal/public water supply (approximately 45%), industry and mining (approximately 27%), power generation (approximately 14%), irrigation and aquaculture (approximately 8.5%) and livestock (approximately 4%). Water used in Chesapeake Haynesville 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 Haynesville Shale.

Water Use Compared to Other Industry Source

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 Haynesville deep shale gas well will produce approximately 6.5 billion cubic feet (Bcf) of gas over its lifetime, the amount of water used to produce the gas equates to about 0.84 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 10% of the water needed to produce one MMBTU of coal that is ready to burn in a power plant, or 0.03% 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 ¹	Range of Gallons of Water Used per MMBTU of Energy Produced
Haynesville Shale Natural Gas	0.84 ²
Conventional Natural Gas	1 – 3
Coal (no slurry transport)	2 – 8
Coal (with slurry transport)	13 – 32
Nuclear (uranium ready to use in a power plant)	8 – 14
Chesapeake Deep Shale Oil	7.96 – 19.25 ³
Conventional Oil	8 – 20 ³
Synfuel - Coal Gasification	11 – 26
Oil Shale Petroleum	22 – 56
Oil Sands Petroleum	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: "Deep Shale Natural Gas: Abundant, Affordable, and Still Water Efficient", GWPC, 2010.

²The transport of natural gas can add to two gallons per MMBTU.

³Includes refining which consumes a major portion (90%) of the water needed (7-18 gal per MMBtu).

Water Sources

Chesapeake utilizes several sources of water in Haynesville deep shale gas exploration including rivers, bayous, ponds, lakes and groundwater wells. Chesapeake is also currently 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, marginal (saline) groundwater and re-use of fracturing water. Chesapeake often works directly with local officials to arrange water purchases from a municipality when drilling inside city limits or rural water systems in rural areas. Water is typically transported by truck to drilling locations for storage in tanks or impoundments prior to use. Chesapeake also uses temporary pipelines to transport water supplies. Due to the extensive and diverse geographic area overlying the Haynesville Shale, the overall mix of water sources used depends on the region and the availability of sources near drilling sites.

Water Regulations

Regardless of the source, water used in Chesapeake's drilling and fracturing process 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.

In the Haynesville Shale area, Chesapeake coordinates closely with entities such as the U.S. Army Corps of Engineers, Louisiana Department of Natural Resources, Louisiana Department of Environmental Quality, Louisiana Department of Transportation and Development, Texas Commission on Environmental Quality, Texas Water Development Board, Texas Railroad Commission, Texas Groundwater Conservation Districts, Sabine River Authority and various local authorities having water resources jurisdiction.

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 wells have 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, Inc.
- Ground Water Protection Council (GWPC)
- Louisiana Department of Transportation and Development (La DOTD)
- Sandia National Laboratory
- Texas Water Development Board (TWDB)
- U.S. Department of Energy (DOE)
- U.S. Geological Survey

About Chesapeake

Chesapeake Energy Corporation is the second-largest producer of natural gas, a Top 15 producer of oil and natural gas liquids and the most active driller of new wells in the U.S. Headquartered in Oklahoma City, the company's operations are focused on discovering and developing unconventional natural gas and oil fields onshore in the U.S. Chesapeake owns leading positions in the Barnett, Haynesville, Bossier and Marcellus natural gas shale plays and in the Granite Wash, Cleveland, Tonkawa, Mississippi Lime, Bone Spring, Avalon, Wolfcamp, Wolfberry, Eagle Ford, Niobrara, Three Forks/Bakken and Utica unconventional liquids plays. The company has also vertically integrated its operations and owns substantial midstream, compression, drilling, trucking, pressure pumping and other oilfield service assets. For more information on Chesapeake environment initiatives, visit the environment section of CHK.com, HydraulicFracturing.com, NaturalGasAirEmissions.com, NaturalGasWaterUsage.com, AskChesapeake.com or FracFocus.com.