

# Highly Accurate Metering for Fracking Fluids

By Kevin Clark  
Source: Turbines, Inc.

In many shale plays, the composition of the “flowback” from fracking sites are a complex combination of water, extraction chemicals, soluble and insoluble gases, oil, as well as proppants (small particulates, typically sand or ceramic). The substantial volume of material coming to the surface is processed through systems designed to separate the oil, gas, and water emulsion, while employing filters to remove proppants from the mixture. Once separated, the fluids and gas are pumped into tanks for further processing; and in the case of water, pumped to holding tanks or evaporation ponds.

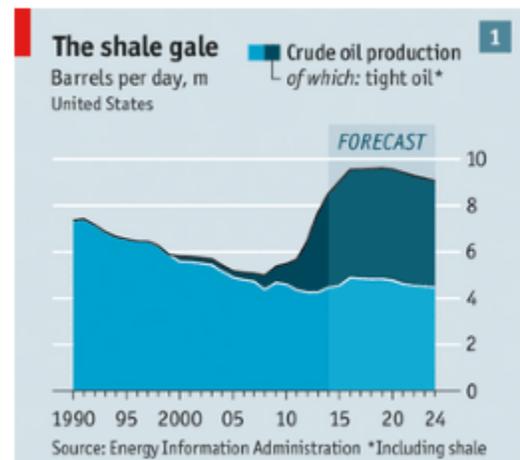
This article will delve into the importance of highly accurate measurement of oil and gas as those flows go through the collection piping and production manifold toward the processing facility or storage units. It will also cover the measurement of flowback and wastewater that are intended for potential re-use or onsite disposal, both of which are governed by increasing regulation.

## Oil & Gas Measurement

Well yield is closely watched by Exploration and Production (E&P) companies looking to maximize their investment by ensuring the accuracy of their well depth and spacing, as well as validating that production drop-off rates are within acceptable levels. Unlike traditional wells, which experience a 50% drop in production in the first two years, shale oil wells can drop off as much as 70%.

In order to maintain the sheer volume of tight oil production, which is forecast to double U.S. capacity within just a few short years (see chart), E&P companies are drilling thousands of new wells a year. For example, the International Energy Agency believes that 2,500 new wells must be created annually in the Bakken play in order to maintain yield levels.

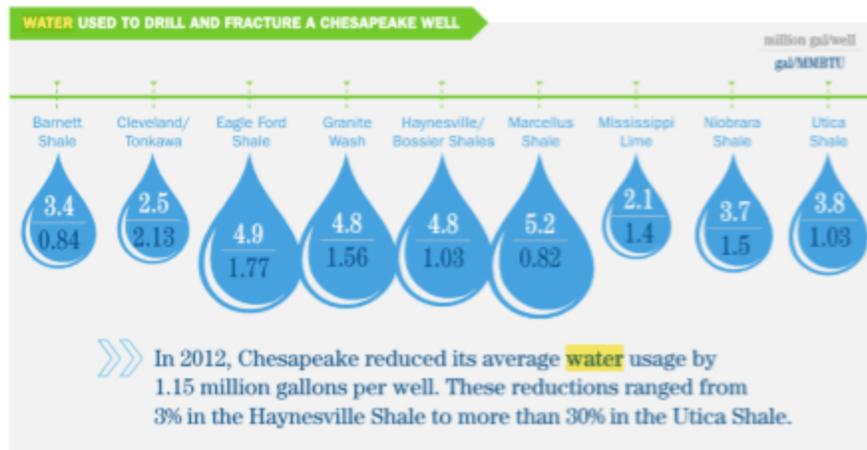
With this much activity and a steep yield curve, E&P companies must consider technologies that improve the measurement of the oil and gas being produced from each well. With a slightly higher break-even price per barrel than conventional wells – ranging from \$60-80 per barrel – E&P companies must find ways to improve their collection and measurement. While measurement technologies won’t stem the drop in yield, they’ll more precisely measure the amount of oil and gas coming from the wells.



Source: *The Economist*, February 15, 2014

## Water Measurement

The amount of water used for each fracking well depends on the density of the rock, but generally ranges from two (2) to more than five (5) million gallons per horizontal well (see chart). When the natural gas and oil have been collected, the flowback may contain traces of chemicals used in the fracking process and materials found underground. Now considered wastewater, this liquid cannot be release directly into waterways and must be managed appropriately.



Source: Chesapeake Energy 2012 Corporate Responsibility Report

With a broad mix of state and federal regulations, particularly with wastewater, E&P companies must get ahead of the curve to ensure their flowback measurement is as accurate as possible. Additionally, under the National Pollutant Discharge Elimination System (NPDES) permit program, the Environmental Protection Agency (EPA) can regulate the discharge into waterways and public treatment facilities that can process wastewater in compliance with federal, state, and local requirements.

While onsite storage in evaporation ponds is a viable and cost-effective option, many E&P companies are turning toward recycling of the flowback in order to reduce their demand for freshwater and reduce onsite storage. By shifting to recycling methods, E&P companies can cut costs of expensive removal by tank trucks and lower their costs using underground injection of wastewater. For instance, disposing of liquids by truck can cost as much as \$12 per barrel, depending upon the location and demand from other producers. Given the break-even cost explained earlier in this article, water recycling makes commercial and environmental sense, particularly with large-scale operations that have massive water requirements and produce significant amounts of wastewater.

Even when recycling is chosen by the E&P company, the implementation of high quality metering and accurate, verifiable measurement using an independent lab calibrated monitoring system, play a prominent role in this effort to self-monitor the use of water at each drill site. Should E&P companies select the option to transport liquids to a local treatment facility for processing, the need for greater accuracy and accountability increases significantly due to the potential damage to local water resources and possible violations of governmental regulation.

In either scenario, by documenting actual flow rates and totalized volumes, E&P companies can prove the amount of liquids used by their wells and help them understand the operational and economic impact on their facilities.

## Selecting Accurate Measurement Technology

Among all the possible metering technologies available in the market, turbine meters offer a low cost, accurate, and reliable solution for measuring oil, gas, and flowback wastewater at fracking sites.

Industrial-strength turbine meters often consist of an axial stainless steel rotor, mounted stainless steel shaft and shielded ball bearings, which spin within the body of the meter. Liquids or gases flowing through the meter spin the rotor at a rate that is directly proportional to the flow rate of the fluid moving through the pipe – with higher flows leading to higher speeds. As the rotor spins, a magnetic sensor mounted directly above it in the housing detects the speed by counting the rate at which each rotor blade passes beneath it.

Turbine meters can be custom designed to fit the desired line size, using a variety of materials selected for the particular temperature, pressure, flow rate, and flow medium requirement of each application. Materials are selected for durability, corrosion resistance, and value.

In order to maintain optimal performance of the meter, periodical maintenance is required. Due to this inevitability, hydraulic fracturing operators require accessible replacement and re-kitting. By design, turbine meters are easy to replace and can be switched out quickly and relatively effortlessly with some manufacturers offering meters that can be re-kitted without removing the actual meter body from the pipeline.

## Local Suppliers

With the help of experienced turbine meter manufacturers, E&P companies can improve the accuracy of their measurement while also lowering maintenance costs and downtime. The key to being able to support high growth in new wells across the country is having immediate inventory availability and accessibility to the right parts. Meter suppliers that can achieve quick delivery are critical to maintain peak production efficiency in the field.

It's also imperative that E&P field personnel have access to application engineers with significant expertise to recommend the right metering solution, and provide timely customer service when needed in the region where they operate. This is particularly important in shale plays where the turnover in personnel can result in an experience void. This can be partially resolved due to the simplicity of the turbine meter design and operation, but fully resolved only if the field personnel have access to knowledgeable application engineering help.

## Conclusion

As stated by Wyoming Governor Matthew Mead to *The New York Times*, "I am not going to accept the question of do you want a clean environment or do you want energy... The fact is that in Wyoming, we want and need both."

It's commonly understood that the U.S. is on track to be a net exporter of natural gas by 2020, with shale gas outpacing all other sources by a large margin. Similarly, net imports of petroleum and other refined liquids will also decrease as domestic production of crude oil from tight oil formations increases and tightening fuel standards take effect.

The delicate balance between oil independence and long-term sustainability primarily rests in the hands of decision makers at the E&P companies. They must adopt highly accurate and validated measurement technologies to accurately measure and account for their extraction activities.

*About the Author: Kevin Clark is the General Manager at Turbines Research & Development, LLC, a subsidiary and the research and technical support arm of Turbines, Inc., which serves a range of industries and applications, from oil and gas, to cryogenic liquids, to custody transfer. Previously, Kevin was a Mechanical Engineer at Sponsler, Inc. and is a graduate of Clemson University with a BS in Mechanical Engineering.*