The Haynesville: A Natural Gas Bellwether

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The Texas-Louisiana Salt Basin, and in particular the Haynesville Shale, is a prolific dry natural gas play in East Texas and Northwest Louisiana (**Figure 1**) strategically located near petrochemical complexes and LNG export facilities on the U.S. Gulf Coast, which helps facilitate rapid "spuds-to-sales" cycle times. Currently, the play is experiencing a renaissance due to new well design (extended reach laterals, increased proppant loading/concentration), re-fracs of existing wells and associated incremental production, as well as huge development inventory from existing locations and pad drilling.

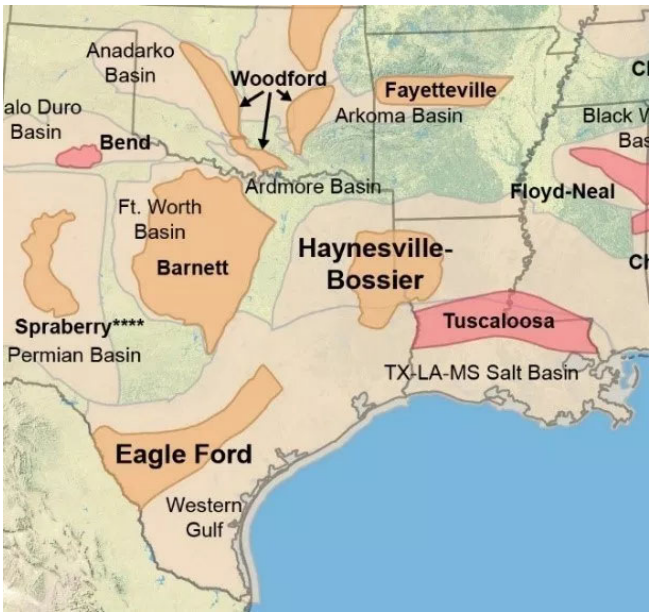


Figure 1 – Geography of the Haynesville Region (Source: Energy Information Administration)

The Haynesville Region is the third-largest natural gas producer in the U.S., producing close to 10 billion cubic feet per day (Bcf/d) (Appalachia Region: ~30 Bcf/d, Permian Region: ~12 Bcf/d), according to the U.S. Energy Information Administration (EIA).

The Upper Jurassic-aged Haynesville Shale formation is a dark organic-rich, brittle (conducive to hydraulic fracing) mudstone-shale that lies between the Bossier and Cotton Valley Lime intervals. The Haynesville Shale is deposited in a deep-basin setting with generally south, basin-ward dip at depths ranging from 10,500 ft. to 14,000 ft. with thick pay intervals ranging from 150 ft. to 400 ft. The formation tends to be over-pressured, leading to high-initial production (IP) rates, which typically alleviates a need for gas compression in the early producing years.

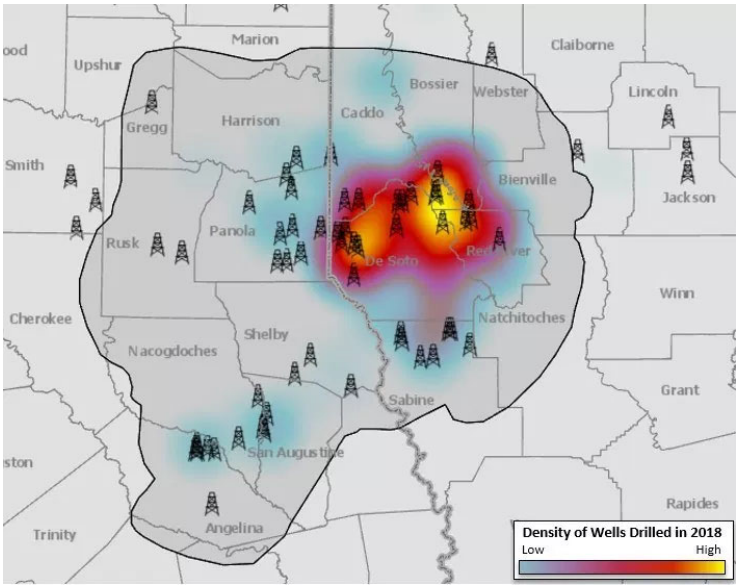
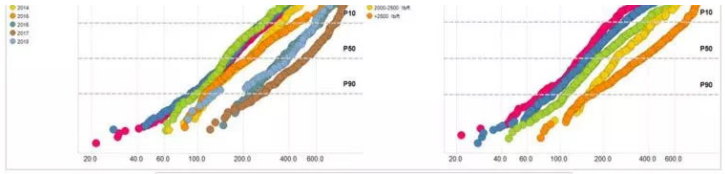


Figure 2 – Active Drilling Rigs, 2018 Density Heat Map (Source: Drillinginfo)

Active industry operators include: Chesapeake Energy Corp., Comstock Resources, BHP Billiton, Exco Resources, Vine Oil and Gas, Covey Park Resources, Indigo Minerals and Goodrich Petroleum Corp. As of October 2018, out of the 50 rigs currently deployed, XTO Energy, Indigo Minerals, BP America and Rockcliff Energy have seven, six, five and five rigs running, respectively. XTO and BP America activities are centrically located in the Angelina River Trend (ART) and Shelby Trough area in East Texas (**Figure 2**). These operators, to name a few, have ignited the renaissance of this natural gas resource play due to achieving consistent well results, coupling longer laterals and high-intensity proppant loadings (**Figure 3**).



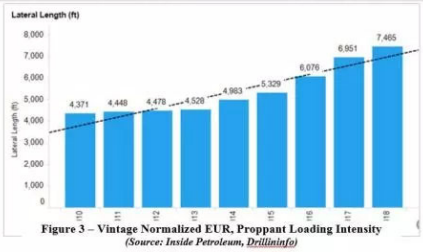


Figure 3 – Vintage Normalized EUR, Proppant Loading Intensity
(Source: Inside Petroleum, Drillinginfo)

Figure 4 shows drilling permit activity for 2015 to present year. In terms of activity, Northwestern Louisiana historically has been the "sweet spot"; however, increasing permits in East Texas is being seen in 2018. Industry participants have delineated a North Louisiana Core (apparent in **Figure 2** heat map) in Caddo, DeSoto, Bienville and Red River Parishes, Louisiana with a higher percent weight of total organic content (TOC), higher average total porosity and higher original gas in place (OGIP).

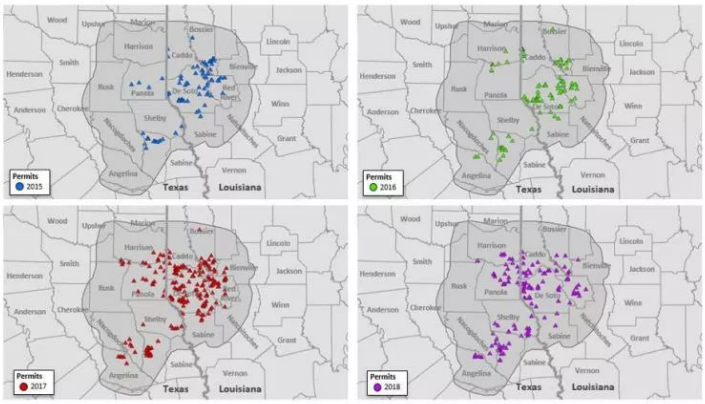


Figure 4 - Haynesville Shale Permit Activity (2015 - Present)
(Source: Drillinginfo)

M&A Overview

In recent years, the Haynesville was nudged out of the market a bit in favor of the lower cost supply in the Marcellus/Utica and associated gas from oil production. However, the Haynesville of today is experiencing a reemergence. The Haynesville play is located near several major pipelines, and there is speculation of at least six LNG export facilities operating by 2022, conveniently located near the Haynesville region. Unlike the Marcellus/Utica region, there is no transportation bottleneck. Furthermore, Louisiana's access to the U.S. Gulf Coast (export hubs to Mexico and soon-to-be-mushrooming LNG plants all geographically close to the Haynesville) and industry advancements in drilling technology has propelled the Haynesville back into the spotlight.

Below in **Figure 5** is the Haynesville Region mergers and acquisitions and divestures (M&A&D) activity in 2016, which was a healthy year for Haynesville upstream transactions. This year saw a total of eight transactions, one being the Range/Memorial transaction, which was valued at $4.4 billion. Of these eight transactions, the average transaction value stood at approximately $960 million.

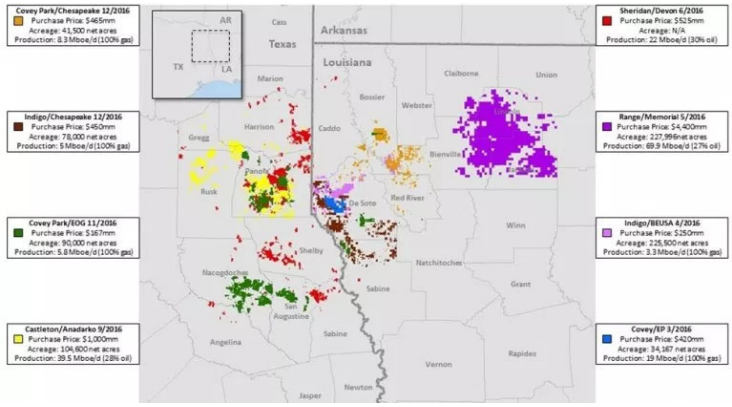


Figure 5 – 2016 Haynesville Region M&A&D Activity (Source: PLS)

As for more recent transactions, **Figure 6** shows activity in 2017 and 2018. The M&A&D market in 2018 has currently seen six transactions, with the largest transaction being the $217-million Tanos/Wildhorse deal in February. For these six transactions, the average transaction value was approximately $174 million, a significant decrease comparatively to 2016.

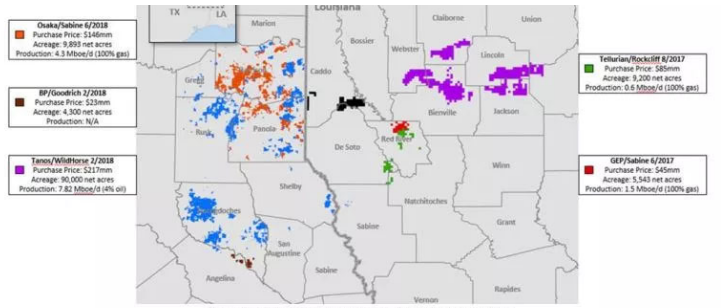


Figure 6 – 2017-2018 Haynesville Region M&A&D Activity
(Source: PLS)

In terms of total number of transactions in the last three years (**Figure 7**), De Soto Parish has been involved in 14 deals from 2015 to 2018. Historically, most activity has been centered in East Texas in Harrison and Panola counties and the North Louisiana Core in De Soto, Caddo, Red River and Bossier Parishes.

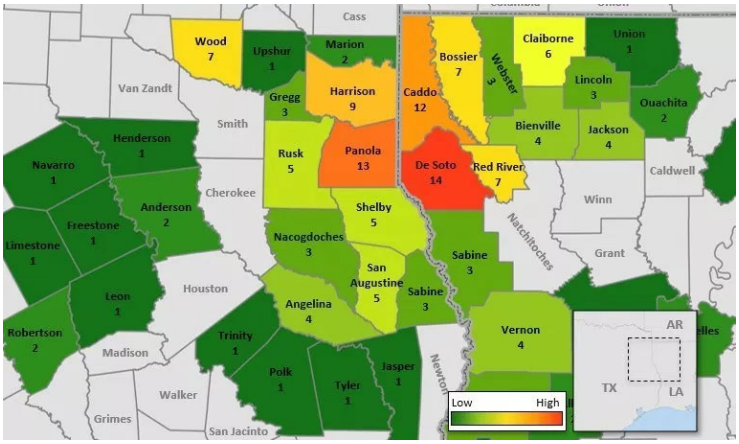


Figure 7 – Haynesville Region Number of Transactions (2015-2018). (Source: PLS)

Geological Overview & Performance Trends

The Haynesville Shale is an upper Jurassic-aged formation bounded between the Bossier Shale formation on top and Buckner formation on the bottom. The organic rich shale is an argillaceous, silty, calcareous mudstone and was formed from a mix of carbonate and clastic systems that were deposited in a relatively shallow, restricted intrashelf basin that was influenced by pre-existing paleo structure.

Jurassic-aged Cotton Valley Sands, Bossier Shale and Haynesville Shale are among the most targeted formations in the region. Other younger productive formations of interest in this basin include: Travis Peak, Sligo, Glen Rose, James Lime, Woodbine, among others.

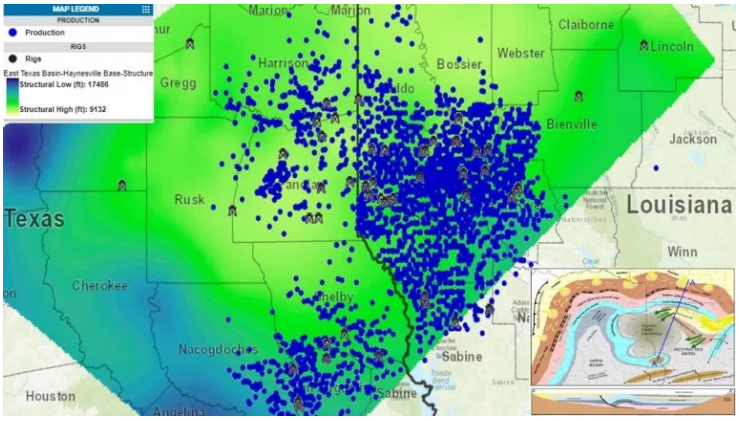


Figure 8 – Haynesville Base Structure Map with Rigs and Horizontal Haynesville Producing Wells (Source: UT BEG/DrillingInfo)

Figure 8 demonstrates that the Haynesville Shale wells are concentrated in the more prolific North Louisiana Core of the play along with rig activity. The inserted late Jurassic depositional model developed by the Bureau of Economic Geology (BEG) shows the flow of organic material from the early Haynesville Sabkha into the gas-productive region of the Haynesville as validated by production data.

The Haynesville Shale deepens to the southeast and is correlated to increasing reservoir over-pressure. The structural features in the South Shelby and Northern San Augustine counties enhances the productivity of wells along these areas due to natural fracturing of the shale. The thickest portions of the Haynesville is in the northwest portions of the basin in Harrison and Panola counties, but they also exhibit higher clay content, which has a deleterious effect on the fracture stimulation capacity of drilled wells.

Understanding thickness, structure, deposition, clay content, over-pressure and other geological parameters is key to developing profitable shale-gas wells and identifying good acreage positions for acquisition. Industry experience clearly demonstrates the perils of inadequate geological study by drilling numerous avoidable non-commercial wells. Intensive reservoir and geological studies for OGIP, porosity-permeability trends and well performance can be important in guiding decision-making processes in the future related to proper allocation of capital and personnel to resource-development activities.

Regarding operator performance and first six-month cumulative gas production, **Figure 9** depicts prolific areas for the top tier operators by well performance. The majority of the higher

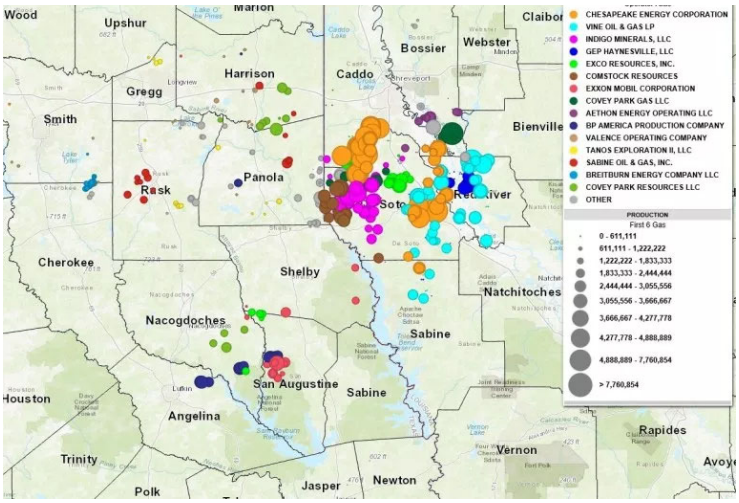


Figure 9 – Top Operator First Six-Month Cumulative Gas Production (2016-Present) (Source: Drillinginfo)

Tags: Haynesville Shale, natural gas, Opportune