

Increasing short- and long-term dry gas production—Haynesville Shale

Low-density ceramic proppant increases conductivity under hot, high-stress conditions.

Haynesville Shale, South Central USA

The challenge

High temperature and high closure stress were recognized as the primary limitations to maximum short-term production and long-term proppant pack durability in the Haynesville shale formation.

The solution

Subsequent modeling concluded that under realistic downhole conditions, short- and long-term conductivity was restricted significantly in fracture treatment designs using Tier 2 (resin-coated sand, RCS) and Tier 3 (sand) proppant.

As a result, the operator chose to use Tier 1 ceramic proppant in its hydraulic fracture design program. Field validation was conducted using a set of 55 wells with 32 months of production data. Twenty of the wells contained primarily low-density ceramic proppant and 35 stimulated primarily with RCS proppant.

Well Data

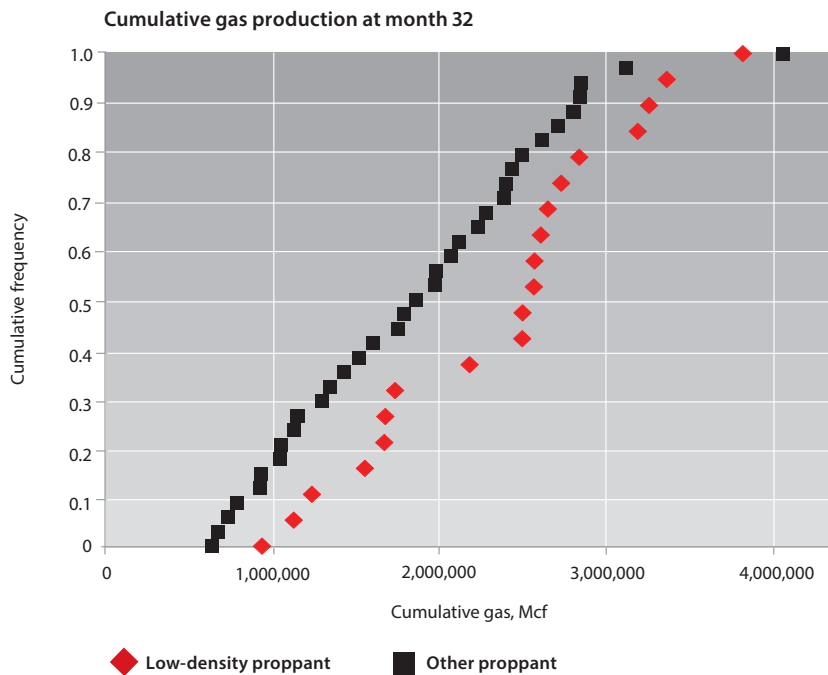
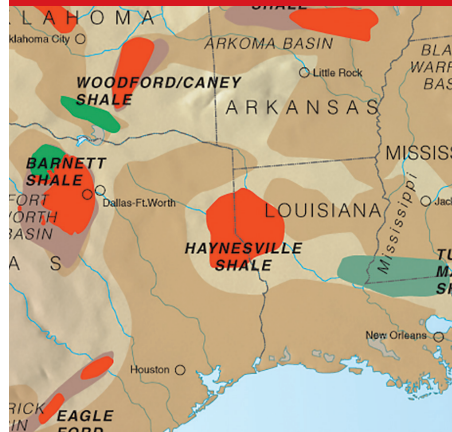
Location: South Central USA

Well Type: Dry gas

Proppant: Low-density ceramic proppant

Well Conditions:

- 11,000 - 13,000 ft TVD
- Horizontal wells with multistage transverse fractures
- Closure stress >10,000 psi
- Porosity - 6-12%
- Permeability - 5-800 nD
- >300° F

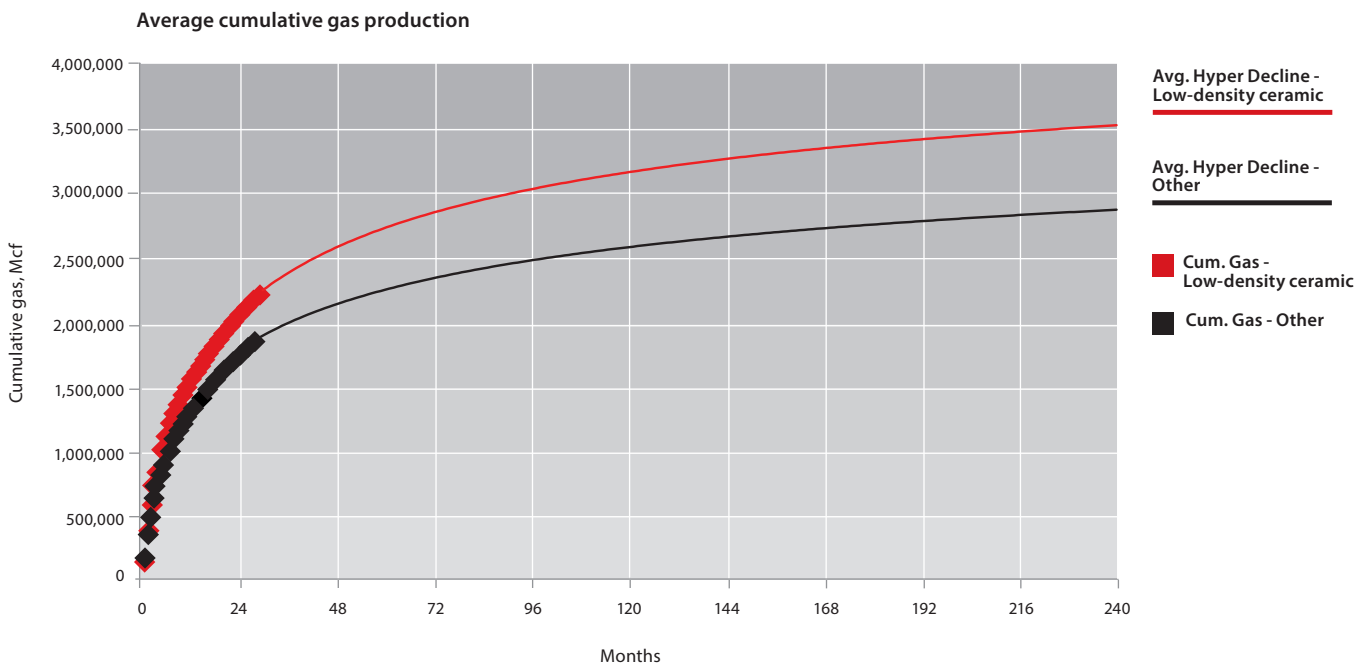


After 32 months of production, low-density ceramic wells produced on average 0.5 Bcf/well more than offset wells containing RCS.

The results

The wells utilizing the low-density ceramic proppant delivered a production increase of 0.5 Bcf per well, with average cumulative gas production of ~2.3 Bcf compared to the RCS average of ~1.8 Bcf per well after 32 months of production. The incremental per well cost of upgrading from RCS to low-density ceramic proppant was quickly offset by the nearly a 10-fold return on investment.

A hyperbolic decline curve analysis projects the ceramic proppant wells will produce nearly 1 Bcf more per well during a 20-year production life compared to the resin-coated sand wells—a 35% increase in the estimated ultimate recovery (EUR).



When projecting to 20 years using hyperbolic decline, it is projected that the ceramic proppant wells will produce an incremental 35% more gas than the RCS proppant offset wells. Sources: SPE 134165 "Improving Stimulation Effectiveness – Field Results in the Haynesville Shale" and SPE 160206 "Hydraulic Fracture Design Optimization in Unconventional Reservoirs – A Case History."

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