

Operator Refractures Wells and Decreases Cost Per BOE by 78%

ACTIVATESM REFRACTURING SERVICE SAVES SIGNIFICANT COSTS COMPARED TO NEW DRILLING

BARNETT SHALE PLAY, WISE COUNTY, TEXAS

CHALLENGE

- » Understimulated vintage completion well resulted in well's rapid production decline
- » Increase EUR at lower cost per BOE compared to new drilling

SOLUTION

- » AccessFrac service generates new fractures from old perforations that were not stimulated in well's first life
- » ACTIVATESM service helped operator overcome economic losses from existing well

RESULT

- » \$1 million NPV after 10 years of incremental production
- » 83% EUR increase after refracture treatment
- » 18% decline rate after refracturing the well, compared to 55% decline rate without the refracturing treatment

OVERVIEW

An operator in the Barnett was looking to increase production from vintage completion wells. After refracturing the well with ACTIVATE service, the operator increased EUR by 83%, resulting in \$1 million NPV.

CHALLENGE

The goal is to increase production from understimulated vintage completion wells that were proving unprofitable, but was not convinced that refracturing the wells would prove economical compared to drilling new wells. Halliburton ACTIVATESM service to select the best candidate well and design the optimal stimulation treatment.

SOLUTION

Halliburton and the operator collaborated to select and rank the best candidate wells based on their reservoir quality. An economic development payback and estimated ultimate recovery (EUR) analysis was performed to evaluate which wells would produce the greatest return at the lowest cost per BOE. For one particular well, AccessFrac[®] stimulation service was used to adjust the original treatment design in response to the treating pressure recorded while on location. Figure 1 shows adjustment in the seating rate based on increasing treating pressure throughout the job. This helped determine how much diverter to pump

DID YOU KNOW

The ACTIVATESM service involves four steps:



Predictable refrac wells can enable operators to build a balanced portfolio of new wells, infills, and refracs, and to reduce the cost per BOE break-even point of their specific acreage. Refracs also allow operators to book incremental reserves.

In basins where we have delivered the ACTIVATE service, operators have seen up to:

- **80% increase in estimated ultimate recovery (EUR) per well**
- **25% increase in oil recovery factor** with balanced portfolio
- **66% reduced cost per BOE** compared to new drills

at the given pressure rate, while reducing injection rate at each stage. With the new design, the job was executed. With AccessFrac service, the refracture treatment enabled five new stage placements, five new perforation clusters, and five diversion drops,* resulting in increased production.

*These are conservative numbers compared to current refracturing operations.

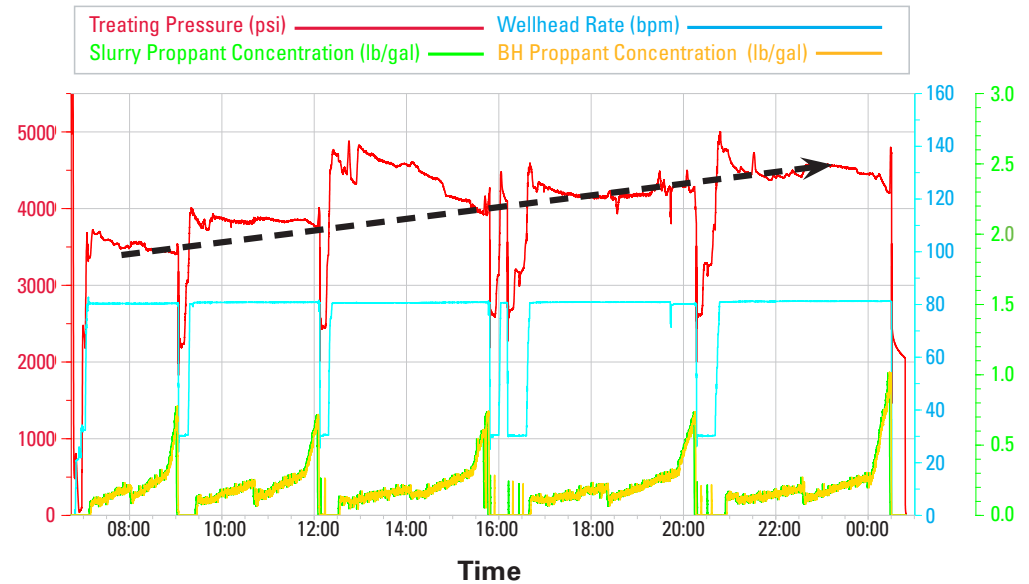



Figure 1 shows a job plot measuring pressure, rate, and proppant concentration. The red curves demonstrate an overall increase in treating pressure from the beginning to end of the stimulation treatment.

RESULTS

Figure 2 shows that the refracturing treatment arrested the well’s decline curve. After the original fracturing treatment, the projected EUR was 1.8 MCF. After the refracture, projected EUR was 3.3 MCF, resulting in a net EUR increase of 1.57 MCF. The flat decline rate was a direct result of design change as part of the refracturing treatment, resulting in 83% increase in EUR in the second life of the well.

The refracture also proved to be more economical than drilling a new well. Initial well costs yielded \$1.65 cost per MCF, whereas the cost of the refracture yielded \$0.36 cost per MCF or 78% lower cost per BOE compared to new drilling. The operator was pleased with the result and has continued to engage Halliburton for the refracturing of future unconventional assets.

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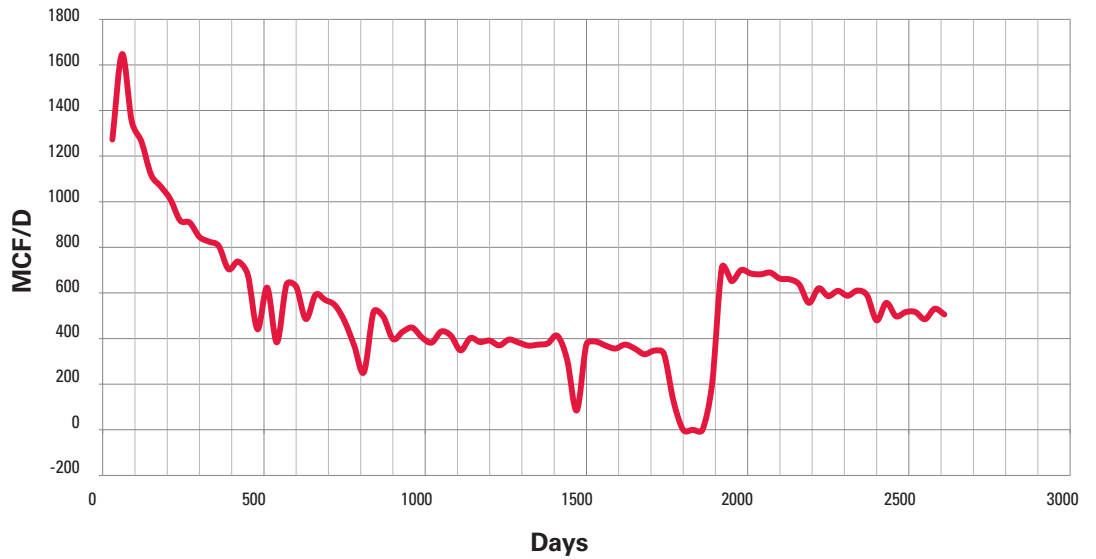


Figure 2 shows that the refracturing treatment arrested the well's decline curve. There was a projected EUR of 1.8 MCF after the original fracturing treatment. After the refracture, the projected EUR was 3.33 MCF, resulting in a net EUR increase of 1.53 MCF. The flat decline rate was a direct result of design change as part of the refracturing treatment, resulting in additional surface and reservoir stimulated area.

Original Well			Refractured Well		
q_i	55,000	MCF/month	q_i	22,000	MCF/month
b	0.9		b	0.9	
D_i	0.1	month ⁻¹	D_i	0.017	month ⁻¹
\$3,000,000	\$1.6	Per MCF	\$570,000	\$.36	Per MCF
G_{pDa}	1,814,005	MCF	G_{pDa}	3,338,741	MCF

Figure 3 compares the well's production and cost before and after the refracturing treatment. Refrac q_i is 40% from the initial q_i .*

*Source: Publicly available quarterly operator reports. Refracturing costs from internal documents and field estimations.

Contact Halliburton to see how the ACTIVATE service can help you build a balanced portfolio and recover bypassed reserves predictively and repeatedly.

www.halliburton.com/ACTIVATE