Acting on modeling insight more than doubles gas production - Marcellus Shale

Data-driven analysis prompts completion modification delivering an additional 270,000 MCF peak month production

Marcellus Shale, Northeast Pennsylvania

The challenge

A non-operating interest holder in a horizontal Marcellus project was concerned that their completions were under-designed and not producing at potential. The questions they had were as follows:

- How effective are these completions?
- How would these wells produce if they were completed and fracture stimulated more effectively?
- What are the primary drivers that control well production and recovery?
- How significant is geology and reservoir characteristics on well production?

The objective was to determine the increased production from the use of more effective completion design for minimal cost and without experimenting on actual wells. Experimenting on actual wells is problematic not only because of cost but also due to the lack of information required to normalize out the effects of well-to-well differences in reservoir characteristics.

The solution

Using the STRATAGEN well performance analysis service, WELLWORX, that uses multi-well, data-driven linear and neural network analysis techniques, develop a predictive model to forecast productivity. This data driven modeling process requires construction of an accurate forecasting model based on readily available well geology and completion information.
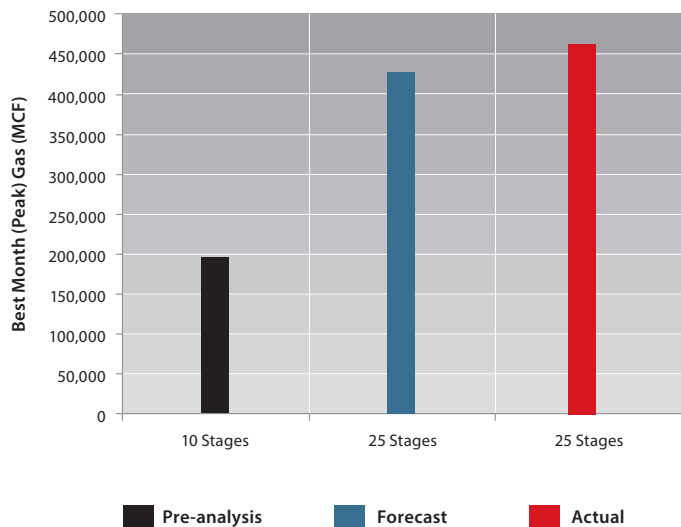
Well Data

Location: Marcellus Shale, Pennsylvania

Well type: Multiple shale gas production wells

Reservoir characteristics: Middle Devonian, organic black shale; 50-200-ft thick; 3-12% total organic content (TOC)

Diagnostic tool: WELLWORX well performance analysis workflow

The WELLWORX well performance analysis service included a model that accurately forecasted what the well would produce with the increased number of frac stages with an accuracy of 8% between forecasted and actual production.

SPE 171003 Understanding Multi-Fractured Horizontal Marcellus Completions

StrataGen
A CARBO business

StrataGen

The results

Geology and reservoir quality dominate Marcellus production however, fracture spacing and proppant volume ranked the highest in significance for controllable factors related to contact and conductivity affecting the level of gas production.

Modeling factors affecting Marcellus production

Non Controllable Factors	Controllable Factors
Geology	Fracture spacing
Reservoir quality	Proppant volume
	Number of clusters
	Fluid volume
	Injection rate

Analysis supported increasing the number of frac stages from 10 to 25 and doubling the treatment volumes. The result was a production increase from nearly 190,000 MCF to 460,000 MCF in the peak month from the new new well completion design. This is a production increase of 2.5 over the previous completion and frac designs.

Other design change involved reducing the number of clusters to 4 and increasing the injection rate to 102 BPM, to increase the injection rate per cluster.

The WELLWORX model estimated production for new test well completion that was within 8% of the actual production rates.

First 30 Day Gas Cum.

$R^2 = 0.8162$
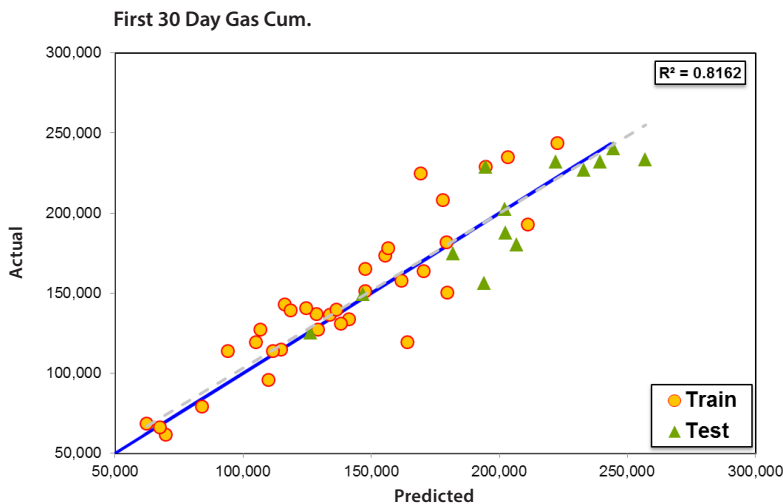
Model predicted versus actual well production is used for model development and model evaluation to provide accurate insight into factors associated with certain wells producing more than others.

Contact:

Robert Shelley
Robert.Shelley@stratagen-engineering.com

Talk to STRATAGEN to find out how we can help you enhance your production.

stratagenconsulting.com

StrataGen
A CARBO business