Auto forecasting test on Pouce Coup South supports manual adjustments

Despite a break from low prices, E&P companies continue to insist on increased staff productivity in the face of workforce and budget cuts and greater technical challenges. It's called doing more with less.

For instance, preparing manual oil and gas production forecasts for hundreds, sometimes thousands of wells, is prohibitively time consuming. To overcome that, engineers are turning to algorithm-based routines featured in auto-forecasting software programs.

Those programs enable engineers to conduct type-well analysis more rapidly. Used properly, auto forecasting generates best-fit declines and decline models, including the commonly used two-segment Arps.

When the evaluator merges historical production data with production forecasts to build type wells, they represent the best available interpretation of the underlying data.

History is key

Anton Siyatskiy, senior petroleum engineer at Ryder Scott Canada, presented, "Auto Forecasting – Its Current Reliability and Uses," at the Calgary reserves conference in May. In his study, he compared manual forecasting (base case), auto forecasting with built-in defaults and manually adjusted auto forecasting. For the comparison, he considered 780 producing wells, including 505 horizontal producers, in the Doig/Montney reservoirs in the Pouce Coupe South area in Alberta.

Siyatskiy presented known challenges with auto forecasting that include the following:

- Having sufficient well history for extrapolation.
- Knowing flow mechanism up front.
- Identifiying basic Arps parameters, such as the B-factor, initial decline, switch time for linear- to boundary-dominated flow (BDF) for horizontal wells and terminal decline (Dmin).

His examination procedures included the following:

1. Selecting area with significant historical production data.
2. Performing manual evaluation (well-by-well examination) in desired bin of wells to generate the reference point (reference type well). Siyatskiy used modified Arps because most wells are in BDF.
3. Conducting auto forecasting by using six scenarios:
   - Three cases with default software settings for 100 percent of production data, 73 percent and 36 percent. Data cutoff times for the three cases correspond to date of study, time period before YE 2014 and time period before YE 2010, respectively.
   - Three cases with manually adjusted auto-forecasting parameters to mimic development of producers, specifically modifying the initial B-factor and Dmin .
4. Identifying how close the auto forecast estimated ultimate recoveries (EURs) were to reference-case EURs.

Methods

Siyatskiy used the binning method to segment out a group of wells for manual forecasting, the reference case. Vintage of production, well location, product type and type of drilling were binning criteria. Siyatskiy binned 45 horizontal gas wells in relatively close proximity with production starting between 2007 and 2009. He then generated a type-well profile to compare to the other methods.

To identify flow-regime deviations, he used frequency histograms to segment out time spans for linear flow (LF) at three to eight months and for BDF at 26 to 39 months. Siyatskiy then generated type-well profiles for those wells.

Please see the six scenarios — three with default software settings, three with manually adjusted, history-matched auto forecasts — on the following chart:

Scenarios Description

Initial production starts in 2007-2009 ← Full Data | 2015 (27% data cut) | 2011 (64% data cut)

Method	Scenarios		
Default software settings	**Scenario 1** B-factor max = 1.5, D_{min} = 5% (no production cut)	**Scenario 3** B-factor max = 1.5, D_{min} = 5% (cut well's production data after 2015)	**Scenario 5** B-factor max = 1.5, D_{min} = 5% (cut well's production data after 2011)
Mimicking that operator's play intelligence is growing with time. Auto Forecast is manually adjusted to fit the history.	**Scenario 2** B-factor max = 1.5, D_{min} = 10% (no production cut)	**Scenario 4** B-factor max = 1.5, D_{min} = 10% (cut well's production data after 2015)	**Scenario 6** B-factor max/min = 2/1.5, D_{min} = 10% (cut well's production data after 2011)

Siyatskiy showed a series of slides documenting the steps he took for every scenario of the six to generate reasonable Arps parameters. The results of the comparison showed a range of differences between the reference case and default and manual auto forecasting. With the complete data set, auto forecasting using defaults was 31 percent higher than the reference case. Auto forecasting using manual tweaks was only 4 to 7 percent higher than the reference case at any one of the three data cutoff points.

Please see the following chart:

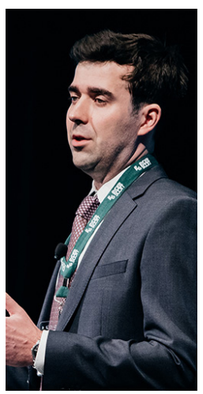
Representation of Results for Every Scenario Compared to Reference Case

Reference case, EUR	3,719		
	Production Elimination		
Scenario	Until 31st of Dec 2010	Until 31st of Dec 2014	Full Data Set
Auto Forecast Default, EUR	4,570	4,601	5,371
Auto Forecast with Manual Tweak, EUR	4,001	3,797	3,871
Difference with Reference Case			
Auto Forecast Default, %	+19%	+19%	+31%
Auto Forecast with Manual Tweak, %	+7%	+2%	+4%

Conclusions

Siyatskiy concluded the following:

- Avoid the default blinded auto forecasting option. This result shows that predicted EURs are significantly overestimated vs. eventual outcomes.
- The percentages of difference would be even higher if remaining technical volumes were estimated vs. EURs.
- Basic understanding of reservoir and well behavior plus application of this knowledge to auto forecast outcomes provide better results for evaluations of type-well profiles. For quick assessments, the study methods cited may be sufficient depending on tolerance levels.
- Always review a well's auto forecast before generating type-well profiles. Always investigate suspicious software results. Automation programs do not understand more or know better than a skilled engineer.
- This relatively simple study used a generic set of data. Industry should conduct more testing. The binning selections in this study may differ from other options, which, if chosen, might cause interpretations to differ.



Anton Siyatskiy