Claim 2 Practise Competently

Reservoir Engineering is the link between the geoscientists and accountants. Oil and gas project outcomes often produce surprises. The greatest learning opportunities come from disappointments. I was part of a team attempting to develop a CSG field in Queensland. The initial pilot well was a great success and the JV decided to embark upon a multi-well development project. These were vertical fracture stimulated wells. With the help of a junior engineer, an extensive effort went into the fracture stimulation design. The Fracture stimulation modelling and design used in the industry has been based on clastic reservoirs which exhibit a high Young's modulus. Coal has a low Young's modulus which makes modelling challenging. Another issue was that the transportation fluid for the proppant [sand] was slick water containing no gel. The distance proppant can travel relates to the fluid velocity. A model was developed which formed the basis of the Fracture stimulation program. The wells were drilled and the fracture stimulation program was executed efficiently and as planned. The model was considered an improvement due to the efficiency of execution. The resulting gas production from these wells was below expectation. This was a surprise as the project execution was good. I commenced a review which focused on the fracture stimulation method and execution to production performance.

The fracture stimulation of coal in Australia was relatively new and best practices had been developed by a series of trials. This method works well when deciding which type of fracture method to use, for example, slick water, Gel or N2. The results were based on total production performance of the Fracture Stimulated well. In this case Water fractures were performed comprising of 4 or 5 fracture stimulation jobs or stages targeting up to 10 coal seams in each well. There had been no analysis determining the performance of each individual Fracture Stimulation stage. Since there are more coal seams than fracture stimulation jobs, inevitably it is necessary to stimulate multiple seams simultaneously. The success of Fracture Stimulating multiple seams was unknown. The well completion comprised of a water pump on tubing positioned below the lowest producing coal seam. The well produces all the seams simultaneously making production performance of individual seams undeterminable. The industry often uses Production logging tools to determine flow rates from individual reservoirs. The method proved unsuccessful as deployment required removal of completion and by the time the production logging tool was deployed, water had entered the wellbore, distorting the gas measurement. A new technique of production logging was developed which could be executed during a routine workover. The process involved using a compressor to unload the wellbore using opened tubing which enables sufficient time for the production logging tool to complete at least one measurement pass of all the coal reservoirs. This breakthrough enabled determination of which coals were successfully fracture stimulated. Based on this information, statistical analysis was performed and determined the success rate of fracture stimulating two or three seams simultaneously. Additional analysis showed that delivery technique can improve success rates. The production logging technique and delivery technique analysis is explained in an industry paper SPE 110137 presented at the 2007 SPE Annual Technical Conference & Exhibition.

This example shows how disappointing results can stimulate opportunities to improve engineering activities. Fortunately, in a previous career, I had gained experience in production logging. This knowledge enabled me to develop a methodology to gather data critical in analysing project performance. Writing a paper and presenting it to my industry peers ensured dissemination of my ideas and findings, as well as gaining peer reviews and comments internationally.