

Success Story – Infill in Big Tank Gas Reservoirs, Gulf of Thailand

Project Team Members – All are working for Chevron Thailand Exploration and Production Limited.

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Innovation Feature

The Gas Field is situated in the Gulf of Thailand, located 160 km. east of the mainland. Currently, the field has been delivering gas to the Kingdom of Thailand for decades with large cumulative production volume. The characteristic of typical gas reservoirs in this Field is small compartmentalized in the fluvial to lacustrine deposition environments. This causes a high decline rate and is considered as one of the major challenges in the Field development. To offset the quick production decline, we have had to routinely bring production from new reservoirs online so the gas deliverability could be maintained above the sale gas nomination.

The working team has identified one of the solutions to mitigate the rapid production decline by focusing on the big tank infill development. Several big tank areas were reviewed and the potentials of remaining reserves were identified from the existing wells in fault blocks accessible from many wellhead platforms. The primary focus would be the big tanks that are partially depleted and have no take point or limited take points to recover remaining reserves. Among those candidate wellhead platforms, one of the platforms was considered as the highest potential location for infill in term of remaining reserves and geological possibility of success. Four infill locations were identified as the primary targets. If the project was executed successfully and proved the successes in term of production sustaining with large amount of reserves (big tank), this will lead to other big tank infill projects in other locations in the Field.

The drilling of this infill project, targeting several big tank reservoirs, was executed during May - June 2013. All wells were completed as the slimhole monobore well. The initial completion was executed on the big tank reservoirs. The first production of all four wells came online in August 2013 with relatively higher rate than other typical infill wells, by approximately 3 times. The reserves of big tank reservoirs were determined by using the material balance analysis. The production volume and reservoir pressure data were gathered from multiple wells together with the recent reservoir pressures from RFT of the new infill wells. The post-drilled reserves of big tank reservoirs per well were very impressive as they are higher than other typical wells by approximately 4 times.

The Asset Team considered that this big tank infill result was very successful. The production rate has been maintained. No decline trend has been observed after being online for one year. The current production is still in the plateau period. This demonstrates that the performance is significantly better than other typical wells and helps maintain the gas deliverability for the Field.

Thai E&P Industry Impact and Value

This infill in the big tank reservoirs has several benefits as follows:

1. Gas Deliverability Sustaining – The infill project in big tank reservoirs has sustained production much more than other typical wells in the Field due to the advantage of the big tank reservoir. Figure 1 shows the historical production performance of four wells of the big tank infill. The sustained production helps the Field being able to strongly deliver natural gas to the Kingdom of Thailand.

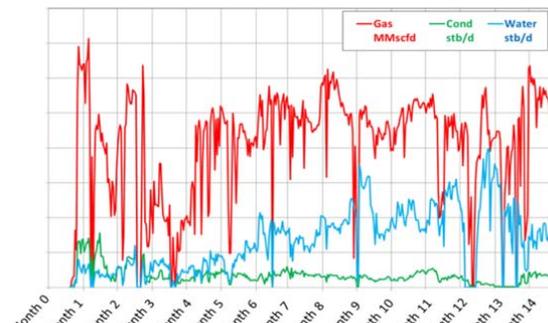


Figure 1: Production performance of four big tank infill wells. They have been in plateau period during the first year after being online.

2. Future Development Project Strategy – The success of this infill drilling project will lead to the focus on other infill locations where there are partially depleted big tank reservoirs. This will increase and bring a great deal of reserves on production for the Field due to the inventory of several big tank reservoirs in other locations and deferring some of major capital projects.

3. Advantage on better completion efficiency of infill wells – Current completion efficiency is much better than the past due to the considerable improvement of drilling, completion, and perforation practices which has less damage to the reservoir and more efficient well development. As a result, a skin damage is less, and this yields the higher rate from new wells from the same reservoir. According to the recent infill wells in the Field, the rate of new infill wells is higher than the old completions by approximately 4 times from the same reservoir.

4. Positive EUR Movement – With the practice of annual reserves update, the big tanks typically have positive EUR revision due to the sustained performance. During the past 5 years, the EUR of platforms involved with big tank reservoirs have been increasing by 2% – 5% every year according superior production performance with low decline rate. This demonstrates the strong production performance of big tank reservoirs which will be certainly beneficial to the E&P industry in the Kingdom of Thailand.

Why should this project win the Thailand Annual E&P Award?

This infill in the big tank reservoirs is one of the most complicated infill projects in Chevron Thailand. This is the fourth infill on the platform, so the team had to gather and consolidate the historical production and reservoir pressure data of many existing wells in determining the remaining potential of the big tank reservoirs. In addition, many existing wells had commingled production; therefore, this led to the challenge of production allocation from those big tank reservoirs. In addition to the historical performance data, the earth scientists had also worked on the reservoir modeling in identifying the size and extension of reservoirs. The reservoir area from earth scientists modeling was consistent with the data from the original gas in place from the material balance analysis. With the extensive study, the project team was confident in executing this infill drilling project by focusing on the partially depleted big tank reservoirs as the primary target and the small virgin gas reservoir as the upside or secondary target. The post-drilled result has confirmed this expectation as 82% of post-drilled reserves was from the big tank reservoirs, and the remaining 18% was from the small virgin gas reservoirs.

Another challenge was the age of the platform; therefore, the team identified the work scopes and prepared the platform ready in order to achieve the safe rig operations. The malfunction topside equipment was performed troubleshooting and repaired prior to rig arrival. In addition, the working team performed a risk assessment and managed to safely produce the nearby platform, flowing through the infill platform while the rig was on location. The drilling operation was completed successfully without any personal injury or incident, and all pre-drilled targets were fully achieved in term of safety, reserves, production rate, and economic.

The success of this infill has confirmed the value of the infill project in big tank reservoirs. The post-drilled performance has proved that the initial rate is high, and the production can be more sustained than other typical virgin reservoirs despite the fact that big tank reservoirs are partially depleted. Although the big tank infill projects are mostly associated with existing platforms and require big efforts in project planning and execution, it is highly worthwhile to pursue the projects. The post drilled results can be paid off easily with the large amount of reserves. From an economic stand point, developing and producing big tank projects can help defer some of other major capital projects such as new platforms resulting in higher overall revenue. Moreover, the big tanks have the outstanding impact in building the gas deliverability of the Field.

What comes afterward when several big tank reservoirs were drilled and produced with huge remaining potential underground? The following opportunities require further studies: booster compressor capacity upgrade, well completion type – bigger tubing size?, additional platform if number of existing slots are limited, etc.