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A Princess Worth Crowning – Gas Injection and Waterflood Expansion into the Pekisko Formation, the First Steps towards an Emission and Pollution Free Asset

Princess Field – Brooks, Alberta

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Summary

Our mission at Imaginea Energy is to consider all three: Planet and People and Profit (the three P's) in each of our projects associated with maintaining and developing oil and gas production. Our goal is to take the Princess Asset in Brooks, Alberta to net-zero carbon emission through: waterflood, gas injection, fuel cell technology, waste heat capture and solar power generation. The first project identified to move towards the zero-net emission goal by reducing flaring and increase reservoir pressure and in turn increase oil productivity is gas injection; what we deem an AND solution - satisfying our 3 P's. This presentation will demonstrate our collective efforts to increase oil production, reduce our environmental impact and improve our reservoir efficiency in our Bantry DD, K and M Pekisko pools in our Princess asset through: geologic, geophysical and production mapping, reservoir material balance simulation, production optimization, waterflood mapping and conformance efforts and, most importantly, gas injection. Getting there is not exploring and bringing on new opportunities in new and exciting plays but rather combining our collective brain power to use all that has been given to us by nature and proven through the development before us to increase our efficiency and operate in a better way for the future of our asset and our planet. This presentation will also touch on some of the other efforts we've taken to move us towards our emission and pollution free hydrocarbon production goal and what is still to come.

Introduction

Imaginea acquired the Princess asset near Brooks, Alberta in September of 2014. Mapping of key pools such as the Bantry DD, K and M Pekisko pools began immediately to gain understanding of original oil in place and the current recovery factor of the pools. Data from geological and geophysical mapping in combination with analogues, material balance forecasting analysis from production data show the opportunity to recover five to ten million barrels of oil through: optimization, waterflood, gas injection, conformance and drilling. Analysis of the waterflood that was initiated in 2012 shows that the reservoir is being supported by the water and improved sweep in the waterflood areas have been observed. Reservoir pressures, however, are still below original reservoir pressure. Waterflood in these pools has also been affected by conformance issues which are being addressed. Additionally, the asset experiences downtime due to third party outages and due to the nature of this carbonate reservoir, production does not return to pre-downtime levels for weeks. These circumstances lead us to consider gas injection that would improve reservoir pressures and eliminate our downtime and flaring during outages. In March of 2015 we began the six month process of identifying wells for injection and submitting applications to the AER. In late November 2015, we expect to have our first gas injection well started. By March of 2016, we expect to have one more gas injection well online within the Bantry DD, K and M complex. Likewise, we have a two-well injection project planned for additional two pools in the north of the Princess asset.

In order to move us to our goal of an emission and pollution free asset we have completed our first solar installation; the first solar powered pump jack in Alberta. This unit produces enough power to produce our 50 cubic meters of oil and water and 500 m3 of gas daily on an annual basis and reduces our dependence on the power grid (which in Alberta ~50% power generation is created from the burning of coal). Currently we are working towards the installation of a 440kW fuel cell unit with heat waste capture and total thermal and electric efficiency over 85% to reduce our dependence on the power grid even further. Additionally, we are moving the field to total automation to increase our operating efficiency, reduce workovers and in turn use less power and increase production run-times. Furthermore, we plan to operate without the use of freshwater by the end of 2016.

Methodology

The following describes an outline of the workflow and execution plan underway by the team of Geologists, Engineers and myself to achieve: gas injection, waterflood optimization, production optimization, mapping and future location identification. The presentation will show the technical efforts carried out by the team in order to ensure a high-chance of project success using methods such as proof of concept.

1. Describe the depositional environment and reservoir mechanism of the Pekisko Formation in Brooks, Alberta.
2. Outline the integrative (geologic, three-dimensional seismic, pressure and production history) mapping generated by our team in conjunction with material balance forecasting to estimate OOIP and ultimate recoveries through waterflood and gas injection. Also note the drilling opportunities identified as a result of this work.
3. Illustrate the understanding of the effects of the waterflood that was initiated few years ago through production data analysis and 3D seismic coherence attribute mapping.
4. Recount optimization projects and conformance initiatives taken to improve our production efficiency and increase our oil to water production ratios.
5. Introduce the Water Alternating Gas (WAG) injection opportunity identified and what expected outcomes were in the assumptions in terms of both economic upside and environmental impact reduction.
6. Trace the WAG project execution and outcomes (initiated in November of 2015) as well as what was different than our assumptions and what may change as a result.
7. Demonstrate the expected production improvements as a result of the WAG project as well as the decrease in our environmental impact as a result.
8. Discuss the gas and water injection expansion planned in this pool and beyond this pool and the overall effects we expect in both improved recoveries and environmental impact reduction.
9. Relate the other efforts we've made and are looking at to reduce our environmental impact and improve our efficiencies in the Princess asset.

Examples

The prospective Pekisko formation in Brooks, Alberta is a carbonate ramp deposit comprised of ooid grainstone facies as well as shoal flank (interbedding of limestone muds and oolithic, crinoidal, and skeletal grainstones) facies. After deposition, erosion, karsting and tectonics have created pool boundaries. This presentation focuses on our Pekisko DD, K and M pools. We started with generating structure and net pay maps, integrating all horizontal and vertical wells and 3D seismic (see Figure 1). To improve upon the waterflood currently in place, we are using the production and injection well data in conjunction with the semblance time/horizon slices extracted from 3D seismic to map the injection flow paths (see Figure 2 - please note the water alternating gas injector identified on this image). Figure 3 is an example of the water cycling that we are seeing in a producer as a result of the existing waterflood, one of the first steps we are taking to improve upon the waterflood itself is to carry out mechanical shut offs to improve oil cuts, reduce water cycling and in turn improve pressure maintenance for the longevity of the pool.

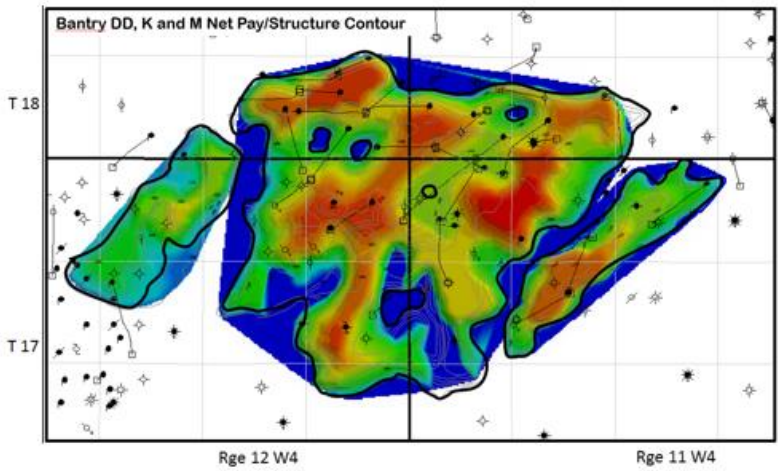

Figure 1: Integrating all the production data, well log data, 3D seismic and reservoir material balance simulation we estimate 8.3 MM m3 of oil in place. To the left is the net pay in colour (2 – 18 m) with the structural contours overlaid. We estimate that these pools are at a current recovery factor of less than 5%.

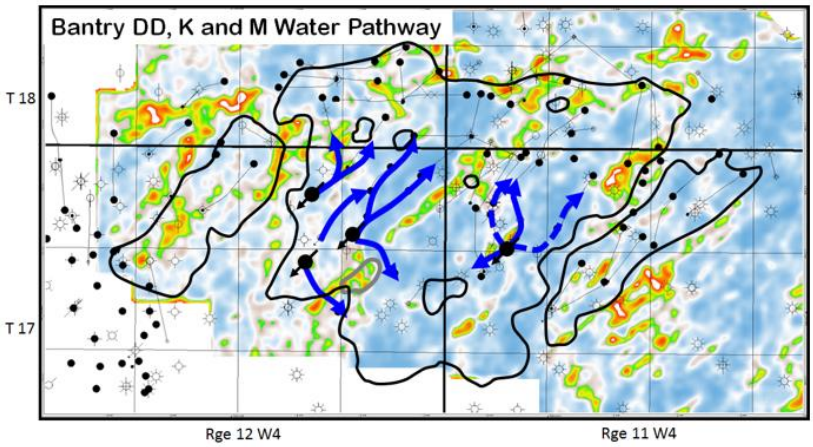

Figure 2: Shows a coherence slice in the heart of the oil leg of the Pekisko DD, K and M pools. Reds and Greens indicate edges or significant structural changes. We have mapped flow paths from the water cycling we see from injector to producer and we believe the paths are along open fractures. The work we are now doing to reduce water cycling is: reducing our injection rates, mechanically shutting off perforations that might draw in more water and placing/choosing new injection in areas without large fractures present.

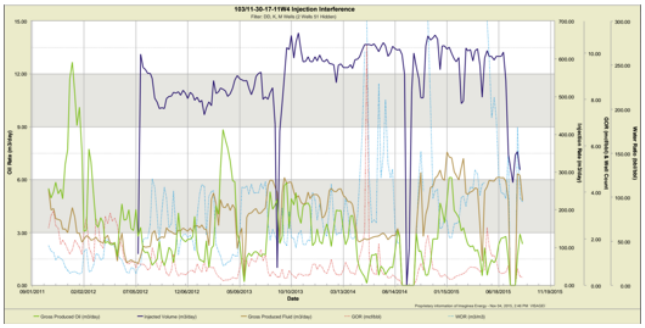

Figure 3: This is the production data taken from our 103/11-30-017-11W4 dual leg horizontal in the Pekisko K pool. Water injection began in mid-2012, we believe we can see a positive response from the water flood until early 2014 where there appears to be water break through. Firstly we have reduced our injection rate and shortly, we plan to swab test each leg individually to see if we can shut off the leg closest to the injector to reduce our water cut significantly and improve our operating efficiency.

Conclusions

In order to draw conclusions on the success of our gas injection project we must achieve the following milestones:

I. November 2015 gas injection initiated – The water alternating gas injection into the 102/05-29-017-11W4 of our Alderson M pool is days away from starting. We are expecting the well to be injecting by November 6th, if not the week following.

II. Measuring the success of the gas injection - By March of 2016, we should know if the gas injection has been successful through increased runtime and improved production rates (there may be a two-month lag to see the impact; therefore, early stage data).

We anticipate the gas injection will provide reduced downtime and, therefore, stabilize our base production during third party outages. Secondly, we anticipate that we will increase reservoir pressure and in turn improve our base production. I will demonstrate the improvements in production through group production plots as well as near-well individual production plots and pressure data. Following water cycling from over-water injection, I will demonstrate fracture pathways detected using the semblance cube attribute as well as the results of mechanical/conformance water shutoffs to reduce water cycling. I will demonstrate that through collective team efforts we are able to increase oil cuts, reduce produced water volumes, improve operating efficiency and increase reservoir pressure.

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