Exploration and New Technoligies Application in the Wild River Basin; A MannvilleTight Gas Case Study

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The Setting

The Wild River Deep Basin Cretaceous play in 1997 was simply a Viking gas pool centered in 58-22 W5M and a Bluesky gas pool at Wild River centered in 56-24 W5M. There was some spotty and sporadic Gething and Cadomin sweet gas production; along with minor deep well control provided by a few successful overpressured Leduc limestone pinnacle sweet gas producers. However, the area had provided only limited or heterogenous reservoir horizons; non-economic due to both thin pay thicknesses and fractional sections of areal extent. Industry had recognized that there was a 'deliverability issue' and various operators had attempted horizontal wells in the Cadomin, Bluesky, Notikewin and a few years later, the Cardium. The Cadomin, Bluesky and Notikewin horizontal rates were determined to be non-economic (frac technology came later) and the Cardium horizontal success was repeatable, but only marginally so. There was also a significant disjoint between the reserves assignable from very positive looking logs of the different reservoir horizons and the decline curve once on stream. Logs were either over optimistic, sw was higher than predicted, clays were blocking pores, or reservoirs were significantly smaller than mapping would suggest. Regardless, the late 90's saw most majors in exit mode; with junior/intermediates moving in, hoping to find the key steps required to tighten the gap between costs and results.

Reservoir Identification & Understanding

Including the Jurassic Rock Creek & Nikinassin with the Cretaceous; there are some 20 plus clastic reservoir units which can be mapped with continuity in the general Wild River area. Early drilling was constrained by being restricted to two completion zones and single wells/section. However, drainage areas appeared to often be quarters or even eighths of sections and the average well could be expected to encounter 6 to 8 pay zones. So commingling and down spacing when they arrived were 100% necessary components for the area's economic success. All zones in the well need to be successfully recognized and completed to achieve commerciality. Second well step outs in the same section and eventually four wells/section were soon deemed necessary to adequately drain the section reserves.

Given the wide variety of stratigraphic styles; Dunvegan near shore sands and bars; reworked Viking estuaries; North-South running shoe string channel sands of the Notikewin/Upper Falher; Wilrich shoreface and beach sands; marine Bluesky bars and NW-SE Gething channel sands through the Cadomin conglomerate braid plain; and thence the Nikinassin delta sands and Rock Creek estuaries: there is a proliferation of targets required to properly realize the entirety of the reserve potential. Overlapping targets or 'sweet spot recognition' was the key to getting better wells.

Operators recognized very early that huge 3D programs would be absolutely necessary to map the various stratigraphic traps at multiple levels. Sweet spots at Wild River are a multiple map exercise. It requires close teamwork between geologists and geophysicists to properly map the overlap of all the reservoir trends and exploit the best sweet spot drilling locations.

However, coupled with continued refinement of the stratigraphic model; there has been the companion development of multi-reservoir structural understanding. Mapping faults or zones of sliding can then predict the appropriate junction points where reservoirs are natural fractured and permeability enhanced. The Wild River 'play area' runs from TD depths of 2850m in the NE to 4250m TD depths in the SW; edging into the first Foothills thrusting carrying Mississippian carbonate reservoirs. In general, the main reservoir units tighten with burial; but playing the areas with natural fracture enhancement has lead to several prolific new discoveries.

Drilling & CompletionTechnology Application

Continuous improvement in drilling and completion technology has been even more critical in fostering development of the Wild River 'play basket'. Use of invert has resolved sloughing in the uphole; while providing perfect in-gauge hole for logging tools in the areas of interest. Where average porosity often runs in a restricted 2-6% range; a reliable porosity curve is critical for pay recognition and subsequent completion. Invert also allows gas to liberate easily into the wellbore, enhancing hotwire recognition to further refine zones for completion. Advancement in primarily PDC bit technology has also allowed wells to be drilled faster and faster.

On the completion side, there has been even more dramatic technology advancement. Industry has progressed from primarily single zone completions with 10 tonne gelled and oil based fracs done in the early '90's. Industry first moved into water based high pressure fracs of 100 tonne or more, injected into thin single metre perf sets. That was almost immediately followed by fraccing multiple zones (three or four separate zones) in one operation; significantly reducing costs but also enhancing frac placement as well. Almost daily improvements or small scale tweaks in completion methodology continue to occur resulting in stronger vertical wells, which are still the necessary first step in new exploration areas.

Application of horizontal drilling and the accompanying 'shale gas frac technology' has now been applied in hundreds of wells, primarily the Cardium, Notikewin, Falher, Wilrich and Bluesky reservoirs. This technology application has provided a much needed uplift to well flow rates and higher reserve recoveries/well; key objectives at a time of very low gas prices. Horizontal tight gas sand wells seem to have a more robust decline curve than one might expect in a typical shale gas reservoir; so matrix pay may provide more reservoir support. The western portion of the play area is still very lightly drilled at one well to approximately 5 sections, full reservoir potential using horizontal drilling is still in its infancy.

Conclusions

Continued advancement of technology, especially the rapid development of horizontal drilling and completion practices has been responsible for dramatically growing gas production in the Wild River core area; providing a very healthy rate of return even in the current low gas price regime. Gas production from the area has not yet reached its peak. The Wilrich in particular continues to provide increasingly spectacular results and is a key development driver.

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