Saskatchewan's Ultimate Potential for Conventional Natural Gas

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Summary

Using a combination of Monte Carlo simulations and the NEB/ERCB shallow-gas methodology to analyse reserve data and drilling trends current to 2004, it is projected that ultimate recoverable resources for conventional natural gas in Saskatchewan are 10.6 Tcf (297.4 $10^9 m^3$) with undiscovered resources of 2.7 Tcf (75.9 $10^9 m^3$).

Introduction

Canada plays an important role in the current North American natural gas market by providing about one-quarter of North American gas production. Within Canada, the province of Saskatchewan is a small, but important contributor to natural gas supply, accounting for about four percent of total Canadian production in 2004.

Increased drilling activity, the discovery of at least one large pool in an existing play not previously accounted for, and cumulative production that was approaching the National Energy Board's previous estimate of ultimate potential for natural gas in Saskatchewan (National Energy Board, 1998), warranted the need for a new assessment (National Energy Board and Saskatchewan Ministry of Energy and Resources, 2008).

Method

Fourteen prospective stratigraphic horizons were identified in the western half of Saskatchewan as based on natural gas reserves data current to 2004 (Figure 1). The eastern half of the province was excluded from analysis because there were no discovered non-associated gas pools by 2004 and discoveries of associated gas in oil pools were very limited; however, it should be kept in mind that there may be significant undiscovered unconventional associated-gas potential in eastern Saskatchewan as indicated by estimates of the Mississippian-Devonian Bakken Formation's ultimate natural gas resources in Montana and North Dakota (Pollastro et al., 2008). A number of factors, including but not limited to historical success rates,

geology, and reservoir quality, were used to create prospective play areas for each identified horizon, now the subject of a forthcoming publication (Saskatchewan Ministry of Energy and Resources, in progress). Play areas were broken down into single sections, or "tracts". The number of drilled and undrilled tracts in a play area was used to indicate play maturity and the number of remaining sections where future discoveries might be possible. Furthermore, using the areal extent of the pools provided in the reserves data, historical success rates were estimated by comparing total pool area to total drilled tracts, from which future success rates were estimated. These success rates played a significant role in the Monte Carlo simulations that were run through Palisade's @Risk software and for the NEB/ERCB shallow-gas methodology. Low, medium, and high cases were run to provide a range of outcomes.

Prospective horizons without booked reserves were considered to be conceptual plays and no resource projections were made. While associated gas was included in the analysis, solution gas was not because no reserves data is available. Historically, dissolved gas has accounted for 7 per cent of Saskatchewan's marketable production. Finally, while shallow gas from tight reservoirs like the Milk River and Medicine Hat sands was considered a conventional resource because of their long production history, potential unconventional resources, like shale gas, were not analysed because of a lack of data.

Results and Discussion

Analysis indicates that the bulk of undiscovered natural gas potential in Saskatchewan is within the Upper Cretaceous (Table 1) and particularly within the Milk River, Medicine Hat, and Second White Specks sections with undiscovered potential of 1.6 Tcf (44.6 10^9m^3) and projected ultimate resources of 6.2 Tcf (174.9 10^9m^3). The potential of the Milk River, Medicine Hat, and Second White Specks intervals was overlooked to a certain degree in a previous projection made by the NEB (National Energy Board, 1998; Table 2) because it was thought that remaining resources would only be discovered by the addition of small pools through infill drilling rather than pushing outward into undrilled areas. Instead, exploration has moved into what was once thought of marginal reservoir as the price of natural gas has risen and production practices and technology have improved.

Projections of ultimate Lower Cretaceous resources (including the Success Formation, which was analysed with the Mannville Group in 1998) remain largely unchanged at 3.8 Tcf (106.2 10^9m^3). Jurassic projections have shrunk considerably and now account for only 38 Bcf (1.1 10^9m^3) of Saskatchewan's ultimate potential. The Devonian-Mississippian Bakken Formation of western Saskatchewan, on the opposite side of the province as the recent Bakken oil activity in the Williston Basin, appears to have considerable undiscovered potential for natural gas at 0.2 Tcf (5.9 10^9m^3) and ultimate potential of 0.4 TCF (11.2 10^9m^3) as numerous gas pools have been discovered since 1990. Finally, the new estimate for ultimate natural gas resources in Saskatchewan is 42 per cent larger than the estimate made in 1998, largely due to the highly prospective Upper Cretaceous section, which is dominated by shallow, biogenic gas. Based on cumulative production to the end of 2004, 5.2 Tcf (146.8 10^9m^3), the remaining conventional natural gas in Saskatchewan is 5.3 Tcf (150.6 10^9m^3). Current annual production of non-associated natural gas in Saskatchewan is approximately 6.9 10^9m^3 (245 Bcf).

References

National Energy Board, 1998. Non-Associated Natural Gas Resource Assessment –Saskatchewan. 14 p.

National Energy Board and Saskatchewan Ministry of Energy and Resources, 2008. Saskatchewan's Ultimate Potential for Conventional Natural Gas. NEB Miscellaneous Report 2008-8. 30 p.

Saskatchewan Ministry of Energy and Resources, in progress. Saskatchewan's Ultimate Potential for Conventional Natural Gas – Energy Market Assessment play map series.

Pollastro, R.M., Roberts, L.N.R., Cook, T.A., and Lewan, M.D., 2008, Assessment of undiscovered technically recoverable oil and gas resources of the Bakken Formation, Williston Basin, Montana and North Dakota, 2008. U.S. Geological Survey Open-File Report 2008–1353, 3 sheets.

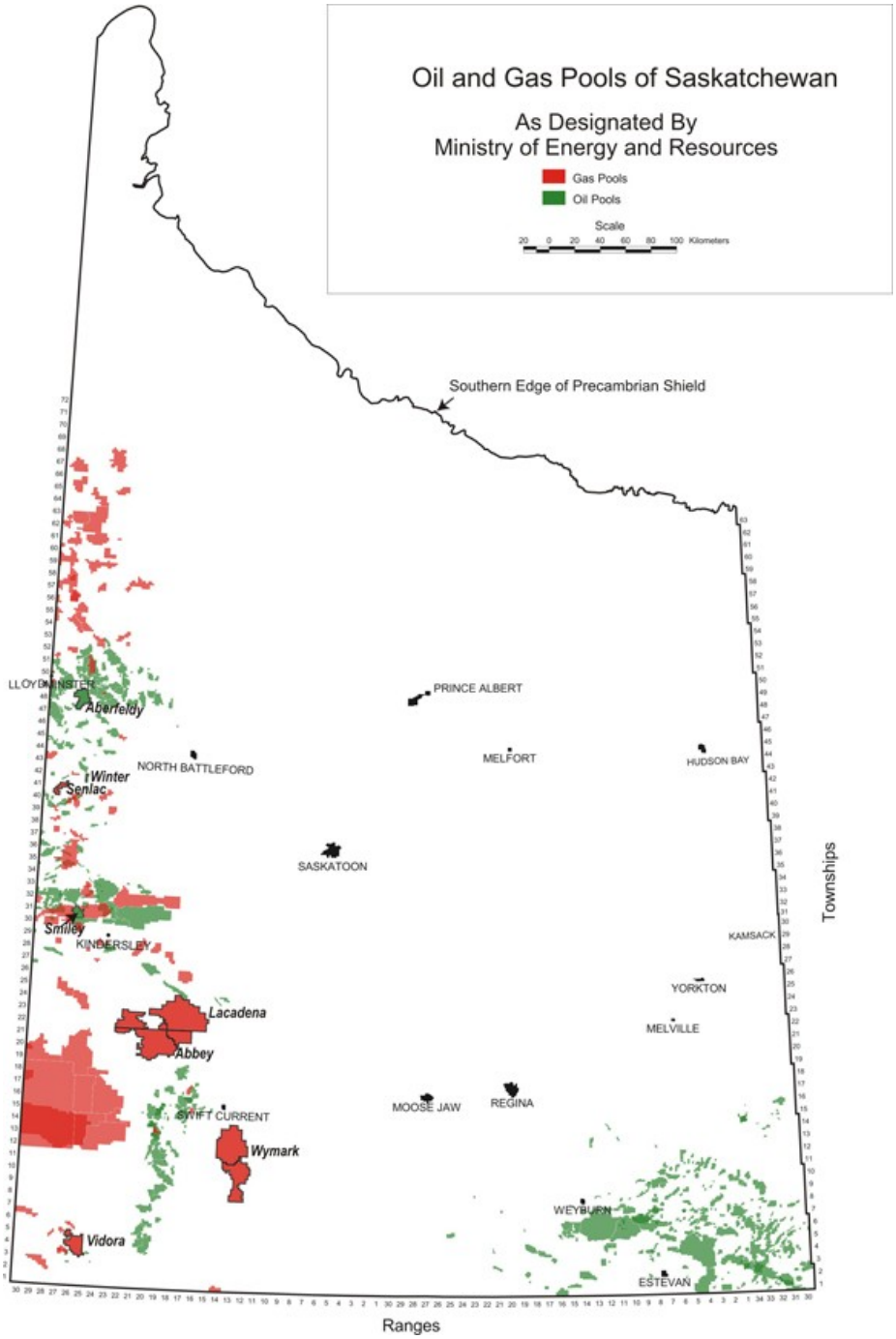

Figure 1. Oil and gas pools of Saskatchewan.

Table 1. Results of horizons analyzed

Age	Formation	2004 Marketable Volumes (Bcf)					
		Discovered	Undiscovered	Ultimate	Discovered	Undiscovered	Ultimate
Upper Cretaceous	Bearpaw	12	4	16	4,747	1,612	6,326
Upper Cretaceous	Belly River	80	24	104			
Upper Cretaceous	Ribstone						
Upper Cretaceous	Milk River	3,140	1,245	4,352			
Upper Cretaceous	Medicine Hat	714	145	859			
Upper Cretaceous	Second White Specks	802	194	996			
Lower Cretaceous	St. Walburg	55	109	164	2,901	864	3,768
Lower Cretaceous	Viking	815	157	971			
Lower Cretaceous	Spinney Hill	6	6	13			
Lower Cretaceous	Mannville	1,976	563	2,542			
Jura-Cretaceous	Success	49	29	78			
Jurassic	Roseray	8	0	8	27	11	38
Jurassic	Shaunavon	19	11	30			
Mississippian	Bakken	188	208	396	188	208	396

Table 2. Comparison of 2008 study results with 1998 NEB study.

Age	Formation	1998 Marketable Projection (Bcf)			2008 Marketable Projection (Bcf)		
		Discovered	Undiscovered	Ultimate	Ultimate	Undiscovered	Discovered
Upper Cretaceous	Bearpaw	2	N/A	N/A	16	4	11
Upper Cretaceous	Belly River	63	64	127	104	24	80
Upper Cretaceous	Ribstone						
Upper Cretaceous	Medicine Hat	3,415	35	3,451	6,206	1,584	4,656
Upper Cretaceous	Milk River						
Upper Cretaceous	Second White Specks						
Lower Cretaceous	St. Walburg	40	N/A	N/A	164	109	55
Lower Cretaceous	Viking	739	500	1,239	971	157	815
Lower Cretaceous	Spinney Hill	4	N/A	N/A	13	6	6
Lower Cretaceous	Mannville	1,565	923	2,487	2,621	592	2,025
Jura-Cretaceous	Success						
Jurassic	Roseray	29	82	111	38	11	27
Jurassic	Shaunavon						
Mississippian	Bakken	138	39	177	396	208	188