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Estimating the Size and Value of the Duvernay Formation in Alberta for Risk-Based Decisions

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Summary

The Duvernay Formation of Alberta is a shale and low permeability source rock that produces gas, liquids, and oil, and is currently in the early to middle stages of development. This development creates both risk and opportunity with respect to Alberta's public-interest outcomes, which are managed by the Alberta Energy Regulator (AER). In order to respond to these risks and opportunities and regulate to balance outcomes, the AER has estimated the economic value of the Duvernay and potential future development for the next 30 years (AER, 2016).

Introduction

Development of energy resources is regulated in Alberta by the AER. The AER, like its predecessors, was created by the Government of Alberta to ensure that Alberta's public-interest outcomes are delivered during development of Alberta's hydrocarbon resources. The outcomes include such matters as ensuring public safety, maintaining economic competitiveness, achieving resource conservation, having orderly development, protecting the environment, and ensuring wise use of water. Balancing these outcomes during development is the job of the AER. Good regulators use science-based evidence in a risk-management framework to find the best balance between permitting development and protecting society's desired outcomes. One significant input into this work at the AER is knowledge of the potential size and future value of energy resources from development. With this knowledge, the regulator can better understand risk of development in terms of rewards from that development and find the best balance that achieves policy and legislative priorities.

The Devonian Duvernay Formation of Alberta hosts distinct shale gas, liquid, and oil plays currently at early to middle stages of development. The unconventional nature of the reservoirs will create new demand for access to Alberta's land and water resources. This demand creates risk to Alberta's public-interest outcomes, and that risk needs to be managed by the AER. Moreover, the risk-management framework for regulating Duvernay development needs to be informed by forecasts of demand for land and water as well by the size, location, and economic value of the resource. This presentation details how the AER is creating estimates of the size, location, and economic value of the Duvernay resource at the play scale for the purpose of risk-based regulatory management.

Theory and/or Method

The AER has recognized two main plays in the Duvernay Formation. These are the Duvernay Fox Creek play and the Duvernay Innisfail play (Figure 1). Their boundaries correspond to the Devonian Frasnian-age west and east shale basins, respectively (Switzer et al, 1994). While the Duvernay plays cover a large extent, for evaluation purposes only the productive areas were subdivided into three assessment areas: Kaybob in the north portion of the extent, Edson-Willesden Green in the central portion of the extent, and Innisfail in the south portion of the extent (Figure 1). These assessment areas were divided based on similar geological characteristics and current development trends. The assessment areas are not to be confused with Alberta petroleum fields that share names.

Within each assessment area, we used concepts from common risk segment mapping to identify potential future drilling locations. This approach overlays maps in ArcGIS of inputs determined to contribute to geological prospectivity along with a map of hydrocarbon fluid regions and surface features such as cities, towns, provincial parks, water bodies, and protected areas. By identifying sections with optimal geological prospectivity and the most economic fluid types in the reservoir, while avoiding undrillable surface features, we assigned future drilling locations for the purpose of estimating the value of the Duvernay.

To estimate the value of hydrocarbons in the Duvernay, the AER has adopted aspects of the Canadian Oil and Gas Evaluation Handbook (SPEE, 2007). The value of developed reserves was estimated from decline curve analysis from 242 wells drilled as of the end of 2015. The value of undeveloped reserves and contingent and prospective resources was estimated by determining potential future drilling locations and applying type curves to those locations (AER, 2016).

Examples

To estimate the potential number of wells needed to for undeveloped reserves, we identified previously drilled sections currently containing wells and used them as a proxy for determining a set number of potential wells. The number of contingent resource wells was identified by calculating the number of sections directly offsetting sections already intersected by a Duvernay wellbore, but excluding undeveloped reserves sections. The number of prospective resource wells was identified by calculating the number of sections within two miles of any contingent resource location.

In each case, the number of potential wells was assessed for probability based on their proximity to geological prospectivity and fluid type. For example, undeveloped reserves locations were only assigned within the condensate and oil regions because large quantities of liquids are needed to remain economic in the current low commodity price environment.

This presentation will give examples of this methodology and provide results of the Duvernay reserves and resources estimation work completed by the AER in 2016.

Conclusions

By integrating geological evaluation and engineering methods to predict future drilling locations using concepts from common risk segment mapping, accurate reserves and resources estimates have been assigned for the Duvernay.

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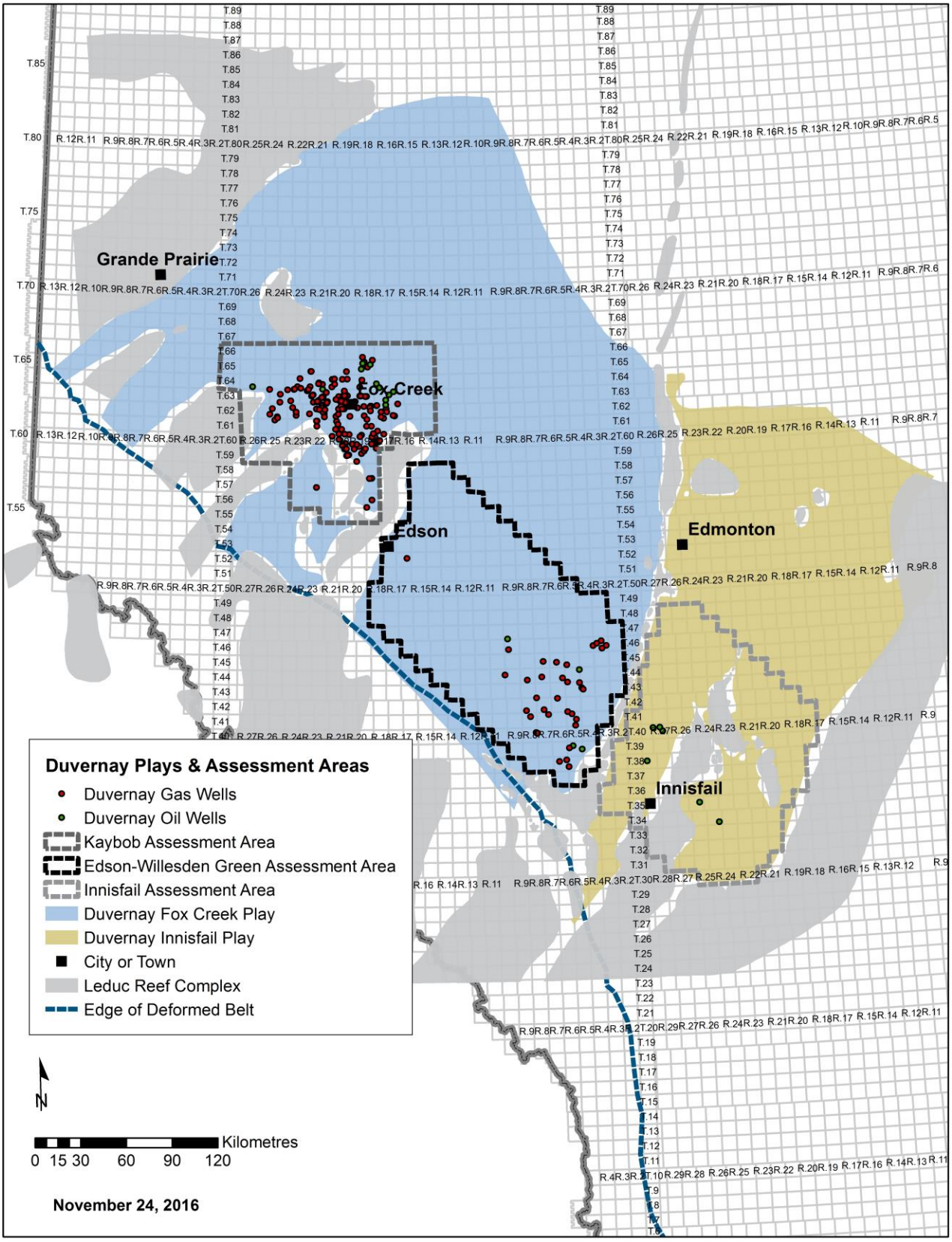

Figure 1 Duvernay Geological Plays & Assessment Areas

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