

Improving Gas Storage Deliverability Using 3D Seismic: A Case Study

Roger Edgecombe¹, Shelie Cascadden², Julie Clarke², Marissa Whittaker³, Luc Gravel¹, Chris Helly¹
and Ian Scotland¹

¹ RPS Energy Canada Ltd.

² Enbridge Gas Inc.

³ Nomad Geoservices Ltd. (subcontracting to RPS Energy Canada Ltd.)

Abstract

Within the Michigan Basin, Silurian aged reef structures underlay much of southwestern Ontario, and were developed through cyclic sea level changes where each transgression enabled reef growth. Many of these reef structures produce hydrocarbons, whereas others are used for seasonal gas storage. Enbridge Gas Inc. (Enbridge) owns and operates the Dawn Storage and Market Hub, which is the largest natural gas trading hub in Eastern Canada, and second largest in North America.

In an effort to improve deliverability, Union Gas, now Enbridge, contracted RPS Energy Canada Ltd. (RPS) to analyze the Bickford Pool, one of the 34 storage pools within the Dawn Hub. Using modern seismic methods, and a fit-for-purpose approach, the objective of the project was to identify drilling locations designed to increase both injection and deliverability.

Prior to the project the Bickford Storage Pool had more than five injection and withdrawal wells, none of which were positioned using the legacy three dimensional (3D) seismic data. In an effort to optimize future subsurface imaging, RPS conducted a detailed analysis of past 3D seismic surveys in the area and recommended that acquiring and processing a program with updated parameters could increase the probability of imaging the reef with sufficient resolution to optimize drilling targets.

A new 3D seismic survey was designed, acquired and processed in 2016-2017. Several fit-for-purpose processing workflows were investigated to address noise, amplitude fidelity, and imaging challenges with the general pre-project assumption that post-stack inversion would be used as the final interpretive tool. Post-stack acoustic impedance inversions were used to map zones of connected low impedance within the reef. Well log analysis, and local geological knowledge, suggest the zones of low impedance correlate to high porosity and permeability.

Using newly acquired seismic data and modern processing run streams, three new well locations were identified and drilled in 2018. Deliverability of each of the new wells exceeded that of any pre-existing well within the reef structure (with one exception) and has increased the deliverability of the pool by 247.7 MMscfd (7.01 MM m³/day) at 100,000 dP².

This case study demonstrates that established seismic processing technology, and post-stack inversion methods with a focused fit-for-purpose design philosophy, can generate excellent results (value) in a 'mature area'.

Key words: gas storage, 3D seismic, megabasin, seismic survey design, seismic acquisition, subsurface imaging, seismic interpretation, seismic inversion, well planning, geomodelling, optimization, deliverability