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Helium Exploration and Production in Western Canada: Opportunities and Challenges

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Helium is a critical resource with applications in medical imaging, scientific research, semiconductor manufacturing, and space exploration. With increasing global demand and declining supply from conventional sources, Western Canada has emerged as a significant region for helium exploration and production. While helium is traditionally produced as a byproduct of natural gas extraction. In addition to the helium-rich natural gas accumulations, Western Canada also has nitrogen-rich, non-hydrocarbon reservoirs that allow for dedicated helium development. This differentiates the region from traditional helium-producing areas, such as the United States, where helium is often extracted alongside natural gas. This presentation reviews the current landscape of helium exploration and production in Western Canada, primarily focusing on the geological characteristics, but also addressing some aspects of extraction methods, regulatory framework, market dynamics, and environmental considerations associated with helium development.

The geological formations in Western Canada, particularly the Lower-Middle Devonian in Alberta and NE British Columbia, Cretaceous Mannville Group in SE Alberta and Cambrian Basal Cambrian Sandstone and Deadwood formations in Alberta and Saskatchewan, contain reservoirs with helium concentrations ranging between 0.5% and 2.0%, which are considered commercially viable. As helium is mainly sourced from radiogenic generation within uranium- and thorium-bearing basement rocks, it is often trapped in overlying Cambrian and Devonian reservoirs, where sediments drape basement highs. This “buried-hill” play has been successfully developed in Saskatchewan, while Alberta exploration targets both “buried-hill” features and structural traps created by drape over Leduc reefs.

Current Western Canadian helium plays tend to deliver relatively modest field sizes, typically on the order of 0.2–6 BCF of recoverable helium. These volumes are smaller than many established U.S. fields, which commonly exceed tens of BCF, and substantially smaller than the largest international fields. As a result, project economics are more sensitive to capital efficiency, processing costs, and infrastructure availability, often leading to higher per-BCF development costs than the global average.

Saskatchewan currently has the largest helium purification facility in Canada, supporting the province as a Canada’s dominant producer. Further, it is one of the few jurisdictions in the world that supports the drilling of dedicated helium wells, rather than as a byproduct of hydrocarbon production. Production from such dedicated wells results in less greenhouse gas emissions than other jurisdictions because such wells often contain non-greenhouse gases such as nitrogen.

The regulatory framework governing helium extraction in Western Canada is evolving to accommodate the growing industry. Saskatchewan has implemented helium targeted policies designed to encourage exploration, streamline permitting, and attract capital. However,

commercial challenges remain, including limited midstream and liquefaction infrastructure, exposure to helium price volatility, and increasing competition from emerging international producers.

Market conditions play a crucial role in shaping the future of helium production in Western Canada. The global helium market has experienced supply disruptions due to geopolitical factors and declining production from traditional sources. Western Canada's helium industry stands to benefit from future supply shortages, as the region offers a geologically promising alternative. The development of new liquefaction and storage facilities, along with strategic export agreements, will be essential in positioning Canada as a reliable supplier in the international helium market.

Despite its potential, helium production in Western Canada must also address environmental concerns. Unlike hydrocarbon extraction, helium production from nitrogen-rich reservoirs generates minimal greenhouse gas emissions, making it a relatively cleaner industry. However, water usage, land disturbance, and energy consumption associated with helium extraction remain areas of concern. The application of best practices, coupled with technologies such as carbon capture and sequestration, can further improve the environmental performance and long-term sustainability of helium projects.

As global demand for helium continues to grow, Western Canada has the potential to become a stable, scalable, and strategically important source of supply, supported by geological settings and the ability to develop dedicated helium projects. Success will depend on supportive regulatory frameworks, continued investment in infrastructure, research and exploration with a strong focus on environmental performance.