

North American Natural Gas Markets Under LNG Demand Growth and Infrastructure Restrictions

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In this paper, we investigate how North American natural gas markets and infrastructure evolve under various scenarios distinguished by different levels of liquefied natural gas (LNG) demand and restrictions on where new LNG export facilities can be built. We are motivated by the strong LNG demand growth, especially in Asia, which could increasingly motivate gas infrastructure development in North America. However, opposition to new gas infrastructure is formidable in some U.S. states and Canadian provinces that are well positioned to supply LNG to the Asian market. In order to analyze the effects of these two conflicting phenomena, we build a mixed complementarity model with endogenous capacity investments. The model is a collection of optimization problems of six strategic player types: suppliers, traders, storage operators, liquefiers (LNG exporters), the pipeline network operator, and the tanker network operator. Market clearing conditions among these players and demand markets are used to determine regional market prices. Our model includes six regions for the U.S., two regions for Canada, and one region for Mexico, as well as two LNG demand regions for the Atlantic and Pacific LNG markets. The model is parameterized using publicly available data sources, and five main scenarios are run through the year 2050 based on LNG demand, North American demand, and restrictions on building new LNG infrastructure in the Western U.S. and Western Canada. Our results show that even if new export terminals cannot be constructed on the West Coast, LNG exports largely shift to other regions, most notably the Southwest region of the U.S., rather than suffer an overall decline. This suggests that the total North American LNG export volume would be robust to regional infrastructure restrictions. We also observe that increasing external demand for LNG puts upward pressure on regional prices in North America, and directs production and pipeline flows toward the regions that export LNG, as well as inducing capacity expansions in both production and pipelines to support growing LNG exports.

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