SHALE GAS, DRILLING ACCESS RESTRICTIONS AND THE FUTURE OF US LNG IMPORTS

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Overview

The successful recovery of natural gas from shale formations – such as those in North Texas (Barnett shale), Arkansas (Fayetteville shale), and Oklahoma (Woodford shale) – has prompted producers to look more carefully at the potential for similar success in other shale formations in North America. In fact, industry reports indicate that such potential exists in many areas of the United States and Canada, such as the Haynesville, Huron, Floyd, Marcellus, Horn River, Montney and Utica shales, to name just a few of those recently identified. While shale gas resources are generally more expensive to exploit than many other types of natural gas deposits, the current and expected future price environment in North America has made these resources very attractive. Moreover, due to the shear quantity of this unconventional natural gas resource believed to be technically recoverable, exploitation of shale gas could dramatically affect domestic supply of natural gas in North America and hence demand for LNG imports.

Another factor that could alter the domestic supply picture concerns the resources that are currently off-limits due to various access restrictions. Pressure has been rising for US politicians to remove restrictions that currently limit access to natural gas resources located in certain offshore regions in the Outer Continental Shelf (OCS) in the Lower 48 states of the US and Alaska. There are also limitations on certain onshore resources in the Rocky Mountain states due to various legal frameworks that raise exploitation costs above economic levels at current prices. Removing access restrictions on both the onshore and offshore would expand US production and reduce the demand for LNG imports.

In this paper, we examine the individual and combined impacts that development of shale gas resources and the removal of access restrictions might have on LNG imports to North America in coming decades. This is done using the Rice World Gas Trade Model (hereafter the RWGTM) so that the effects of changes in US supply can be modeled appropriately in a global market setting

Methods

Scholars at Rice University have developed a dynamic spatial general equilibrium model of the world market for natural gas (hereafter referred to as RWGTM).[2] The RWGTM proves and develops reserves, constructs transportation routes and calculates prices to equate demands and supplies while maximizing the present value of producer rents within a competitive framework. By developing both pipeline transportation routes and LNG delivery infrastructure, the RWGTM provides a framework for examining the effects of critical economic and political influences on the global natural gas market within a framework grounded in geologic data and economic theory.

The resource data underlying the model is based on the World Resource Assessment of the United States Geological Survey (USGS) as well as data for existing reserves from the Oil and Gas Journal Database. Long and short run capital and operating cost curves for resource development were derived using data from the National Petroleum Council (NPC). Demand for natural gas is determined endogenously as the equilibrium price of natural gas adjusts, although there are also exogenous influences such as the level of economic development, the price of competing fuels, and population growth. The data used in estimating the demand relationship were obtained from the U.S. Energy Information Administration (EIA), the International Energy Agency (IEA), the World Bank, and the OECD. The costs of constructing new pipelines and LNG facilities were estimated using data on previous and potential projects available

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[2] The solution algorithm is based on the software platform MarketBuilder from Altos Management Partners. Rice University has licensed the software from Altos in an R&D capacity.

from the EIA, IEA and various industry reports. The extent of regional detail in the model varies based primarily on data availability and the potential influence of particular countries on the global natural gas market. For example, large consuming and producing countries, such as China, the U.S., India, Russia, and Japan, to name a few, have extensive sub-regional detail in order to understand the effect that existing or developing intra-country capacity constraints could have on current or likely future patterns of natural gas trade. In sum, there exist over 280 demand regions and more than 180 supply regions. Output from the model includes regional natural gas prices, pipeline and LNG capacity additions and flows, growth in natural gas reserves from existing fields and undiscovered deposits, and regional production and demand.

Results

The RWGTM indicates growing interconnectedness of the global market for natural gas. A recent study by the Baker Institute indicates that removing current restrictions on resource development in the U.S. Outer Continental Shelf (OCS) and the Rocky Mountains (RM) has substantial implications for the future emergence of a natural gas producers' cartel, thus highlighting the importance of domestic policies on global market developments. Thus, the restrictions to resource development in the US have wider reaching implications in a globally connected natural gas market, affecting prices and import flows in Europe and Asia and export flows from Africa, the Middle East and Former Soviet Union. In general, lifting access restrictions increases the diversity of supply globally, leaving more time for new technologies that can displace demand for natural gas to be developed prior to supplies becoming concentrated in a few regions. Similarly, the development of shale gas plays in the US and Canada will have global effects. However, the effects of both policy changes together are unlikely to be additive since developing some of the resources that currently are in restricted areas may make the development of some of the more expensive shale plays less attractive. In addition, the effects of increased US domestic supply will depend critically on whether the expansion is large enough to reduce LNG imports to zero. If the US and Canada were to cease trading natural gas with the rest of the world, the North American gas markets could once again become somewhat disconnected from developments elsewhere in the world – at least for a short period of time.