

# Shale Gas and Energy Markets in Transition: Lessons from North America

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## Overview

Slow demand recovery, pollution controls and resurging oil and natural gas supplies are transforming North American energy markets at a time when major investments and infrastructure are required. With the application of hydraulic fracturing and horizontal drilling, these conditions are moving North American energy markets towards greater self-sufficiency over the next several decades. At the same time, they are creating considerable risk and uncertainty about the future energy landscape as the nation and the world try to recover from the Great Recession.

This study evaluates the impacts of newer estimates of the unconventional supply based upon recent and ongoing assessments, such as those conducted by the Bureau of Economic Geology (BEG) at The University of Texas. Moreover, the shale revolution extends beyond natural gas to include petroleum supplies. Advanced technologies and less-expensive resources change production incentives and influence the competition between all fuels at the end-use level. Alternatively, policy concerns about drinking water safety, water availability and fugitive greenhouse gas emissions from drilling may limit production of both fuels.

A main goal of the study is to place the North American developments within a broader global context where new markets for natural gas may evolve and new shale formations developed. An important issue in our working group's discussion has been the role of North American exports in responding to these more global developments.

## Methods

The conclusions are those that have been discussed by a working group of 45 leading experts and advisors from business, governments, research institutes and universities. The approach is based upon model-based evaluations of energy-market responses to alternative natural gas resource base assessments and key policy changes in the electric power and other sectors. All evaluations apply a common set of assumptions allowing the study to compare key energy market outcomes across different models. Statistical methods are used to summarize response surfaces from various models. Emphasis is placed on what insights can be learned by considering all models rather than a single framework.

## Results

Long-term natural gas prices are likely to rise over time even with expanded supply. Expectations are for natural gas wellhead prices to range between \$5 and \$7 (2012 dollars) by the year 2035 with conditions similar to the EIA Reference outlook. A more abundant resource outlook reduces these prices to \$3.50 to \$5.00 in that same year.

Over the longer term natural gas will substitute for coal principally, with secondary effects on other sources like nuclear and renewables. Across all models, natural gas use responds strongly to natural gas price changes, rising 3.4% higher than expected otherwise for every 10% decline in natural gas wellhead prices.

Lower natural gas prices contribute to lower electricity prices. Competition between direct natural gas use and energy applications powered by electricity is an important dimension of how energy markets respond to more available natural gas supplies.

North America is expected to play a more important role in international natural gas markets. Total U.S. exports could reach as high as 6 trillion cubic feet by 2035 (or 25 percent of current total U.S. consumption). In addition to possible exports to Mexico depending upon evolving conditions, opportunities exist for LNG exports to Asia. These

markets are not assured, however, as other world regions offer promising options to supply these markets. A significant barrier will be the liquefaction, regasification and shipping costs of transporting supplies overseas to growing Asian markets.

Expanding natural gas supply, in the absence of any concerted climate change policy initiative, is unlikely to dampen greenhouse gas emissions significantly. Natural gas replaces both carbon-based and carbon-free fuels and it stimulates total greenhouse gas emissions by reducing prices and augmenting economic growth.

Important changes are materializing in the regulation of North American power sector. Plans are developing to target the carbon-dioxide emissions rate of existing power plants. Depending upon the specific rules for implementing this clean power plan, natural gas market conditions may play a critical role in determining the impact of such proposals.

## **Conclusions**

Despite very different assumptions and model structures, the study derives important policy-relevant insights related to natural gas substitution, natural gas export potential and natural gas as a bridge fuel for a reduced-carbon world. A few of these insights are described in the above section on Results.