

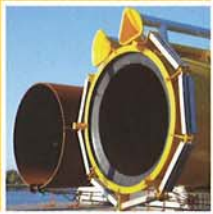
AMERICAN CLEAN SKIES FOUNDATION

The Recognition of **Natural Gas Abundance** Continues to Grow



NAVIGANT
CONSULTING

In July 2008, the American Clean Skies Foundation (ACSF) released the *North American Natural Gas Supply Assessment*, a groundbreaking study of the enormous potential of new domestic natural gas development in “unconventional” resource areas that include onshore gas shales, tight gas and coalbed methane. The study, prepared for ACSF by Navigant Consulting Inc. (NCI), concluded that the United States held a recoverable natural gas resource base in the range of 1,680 trillion cubic feet (Tcf) to 2,247 Tcf, representing a remaining life of between 88 and 118 years at then-current production rates.

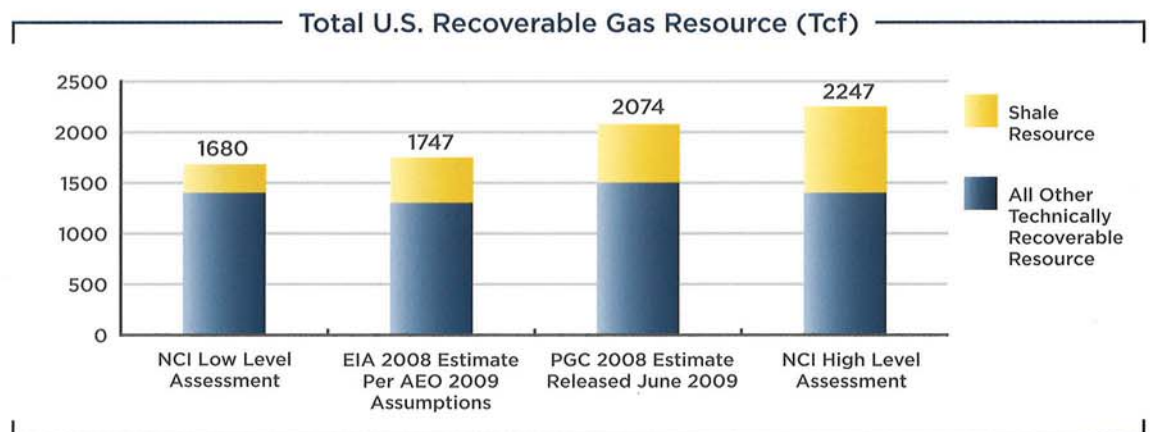


About the Study

The American Clean Skies Foundation commissioned Navigant Consulting Inc. to undertake an assessment of the North American Natural Gas Supply. The 2008 study was conducted by a team of consultants under the leadership of Directors Richard G. Smead and Gordon B. Pickering. Also contributing expert advice and input was Kenneth Medlock III, a fellow in energy studies at the James A. Baker III Institute for Public Policy and an adjunct assistant professor of economics at Rice University. Since the time of the study's release, ACSF has directed Mr. Smead and Mr. Pickering to perform periodic updates of industry performance, and to conduct multiple dialogues with industry participants, outside experts and governmental policymakers to explore and update the study's conclusions.

Current Resource Estimates Are Converging on a Showing of Abundance

At the time of its release, the *North American Natural Gas Supply Assessment* was viewed as a dramatic, game-changing report on the robust growth of domestic unconventional natural gas development. However, since the time of its release, the bulk of the industry and the expert community have reached similar conclusions, with virtually all estimates of the recoverable resource base falling within the Navigant Study's range. The most recent evidence of this evolution in industry perception is the June 2009 release of the Potential Gas Committee's biennial study of U.S. natural gas supply, which arrived at a resource base of 2,074 Tcf. The Potential Gas Committee is comprised of



Economic Turmoil and the Future

The period since the release of the *North American Natural Gas Supply Assessment* has been one of significant economic turmoil, both domestically and worldwide. That turmoil has taken its toll on natural gas demand, the availability of capital and the worldwide natural gas supply-and-demand balance. As a result, drilling has slowed until demand can catch back up with supply. This slowdown in the pace of development demonstrates yet another positive characteristic of shale gas: As with any other manufacturing business, it is possible to “dial down” or “dial up” production to match market demand. The last year’s events took place so abruptly, and the increase in U.S. supply availability was growing so fast, that it is taking some time for supply and demand to come back into balance. When they do, the U.S. natural gas industry is poised to respond and resume rapid growth in availability. All that is needed is for the market to ask for the supply of such applications as power generation in lieu of higher-carbon fuels, or vehicle fuel in lieu of imported oil.

Canada

As noted in the *North American Natural Gas Supply Assessment*, Canadian natural gas production has been stable during the past decade, with overall production of 6.3 Tcf in 2007, close to the 10-year average of 6.4 Tcf annually. Alberta is Canada’s largest producer,

accounting for 78 percent of the country’s total production with 4.8 Tcf annually.

Conventional gas makes up most of Alberta’s current production despite the sharp increase in production of coalbed methane — a trend that is expected to continue. Shale production in Alberta, however, is statistically insignificant. By contrast, one-third of production in British Columbia is from new unconventional sources. British Columbia has an estimated 15 Tcf of tight gas, 5 Tcf of shale gas and 4 Tcf of coalbed methane. The British Columbia shales have continued to stimulate industry excitement in Canada and are expected to become a major resource to bolster Western Canadian supply.

In part, it is this manufacturing-type ability to dial up or dial down development that can help maintain stable prices as demand increases. Historically, long exploration lead-times for conventional natural gas often caused supply to be unsynchronized with demand changes, leading to a “roller coaster” of supply-and-demand relationships and thus prices. Shale development is different. It can respond as the market asks for it.

Conclusions

Due to the rapid and successful development of the U.S. unconventional gas resources, and in particular to the forward-looking and enormous potential of shale gas, the nation’s supply of clean-burning natural gas is plentiful. Meanwhile, the ongoing progress in applying improved technology makes the scenario even more positive. This quote from the *North American Natural Gas Supply Assessment* is as true now as it was a year ago: “Given the amount of activity in shale and the room for technological innovation to have substantial commercial value, it is likely that new

techniques will lower costs of production per Mcf (thousand cubic feet) over time, just as it has with other hydrocarbons.”

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Unconventional Supply is Driving the U.S. Natural Gas Supply Abundance

The substantial growth in the U.S. natural gas industry's supply capability has been centered on "unconventional" supplies, which include tight sands (deep, hard-rock wells), coalbed methane (shallow wells drilled around coal fields), and shale gas (explained in detail below). Unlike "conventional" supplies generally sought and found around oil formations, the unconventional plays are pure natural gas. They now account for about one-half of U.S. natural gas supply.

...And Shale is the Key

Beginning with the *North American Natural Gas Supply Assessment*, both the industry and policymakers have focused on the most rapidly growing component of the unconventional supplies: gas from shale formations.

There are at least 22 major shale plays in the United States, spread over more than 20 states.

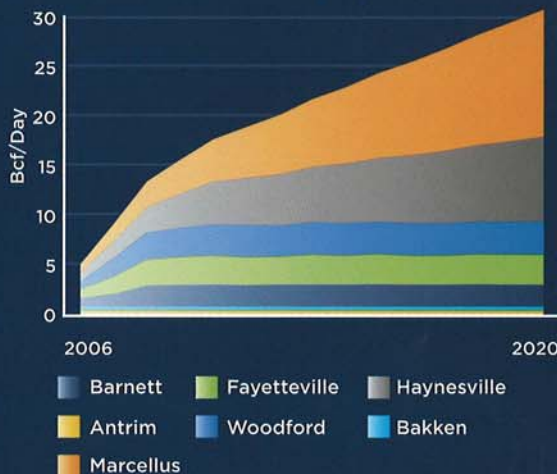
Recent focus has been on the "Big Seven," the basins where development is either well underway or on the verge of rapidly increasing. The Big Seven include Barnett (Texas), Woodford (Oklahoma), Fayetteville (Arkansas), Bakken (North Dakota/Canada), Antrim (Michigan), Haynesville (Louisiana), and Marcellus (Pennsylvania, New York, West Virginia). The first six of these plays have exhibited an exponential rate of growth over the 10 years from 1998 to 2008. The seventh, Marcellus, is expected to be approximately as large as Haynesville and is on the verge of development.

Producer estimates of the ultimate capability of these plays are very large. Some estimates place the potential production from the Big Seven as high as 30 billion cubic feet (Bcf) per day, as early as 2019 or 2020. This would represent an increase in total U.S. natural gas supplies of approximately 30 percent over today's levels.

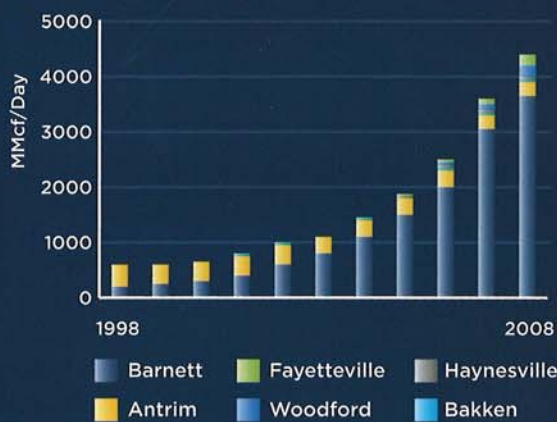
Concentrating on the two newest and largest shale plays, Haynesville and Marcellus, the potential is truly impressive. Haynesville, located in northern Louisiana right under the heart of the U.S. production-area pipeline network, is expected by many to become the largest single natural gas field in North America. Meanwhile, Haynesville has been characterized by very productive wells, leading to a relatively low unit cost. Marcellus, in the relatively more congested areas of the

Northeast, has been slower to develop but in the end, could be a home run for natural gas consumers. Marcellus is not only located under large existing pipeline systems, but it is in the middle of the consuming market area. The potential resource in Marcellus has also undergone a dramatic evolution: The study's high-end estimate for Marcellus was 250 Tcf, roughly equal to the total existing proved natural gas reserves in the rest of the country. At the time, the highest alternative estimate for Marcellus was one released by Dr. Terry Engelder at Pennsylvania State University. Dr. Engelder, a prominent expert on Marcellus, estimated a recoverable resource of 50 Tcf. More recently, however, Dr. Engelder has estimated that as much as 500 Tcf should be recoverable — 48 percent greater than the estimate in the *North American Natural Gas Supply Assessment*.

Producer Estimates of Ramp-Up to 30 Bcf/Day by 2020



Production from the First Big Six Shale Plays Increased Exponentially



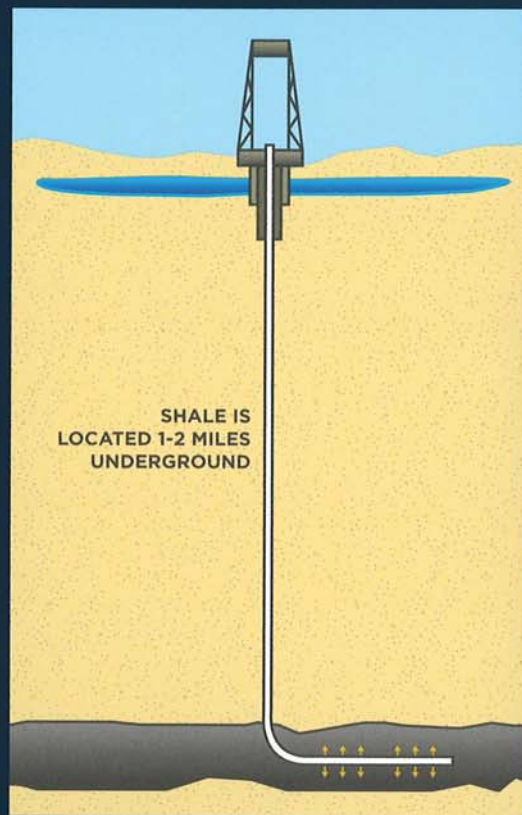
Why have industry experts' estimates of the recoverable shale resource grown so rapidly?

The answer lies in the nature of shale. This deep, hard rock is actually the "kitchen" where natural gas is initially formulated and "cooked" before it moves into the concentrated pockets that are more familiar to the conventional natural gas industry. The existence of large quantities of natural gas in shale has long been known, but the formations were so non-porous and spread out geographically that it was not economically feasible to produce much shale gas.

Then, over the course of the last decade, a number of technologically sophisticated independent producers were able to combine horizontal drilling, hydraulic fracturing, and state-of-the-art geosciences and geophysics to change the game.

They were able to assemble centers of excellence in using these tools to unlock the potential of shale for the first time, in truly impressive quantities. Thus, the rapid increase in estimates has not necessarily been an increase in the quantities of natural gas believed to exist beneath the United States, but rather a quantum increase in the portion believed to be recoverable because of these industry advances. The industry has become more like a manufacturing business than a resource-extraction business: The shale formations represent a large source of raw material for the production of natural gas. And as the industry continues to improve its technical capabilities, it will continue to be able to produce more product, more efficiently from that raw material.

In horizontal drilling, the well descends vertically for several thousand feet and is then redirected to run along the gas formation, rather than perpendicular to it. This allows more of the formation to be reached. Next, hydraulic fracturing is used to open the pores in the formation. High-pressure fluid (primarily water) is injected through perforations in the horizontal pipe, prying apart tiny cracks in the rock to as much as 100 feet from the pipe. "Proppants" such as sand are included to hold the tiny fissures open so that gas can flow.



(Not to scale)



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