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UNDERSTANDING THE AMERICAN NATURAL GAS BOOM - A SHORT SUMMARY

By Ralph A. Cantafio[1] and Rosanna Slingerland[2]

INTRODUCTION

The question I hear routinely whether from prospective clients, while lecturing, or in social settings is often the same: Why all the sudden interest in natural gas? The answer is no doubt worthy of an extensive paper, but the objective of this article is to answer the same as simply as possible. As set forth below, I summarize the three most significant forces as: 1) domestic availability; 2) environmental preference; and 3) emerging technology resulting in increased labor opportunities.

WHY NATURAL GAS?

Natural gas is seen by many to provide significant environment benefit beyond that of other types of fossil fuels. As the cleanest burning carbon based fuel, it produces 45% less carbon dioxide waste product than that of coal and 30% less than oil. It is estimated by some that by substituting natural gas in place of the traditional use of coal and oil, the output of greenhouse gasses produced in the United States could alone mitigate much of the negative carbon footprint believed to cause climate change.

It is also believed that increased use by the United States of shale based natural gas ("shale gas") would produce major economic and political benefits domestically. The extraction process involving shale gas is very labor intensive. The industry has the ability to create not only increased employment, but employment that compensates with high paying jobs. Further, the payment of royalties to owners of mineral rights will provide further financial benefit to those landowners. In many cases, the extraction of shale gas will occur in otherwise economically depressed geographical areas.

The Pennsylvania Department of Labor recently reported that the production of shale gas from its portion of Marcellus region had generated almost 50,000 new jobs in just the past year and a

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half. New York Governor Andrew Cuomo recently set aside a statewide fracking moratorium (instead limiting prohibition to certain regions containing what are believed to be critical watersheds and aquifers) in part to generate new and higher paying jobs in his state. In towns like Cotulla, Texas where until recently there was a net population decrease and persistent double digit unemployment, because of development of the Eagle Ford shale formation the community is experiencing an economic transformation as sales and other tax revenues boom.

HOW IS NATURAL GAS USED?

Natural gas is typically used in the heating of homes. More importantly, natural gas could substantially replace the use of coal and foreign oil in the generation of electricity. T. Boone Pickens and others also believe that natural gas could be used to fuel a new generation of automobiles and trucks, particularly commercially.

HOW MUCH NATURAL GAS IS THERE IN THE UNITED STATES?

Reports vary as to the amount of natural gas found in the United States and the waters immediately adjacent to our country. The science to approximate the same is not exact. Precision aside, many analysts believe that the amount of natural gas that could be extracted from shale alone could be an amount equal to the entirety of the remaining oil reserves held by Saudi Arabia. Estimates of reserves are increasing because of the new ability to access shale gas. That is why there might now be enough domestic natural gas deposits to significantly diminish America's foreign energy dependency for decades to come. The benefits from no longer sending so many dollars abroad for oil and the web of international and political complexities resulting from the same are self-evident.

WHERE IS THE SHALE GAS LOCATED?

The largest deposit of shale gas is believed to be in Marcellus shale. This formation is located on the east coast and generally extends from the Finger Lakes of New York state as its north boundary moving through central and western Pennsylvania then southward toward Kentucky. The Marcellus shale is a layer of rock more than a mile underground. It is a remaining geological structure which was once part of an ancient sea. The layer of rock referred to as Marcellus shale is found to have significant pockets of trapped natural gas. Some analysts estimate this reserve to contain as much as 516 trillion cubic feet ("cfs"). This resource alone would make it the second largest natural gas field in the entire world. It could account for more than twenty (20) times our current domestic annual national consumption of natural gas.

This Marcellus shale does not include other large shale gas deposits located in Arkansas, Colorado, Louisiana, Oklahoma and Texas. Last year alone, the United States Department of Energy ("DOE") more than doubled its estimate of what it referred to as "technically recoverable" domestic reserves of natural gas to an all time record of 827 trillion cubic feet.

WHAT IS THE ROLE OF FRACKING AS TO THESE INCREASED AMOUNTS OF "TECHNICALLY RECOVERABLE" DOMESTIC RESERVES?

The process to remove these pockets of natural gas trapped beneath and within this layer of shale is referred to as hydraulic fracturing or "fracking." This is a very complex process that is highly consumptive of resources, especially those of water and human labor. As a review of recent news suggests, the potential harm caused by fracking is a very significant topic of discussion for politicians and environmentalists.

To understand the fracking process, which is already used in thousands of wells across the United States, one begins with understanding traditional drilling. Because of the location of "traps" of natural gas, drilling for natural gas continues down to often two (2) miles below the surface of the earth. The drilling process includes not only vertical drilling of a traditional nature, but also utilizes newer techniques involving horizontal drilling.

Most wells are vertical wells. As the name suggests, vertical wells are drilled straight down into the earth. However, often vertical drilling cannot be used for any number of reasons to access target areas ("pay zones") that will result in the production of natural gas in paying quantities. As a result, wells are frequently drilled non-vertical. Non-vertical drilling is said to be directional or horizontal.

Why might this be? While the reasons for horizontal drilling are voluminous, a short summary might help. The reservoir in question or pay zone might be located under a sub-division or maybe a park. Horizontal drilling allows the use of a single drill pad for multiple wells reducing the surface footprint. By drilling horizontally and combined with fracking, a pay zone through shale can make a previously unproductive formation highly productive. Horizontal drilling can access a maximum number of fractures to capture more natural gas than a vertical well. Horizontal drilling is used to relieve pressure on a well said to be out-of-control intersecting with an existing well to provide a relief well. In a non-oil and gas context, horizontal drilling can be used to place conduit for gas, electric, telephone, or fiber optic lines under roads, rivers, and the like.

Horizontal drilling for natural gas will sometimes will exceed more than a mile. It is in this context that fracking is utilized.

When fracking, a mixture of water, sand, and a multitude of chemicals is pumped into wells at great pressure so as to manipulate cracks in the shale fracturing the existing rock. Once this rock is open, these fissures are exploited so that natural gas once trapped can flow to the wellhead, tremendously increasing the productivity of fields. Low permeability rock units containing significant amounts of natural gas can be made commercially productive. It is the nature of these shale formations that the complication is not in necessarily locating the natural gas reserves, but in actually recovering gas in an environment where one finds very fine pore spaces in this low permeability shale formation. So as to increase yield, drilling occurs horizontally through the shale rock formation then fracking is employed to produce artificial permeability. It is this

combination of horizontal drilling along with fracking that dramatically increases the yield from these shale formations.

COMPLICATIONS IN THE FRACKING PROCESS

There are a multitude of general concerns pertaining to fracking. Most of the more significant concerns result from issues as to the potential contamination of water supplies and depletion of water. This is a concern because the fracking of a single well potentially can utilize two (2) million gallons of water a day. Most of this water is extracted from local aquifers. Approximately half of this fracking water comes back up to the well. This water carries with it a multitude of chemicals utilized in the fracking process itself. As one might imagine, existing purification plants typically cannot even begin to process this volume of waste water. This problem is further magnified because much drilling occurs far outside of the geographical bounds of water and sanitation districts. It comes as little surprise that much of the waste water from fracking is stored then in ponds, often plastic lined, located not far from the wellhead. Even industry concedes that some of these plastic lined ponds have leaked and have been said to contaminate local groundwater and streams.

There is also much debate over the actual mixture of chemicals injected into the underground and used in fracking. There are complaints of leakage of water containing toxic chemicals used in fracking resulting in complaints of contaminating underground aquifers, including those that sometimes provide drinking water. There is the well known case in Dimock, Pennsylvania, recently the topic of a 60 Minutes segment, where one resident's well exploded as a result of highly flammable natural gas mixing with the well water. Local environmental officials determined that the aquifer in question had been contaminated with methane gas and other heavy metals.

INDUSTRY RESPONSE

The Oil and Gas Industry concedes that accidents have occurred as a result of fracking, but underscores these incidents are not seen as alarming or even surprising based upon the sheer volume and number of fracking operations. Industry insists that fracking has not significantly or traditionally contaminated aquifers or wells, in part because a vast majority of the fracking activity in question is occurring some 8,000 to 10,000 feet below the earth's surface. This activity thus occurs far beneath any impacted water table in question. Industry also notes that the shale formations that are the target of fracking fluids are often located many hundreds (in fact thousands) of feet below these aquifers and other water formations used domestically. In fact, not only are the shale formations in question almost always far beneath any aquifer, but there exists a layer of shale consisting of a permeable rock that separates fracking activities from water resources. The Environmental Protection Agency ("EPA") has already produced an initial report. The EPA report essentially adopts the positions advocated by the Oil and Gas Industry as to safely. However, the general science of fracking at this point is uncertain and unclear.

VOLUNTARY DISCLOSURE BY INDUSTRY

Certain newer studies have found instances in which chemicals and methane have contaminated ground water near fracking sites. Currently, the Oil and Gas Industry is attempting to offset negative reporting and general concerns involving the actual chemical mixture used in fracking by voluntarily providing such information and providing this information on the internet. It is hoped that in Colorado that there will near 100% voluntary compliance by industry as to revealing the chemical mix of fracking and such will be achieved in the very near future. This approach is intended to offset the concern that when any industry systematically does not reveal the content of its chemical mixes that the reason must be because the contents are hazardous to the general public. The industry is moving forward voluntarily in an effort to offset this perception.

FUTURE OF FRACKING

Currently, there really exists no generally recognized scientific conclusion pertaining to what, if any, fracking's impact on drinking water might be. Congress has requested that the EPA conduct additional studies, but no preliminary report from the EPA is expected until the latter part of 2012. There are also a host of studies being pursued privately and in academic circles.

The general expectation at this time is that the EPA will not be recommending any wholesale fracking ban, in part because of the significant employment opportunities associated with the production of natural gas, the positive impacts that natural gas provides to the environment compared to oil and coal, and the decreased reliance upon foreign energy sources resulting from the increased domestic production afforded by natural gas. Particularly as there currently is no federal law pertaining to the regulation of fracking instead only a quilt work of state regulations, it is believed that the EPA will in due course recommend federal regulation to minimize any environmental impact of fracking, particularly upon groundwater and other water supplies. Fracking, while probably being regulated in the future, will almost certainly continue to occur with increasing frequency.

CONCLUSIONS

Ultimately, it appears by any standard that a new age of energy supply is being observed as the United States takes its first significant steps to wean itself off of the dependency of foreign produced oil and instead to focus upon American based energy sources. Simply put, natural gas is very abundant (particularly domestically); job producing; and environmentally preferred.