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Developing the Marcellus Shale: Legal, Regulatory, and Infrastructure Challenges and Their Effect on Downstream Energy Markets

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NOTE

DEVELOPING THE MARCELLUS SHALE: LEGAL, REGULATORY, AND INFRASTRUCTURE CHALLENGES AND THEIR EFFECT ON DOWNSTREAM ENERGY MARKETS

Aaron Stemplewicz*

The Marcellus Shale natural gas play is largely considered a “game changer” for the U.S. energy sector, as recent technological breakthroughs in drilling techniques and technologies have made natural gas extraction from this massive play commercially viable. This note not only examines the primary driving forces behind the development of this play, but also how the extent and pace with which it is developed will affect downstream energy markets. In particular, three categories of factors are evaluated: legal challenges, regulatory controls, and infrastructure development. Two models of growth and their effect on downstream markets are then proposed and analyzed.

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INTRODUCTION

Natural gas production from shale formations is one of the most rapidly expanding on-shore industries in domestic oil and gas production. This form of energy extraction has become increasingly important in light of recent international events. Specifically, Japan’s nuclear disaster has lead to an increased concern and skepticism over expanding the nuclear power industry in the United States. Additionally, regional instability in traditional oil producing countries has lead to political leaders calling for energy independence. The Obama administration also has expressed its support for expanded natural gas drilling in the United States. This, combined with the fact that current renewable technology – such as wind and solar power – are currently unable to meet the power needs in the United States, means the demand for domestic natural gas is likely to increase.

A combination of natural gas, oil, and coal currently makes up approximately eight-five percent of the energy mix in the United States. 1 Natural gas plays an especially important role in the United States’ energy portfolio, as it supplies approximately twenty-two percent of the nations’ energy. This percentage is expected to increase because assessments of the recoverable volumes of shale gas in the United States have increased dramatically over the last five years. A study released in June 2010 by the Massachusetts Institute of Technology indicated that natural gas production in the United States is likely to increase from twenty-two to forty percent by 2050.2

The Marcellus Shale is the most “expansive shale gas play” in the United States, spanning large portions of five states.3 The Marcellus Shale contains roughly eighty-four trillion cubic feet of undiscovered, technically recoverable natural gas and 3.4 billion

3 Shale Gas Primer, supra note 1, at 21.
barrels of undiscovered, technically recoverable natural gas liquids according to a recent assessment by the U.S. Geological Survey ("USGS"). To put this in perspective, consider that one trillion cubic feet of natural gas can heat fifteen million households for an entire year. As such, many energy experts believe the Marcellus Shale has the potential to be enormously profitable and a "game changer" in the energy industry. Michael Krancer, the current Secretary of the Pennsylvania Department of Environmental Protection, said that natural gas "should not be considered a 'bridge' fuel"; rather, it should be considered the "fuel of the century."

A number of factors will significantly influence the extent to and speed at which the Marcellus Shale is developed. These factors can be grouped into three primary categories: legal challenges, regulatory controls, and the development of distribution infrastructure. While there will exist some overlap between these general groupings, they provide a useful framework for discussing the contributing forces that will shape the way in which the Marcellus Shale is developed. Below is a discussion of the way these factors will independently impact the development of the Marcellus Shale, and, consequently, what affect the pace of development will have on downstream energy markets.

A highly volatile and contentious debate has emerged between industry/business organizations and environmental advocacy groups over the development of the Marcellus Shale. As a result of this dispute, some significant informational overreach by both sides has materialized, and this information has reached the public fora. As such, a secondary goal of this note is to highlight the most salient issues and dispel some of the misinformation that has been propagated by both sides.

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5 SHALE GAS PRIMER, supra note 1, at 3.
I. BACKGROUND

In order to gain an understanding of the way in which the development of the Marcellus Shale will affect the energy mix, not only in the northeastern United States but also nationally, it is necessary to review some geological information on the Marcellus Shale as well as the technology and techniques used to extract the gas.

A. Shale Rock Geology and the Marcellus Shale

The lower forty-eight states in the United States contain a wide array of highly organic shale, which have vast deposits of hydrocarbons, such as natural gas, locked within them. This shale developed millions of years ago as a result of large amounts of plant and animal life settling on the bottom of a seabed. The chemical makeup of the natural gas from shale is typically ninety percent methane, which is currently a highly valuable commodity for both power generation and heating. There are over twenty identified shale formations containing recoverable natural gas deposits; however, none have shown as much promise as the Marcellus Shale.

The Marcellus Shale is a Middle Devonian-age shale, approximately 380 million years old. This shale underlies large portions of New York, Pennsylvania, West Virginia, Ohio, and western Maryland, with an estimated depth ranging from 4,000 to 8,500 feet below the Earth’s surface. It is the largest known gas producing shale play in the world, covering over 90,000 square miles, an area slightly larger than the state of Colorado.

7 U.S.G.S., supra note 4.
pubs/OGAPMarcellusShaleReport-6-12-08.pdf.
10 Id. at ES-2.
11 Id. at 21.
12 Id. at 17.
13 Sumi, supra note 8, at 2.
The Marcellus Shale is said to have “favorable mineralogy,” in that it is a highly porous low-density rock, which means it contains a significant amount of recoverable natural gas. As such, many energy experts believe the Marcellus Shale has the potential to be enormously profitable and a “game changer” in the energy industry. Currently, nearly twenty-five percent of the total energy consumed in the United States is derived from natural gas, and some estimates of the value of the gas reserves found in the Marcellus Shale are as high as several trillion dollars. Shale typically has limited permeability; therefore, in order for the gas to be released in commercially viable quantities, artificial fractures must be created in the rock via a process called hydraulic fracturing.

II. HYDRAULIC FRACTURING AND HORIZONTAL DRILLING

Although it has long been known that natural gas exists in the Marcellus Shale in large quantities, it was not until recently that technological improvements allowed for extraction to become a commercially viable business model. In particular, two major innovations played a significant role in making the development of the Marcellus Shale possible: horizontal drilling and hydraulic fracturing.

In many shale formations, including the Marcellus Shale, the pore spaces are not large enough to let the molecules of natural gas flow through them; as a result, in order to produce natural gas from these formations, drillers need to fracture the rock to increase the

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14 Id. at 3.
17 SUMI, supra note 8, at 2.
19 Id. at 10.
formation’s permeability.\textsuperscript{20} To accomplish this, a well is first drilled vertically until it reaches a depth of a few hundred feet above the shale formation.\textsuperscript{21} The driller then deviates the wellbore and directs it in an arch shape until it reaches a horizontal orientation across the formation, now parallel with the surface.\textsuperscript{22} Drillers use this technique for extracting gas from shale for several reasons. First, the wellbore is exposed to a far greater surface area of the formation. Also, natural fractures that exist in shale formations are usually vertical in nature; therefore, extending the wellbore perpendicular to such natural fractures increases the number of fractures to which the wellbore is exposed.\textsuperscript{23} Additionally, horizontal drilling provides the benefit of accessing natural gas from areas where drilling rigs cannot normally be constructed, such as under cities or towns.\textsuperscript{24} Lastly, this drilling technique leaves a smaller environmental footprint on the surface, as several wells can be drilled from a single well pad, and each well can have multiple horizontal arms.\textsuperscript{25} While this technique has existed for a number of years, recent improvements in technology have made horizontal drilling a far more cost effective operation.\textsuperscript{26} Environmental advocacy groups contest that the environmental repercussions resulting from utilizing this method more than offset its benefits, citing such problems as surface spills, contamination events, wastewater disposal issues, massive water withdrawals, and significant habitat destruction through infrastructure development.

The most important innovation that has led to the rapid development of shale formations is that of hydraulic fracturing, also known as “fracking.” Fracking involves injecting a large amount of fluid into the wellbore at high pressure in order to increase its productivity.\textsuperscript{27} The fluids that are injected contain a cocktail

\textsuperscript{20} Sumi, supra note 8, at 2.
\textsuperscript{21} Harper, supra note 18, at 10.
\textsuperscript{22} Id.
\textsuperscript{23} Sumi, supra, note 8, at 7.
\textsuperscript{24} Harper, supra, note 18, at 11.
\textsuperscript{25} Sumi, supra, note 8, at 21.
\textsuperscript{27} Harper, supra note 18, at 10.
of water, proppants (often sand), chemicals, and other friction-reducing substances. The high pressure with which these fluids are pumped into the well creates new cracks in the rock and then props these cracks open with sand or another proppant, exposing the wellbore to a greater surface area and, thus, more natural gas. The fracking fluids developed in the last decade maximize the length of the fracture to distances that previous technology could not achieve. By creating a more porous and permeable target area with these extended artificial fractures, the use of these fluids allows significantly more natural gas to be exposed to the wellbore and then recovered. The exact chemical make-up of the fracking fluids is unknown, as it is confidential proprietary information and exempted from federal regulation by the 2005 Energy Act. While these new techniques and technologies have increased the viability of drilling for natural gas in the Marcellus Shale, they also have generated significant concerns and questions about their impact on the environment and on property rights.

III. Factors Affecting Development of the Marcellus Shale

Below is a discussion of three categories of factors that will affect the development of the Marcellus Shale. These categories include legal challenges, regulatory controls, and the development of distribution infrastructure. The pace and degree of development will have a direct influence on consumer prices as well as influence the import and export markets for natural gas.

A. Legal Challenges

There has been significant litigation in two primary spheres of conflict regarding issues involving the Marcellus Shale. The

28 Id.
29 Id.
30 Id.
31 Id.
way in which the courts ultimately resolve these cases will greatly
influence the development of the Marcellus Shale. The first involves
state-level moratoriums and municipal-level zoning requirements
that have been applied to natural gas drilling operations. The
second set of legal challenges involves the way in which courts in
Marcellus Shale states address liability issues that arise from natural
gas drilling activities.

Natural gas operators insist that the processes – including
hydraulic fracturing – that they use are not only safe, but have been
utilized in other gas producing parts of the country for the last sixty
years.\textsuperscript{33} However, non-profit organizations, environmental groups,
and government agencies have raised concerns that the process
of hydraulic fracturing can have significant harmful effects on
underground drinking water and the environment.\textsuperscript{34} Information
provided in the New York Supplemental Generic Environmental
Impact Statement demonstrates that the first multi-stage slick-water
fracturing of horizontal wells did not occur until 2002, and the use
of multi-well pads and cluster drilling did not happen until 2007.\textsuperscript{35}
This suggests that this form of natural gas extraction is relatively
recent and has yet to establish standard operating procedures.

\textsuperscript{33} Energy In Depth, Nearly 65 Years of Use, and Not One Case of Groundwater
Contamination Caused by Cydraulic Fracturing? How Can that Be Possible?,
JUST THE FACTS, http://www.energyindepth.org/just-the-facts/#groundwater-con-

\textsuperscript{34} Paul Rubin, Report for the Delaware River Basin Commission on Natural Gas
Development Regulations December 9, 2010, available at http://www.delaware-
riverkeeper.org/resources/Reports/Rubin%20report%20finalfinalTOC4.9%20
2011%20.pdf (last visited April 3, 2012) (Environmental groups point to signifi-
cant water quality impacts resulting from shale gas development from: casing and
cementing failures, hazardous waste disposal, wastewater treatment and disposal,
improper well plugging and abandoned wells, impacts from shale gas infrastruc-
ture construction and maintenance, new facility construction and emissions, mas-
ive water consumption, and accidents resulting from negligence and illegal ac-
tions. These concerns do not even include the potential of vertical migration of
fracturing fluids in the substrata into aquifers.).

\textsuperscript{35} N.Y. STATE DEP’T OF ENVT. CONSERVATION, DRAFT SUPPLEMENTAL GENERIC ENVI-
RONMENTAL IMPACT STATEMENT ON THE OIL, GAS AND SOLUTION MINING REGULATORY
On December 12, 2010, this debate resulted in the former Governor of New York, David Paterson, vetoing legislation that would have instituted a moratorium on all new oil and gas drilling permits in the Marcellus Shale for a period of five months. However, the Governor then issued a more limited moratorium via an Executive Order; rather than banning both vertical and horizontal drilling activities, the Governor’s Executive Order banned the issuance of permits for high-volume horizontally drilled wells while allowing permits for existing lower volume vertical wells. The ban prevented any new permits from being provided to natural gas drilling operators using high volume techniques until July 1, 2011. A de facto ban continued as the New York State Department of Environmental Conservation completed its required environmental impact assessment review process before it issues any high volume drilling permits.

The Executive Order was an attempt to appease both sides of the debate; however, it was not well received by many environmental groups. A joint statement by Environmental Advocates of New York – a group of non-profit environmental organizations – stated that, “[u]nlike the moratorium bill, the executive order does not protect against the dangers of all fracking wells, but allows so-called vertical wells – exactly the kind of wells that were responsible for ruining nine square miles of aquifer and poisoning the drinking water of more than a dozen families in Dimock, Pennsylvania, along with many other pollution incidents in Pennsylvania – to move forward.” This statement indicates that these groups will continue to apply pressure on the New York State Legislature to prevent natural gas operators from moving forward with their permitting and drilling processes.

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37 Id.
38 Id.
40 Gavin, supra note 36.
While a statewide moratorium on drilling did not gain the same traction in Pennsylvania as in New York, environmental groups and some municipalities still have raised significant concerns. In November of 2010, the city council in Pittsburgh unanimously voted to specifically prevent any form of hydraulic fracturing within its city limits. The Community Environmental Legal Defense Fund, a non-profit advocacy group, drafted Pittsburgh’s bill. The ordinance is particularly interesting because it not only bans hydraulic fracturing within city limits, but also consists of a new Bill of Rights for Pittsburgh residents, which includes the right to clean water for residents and rights for ecosystems and nature. This bill challenges corporate “personhood” rights as well as those corporate rights that have been codified by state law, such as the Pennsylvania Oil and Gas Act. While the legality of this ordinance is questionable, it has yet to be challenged in court. Thus, until it is repealed or overturned, it will continue to provide local communities with significant power over corporate entities.

The Bill of Rights ordinance voted on in Pittsburgh was likely a response to the legal battles that occurred in several other municipalities in Pennsylvania, where local communities attempted to enact zoning regulations that significantly limited the scope of actions natural gas operators could take in their jurisdiction. A triumvirate of cases has emerged in Pennsylvania that provide a framework to which municipalities can look for guidance to determine what regulations they can and cannot pass.

The Pennsylvania Oil and Gas Act contains a specific provision addressing the role of local ordinances in relation to oil and gas operations. Specifically, it provides that

\[\text{except with respect to ordinances adopted pursuant to . . . the Municipalities Planning Code . . . all local ordinances and enactments purporting to regulate}\]

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oil and gas well operations regulated by this act are hereby superseded. No ordinances or enactments adopted pursuant to the aforementioned acts shall contain provisions which impose conditions, requirements or limitations on the same features of oil and gas well operations regulated by this act or that accomplish the same purposes as set forth in this act. The Commonwealth, by this enactment, hereby preempts and supersedes the regulation of oil and gas wells as herein defined.

Huntley & Huntley, Inc. v. Borough Council of Oakmont and Range Resources – Appalachia, LLC v. Salem Township, were decided on the same day by the Pennsylvania Supreme Court, but had fact patterns that dictated different outcomes. In Huntley, the court found that an ordinance could include provisions including or excluding drilling operations from certain locations, and that a “location” is not considered a “feature” as defined by the Pennsylvania Oil and Gas Act. Furthermore, the court found that allowing drilling as a conditional land use was also not a “feature,” and it was thus allowed under the Act. In Huntley, the primary focus of the ordinance crafted by the borough related directly to traditional zoning purposes, such as preserving the character of neighborhoods and encouraging beneficial and compatible land uses. While this decision provided municipalities with some power not preempted by the clause in the Pennsylvania Oil and Gas Act, the court limited the ruling by emphasizing that a “municipality could permit drilling in a particular district but then make that permission subject to conditions addressed to features of well operations regulated by the Act.” Essentially, the ruling in Huntley was limited to the authority of a municipality to restrict, for aesthetic reasons, the locations where natural gas drilling operations can take place.

44 Huntley, 964 A.2d at 864.
45 Id. at 867.
46 Id. at 867–68.
47 Id. at 866.
In contrast with the decision in Huntley, in Range Resources – Appalachia, the Pennsylvania Supreme Court held that the Pennsylvania Oil and Gas Act preempted the local ordinances enacted by Salem Township insofar as the local ordinances pertained to oil and gas operations.\textsuperscript{48} Salem Township’s ordinance covered, among others, the following subject areas: permitting procedures specifically for oil and gas wells, bonding requirements, regulation of well heads, site restoration after drilling is completed, pre-operation water testing, pipeline and depth markings, and slope and construction of access roads.\textsuperscript{49} The Pennsylvania Supreme Court found the regulations to be “a regulatory apparatus parallel to the one established by the [Oil and Gas] Act,” and thus preempted by the Act.\textsuperscript{50} The Salem Township ordinance was in the form of a separate appendix directly related to oil and gas drilling, and attempted to create a comprehensive scheme to regulate oil and gas drilling. However, the court left open the question as to whether the ordinance would have been valid if it had focused on regulating commercial or industrial development generally, and had subsumed the oil and gas industry within those regulations.\textsuperscript{51}

In August of 2010 a third case, Penneco Oil Co. v. County of Fayette, was decided in the Pennsylvania Commonwealth Court.\textsuperscript{52} In Penneco, the court held that a local “zoning” ordinance that targeted the natural gas drilling in the county was not preempted by Pennsylvania’s Oil and Gas Act.\textsuperscript{53} The Fayette zoning ordinance provided that oil and gas wells were a “permitted use” in certain zoning districts, and that in all other zoning districts, an oil or gas well was a “special exception,” and therefore subject to the following four requirements:

A. An oil or gas well shall not be located within the flight path of a runway facility of an airport.

\textsuperscript{48} 964 A.2d at 877.
\textsuperscript{49} Id. at 872–73.
\textsuperscript{50} Id. at 875.
\textsuperscript{51} Id. at 876–77.
\textsuperscript{52} Penneco Oil Co., 4 A.3d at 722.
\textsuperscript{53} Id. at 733.
B. An oil or gas well shall not be located closer than 200 feet from residential dwelling or fifty feet from any property line or right-of-way.

C. An oil or gas well shall provide fencing and shrubbery around perimeter of the pump head and support frame.

D. The Zoning Hearing Board may attach additional conditions pursuant to this section, in order to protect the public’s health, safety and welfare. These conditions may include but are not limited to increased setbacks.\(^5^4\)

The court found that the first three provisions fall directly within the sphere of traditional zoning restrictions, and as such are not preempted by the Oil and Gas Act.\(^5^5\) Two reasons are provided by the court for finding that the final provision – which includes a provision to protect “the public’s health, safety, and welfare” – also is not preempted. The Pennsylvania Commonwealth Court found that the provision did not relate to “technical aspects of well functioning and matters ancillary thereto (such as registration, bonding, and well site restoration).” Instead, finding that this section of the ordinance was similar to what was found acceptable in Huntley, i.e., “preserving the character of residential neighborhoods, and encouraging beneficial and compatible land uses.”\(^5^6\) The Pennsylvania Commonwealth Court buttressed this argument by stating that the power provided in the ordinance to “protect the public’s health, safety and welfare” is “not unfettered.” While it appears as though this provision may provide expansive powers to municipalities to creatively expand this provision to cover many different drilling activities, the Pennsylvania Commonwealth Court did limit its holding by explaining that this ruling “does not provide Fayette County or its zoning hearing board with virtually unbridled discretion to deny permission to drill an oil and gas well even after

\(^{54}\) Id. at 730.

\(^{55}\) Id.

\(^{56}\) Id. at 732.
compliance with the applicable zoning regulations.” It seems as though there are strong grounds for reversal if this decision were to be appealed or the language challenged in a later case. Specifically, there is a compelling argument to be made that it is the nature of the power enumerated in the ordinance (the power to “protect health, safety, and welfare”), not its degree (fettered or unfettered), which should be the fulcrum from which the court makes its analysis. However, as it stands, Penneco potentially opens the door for municipalities to extend zoning regulations beyond the traditional realm described in Huntley, but to a degree less comprehensive than those regulations found in Salem.

Another issue that will impact the development of the Marcellus Shale is the way in which courts resolve liability issues concerning the activities of natural gas operators. In April 2008, Southwestern Energy, a Houston based drilling company, began hydraulically fracturing a natural gas well in rural Susquehanna County, Pennsylvania. Two and a half years after the drilling began,

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57 Id. at 731.
58 On February 8, 2012, Pennsylvania legislators passed a bill, known as Act 13, overhauling the state’s natural gas drilling regulations and potentially negating the course charted by Huntley, Salem, and Penneco. Among other things, Act 13 “restricts municipal zoning of drilling operations. Townships and municipalities are required to allow drill rigs in all types of zones, except for densely-populated residential areas. It sets state standards for the minimum distance between wells and streams, schools, buildings and water sources. If a local government passes ordinances and regulations that go beyond the new state standards, the Public Utility Commission will have the power to bar the municipality from receiving any impact fee money.” Seven municipalities – including Cecil, Peters, Mount Pleasant and Robinson in Washington County, South Fayette in Allegheny County and the two Bucks County towns of Yardley and Nockamixon – environmental activists from the Delaware Riverkeeper Network and a handful of municipal officials filed a suit on March 28 2012, contesting the law. The Plaintiff’s argue that standardizing zoning rules for gas drilling is an improper and arbitrary use of the commonwealth’s police power. Laura Olsen, Seven Communities File Suit to Oppose Marcellus Shale Law, PITTSBURGH POST GAZETTE (last visited Apr 3, 2012) http://www.postgazette.com/stories/local/marcellusshale/7-towns-file-suit-to-oppose-marcellus-shale-law-628829/.
a lawsuit, *Berish, et al. v. Southwestern Energy Production Co.*, was filed by fourteen families alleging damages ranging from health injuries to a loss of enjoyment of property. Several of the plaintiff’s properties were as close as 700 feet from Southwestern’s drill site, and none were farther than 2000 feet. The plaintiffs in this case allege that insufficient casing in Southwestern Energy’s well resulted in a number of pollutants and other industrial wastes, including the fracking fluid and other hazardous chemicals such as barium and strontium, being discharged into the ground and contaminating the water supply used by the plaintiffs. The plaintiffs brought claims for violations of the Hazardous Cleanup Act, negligence, private nuisance, strict liability, and trespass. They seek compensatory and punitive damages, the costs of future health monitoring, and preliminary and permanent injunctions barring defendant from engaging in the activities set forth in the complaint. In March of 2011, the defendants filed a Rule 12(b)(6) motion to dismiss certain claims by the plaintiffs; specifically, the defendants challenged the allegation that they were strictly liable for the alleged discharge of fracking fluid into the ground contaminating the water supply. The defendants argued that a number of Pennsylvania cases determined that analogous industrial activities were not abnormally dangerous, including storage of toxic insecticide in a barn and storage of gasoline in underground storage tanks. However, the court stated that because determinations about whether or not an activity is “abnormally dangerous” is fact intensive, the defendant’s motion to dismiss the plaintiffs’ strict liability claim must be denied. The court held that plaintiffs sufficiently pled their strict liability claim and met their burden of putting Southwestern

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60 *Id.*
61 *Id.* at 11.
62 *Id.* at 15.
63 *Id.* at 20–56.
64 *Id.* at 19.
65 *Berish*, 763 F. Supp. 2d at 704.
66 *Id.* at 705 (citing Diffenderfer v. Staner, 722 A.2d 1103, 1109 (Pa. Super Ct. 1998)).
67 *Id.* at 705 (citing Smith v. Weaver, 665 A.2d 1215, 1220 (Pa. Super. Ct. 1995)).
68 *Id.* at 706.
Energy on notice as to the basis of the claim.\textsuperscript{69} It is likely that the plaintiffs face a tough challenge in prevailing on this issue, however. An adverse ruling for the defendants likely would have a severe negative impact on future investment in shale gas in the region.

Another case, which has received substantial public attention because it was featured in the popular documentary \textit{Gasland},\textsuperscript{70} is \textit{Fiorentino v. Cabot Oil \& Gas Corp.}\textsuperscript{71} This case arises out of allegations that the drilling activities of the defendant, Cabot Oil and Gas Corp., caused both property damage and personal injuries to a number of families in Dimock, Pennsylvania. The Pennsylvania Department of Environmental Protection already settled claims related to Cabot’s actions, in which Cabot agreed to pay over $4.1 million dollars.\textsuperscript{72} This settlement, however, relates to a separate claim brought by the Department of Environmental Protection against Cabot, not to the \textit{Fiorentino} case, and the fact that Cabot settled for such a substantial amount is a positive sign for the plaintiffs in this case. Many of the claims made in \textit{Fiorentino} are identical to those in \textit{Berish}, except that in \textit{Fiorentino}, a few additional claims are being brought, including breach of contract, fraudulent misrepresentation, and gross negligence. Similar to the \textit{Berish} case, the defendants filed a motion to dismiss the claims brought pursuant to strict liability, medical monitoring and gross negligence. The court ruled on the motion and stated “Pennsylvania courts have yet to address whether the conduct at issue sub judice, gas-well drilling, is an abnormally dangerous activity that is subject to strict liability under Pennsylvania law.”\textsuperscript{73} While acknowledging that in certain similar situations the “abnormally dangerous” rule does not apply, the court articulated that it would be imprudent to “extend th[at] reasoning to drilling

\begin{footnotes}
\item[69] Id.
\item[70] \textsc{Gasland} (HBO Documentary Films, 2010).
\item[71] \textit{Fiorentino v. Cabot Oil \& Gas Corp.}, 750 F. Supp. 2d 506 (M.D. Pa. 2010).
\item[73] \textit{Fiorentino}, 750 F. Supp. 2d at 512.
\end{footnotes}
If the defendants in Berish and Fiorintino are found to be liable, it would be a powerful signal to natural gas operators that they must be more diligent in their well construction and other on-site drilling activities. The concern here is not that the fracturing process causes natural gas migration or property contamination due to upward migration of the remaining fracking fluids; rather, the primary liability issue identified in both of these cases mentioned above seems to be negligent construction of the well casings through the area in which the water table is located. The other primary issue — and the most significant concern for industry — is that if the plaintiffs prevail on their strict liability claims, it is likely this will have a significant negative effect on investment in the region, as investors and current natural gas operators would be wary of their liability exposure. As these two cases are the first of their kind to have been brought in Pennsylvania, it is likely that the way in which they are decided will greatly influence future litigation.

B. Regulatory Controls

The Marcellus Shale spans several states, and thus is subject to regulation by a number of different regulatory bodies at all levels of government. Industry groups and environmental organizations are locked in a contentious war of public opinion, with both sides having important contributions to make on issues such as safety, environmental conservation and protection, and energy security. Below is a survey of several regulatory arenas that are representative of concerns of both industry and environmental groups. The outcome of the debate on these regulatory matters will significantly impact the ways in which development of the Marcellus Shale occurs.

Business and industry groups contest that the disparate array of governing authority has lead to “inefficiency and confusion when a company seeks to capitalize on a new source of natural gas such as the Marcellus Shale.”75 For example, in Pennsylvania natural

74 Id.
75 Laura C. Reader, Creating a Legal Framework For Regulation Of Natural Gas Extraction From the Marcellus Shale Formation, 34 WM. & MARY ENVTL. L. &
gas operators must comply with all the procedures to get a permit pursuant to the Oil and Gas Act, with programs set forth by the Bureau of Oil and Gas management; follow rules set forth by the Coal and Gas Resource Coordination Act, the Oil and Gas Conservation Law, the Clean Streams Law, as well as those established by interstate commissions, including the Delaware River Basin Commission ("DRBC"); and abide by local municipality zoning and land use regulations. Industry groups argue that these regulations are often redundant, and that the regulations and rules ultimately result in bureaucratically induced inefficiencies that natural gas operators are forced to navigate and overcome. Furthermore, they contest that compliance with the rules and processes created by this amalgam of mandates from various local, state and federal regulatory bodies takes a vast amount of time and money, and is a significant impediment to the development of the Marcellus Shale.

Conversely, environmental groups, non-profits, and local governing bodies contest this narrative, and contend that not only are current regulatory measures ineffective in mitigating the significant collateral damage resulting from these extraction techniques, but that additional measures and regulations are needed to properly oversee such a burgeoning and exponentially expanding industry. These groups cite, in Pennsylvania alone, numerous cases of well contaminations, property damage, uncontrolled blowouts, surface spills, and other air and water polluting events that have occurred since natural gas operators have concentrated their activities in the state.

This debate has manifested itself in discussions regarding the viability of The Fracturing Responsibility and Awareness of Chemicals ("FRAC") Act. The FRAC Act is an important piece of legislation that is currently being considered in Congress and could have a significant impact on the development of the Marcellus Shale. On June 9, 2009, Colorado Representative Diana Degette introduced this bill to both the U.S. House of Representatives and
the U.S. Senate. The stated purpose of the FRAC Act is to close what is known as the “Halliburton Loophole,” which was created by an amendment to the Safe Drinking Water Act and exempted natural gas operators from having to disclose the chemicals used in their fracturing activities. The Energy Policy Act of 2005 amended the safe Drinking Water Act by altering section 300h(d) to read as follows:

The term “underground injection” –
(A) means the subsurface emplacement of fluids by well injection; and
(B) excludes –
(i) the underground injection of natural gas for purposes of storage; and
(ii) the underground injection of fluids or propping agents (other than diesel fuels) pursuant to hydraulic fracturing operations related to oil, gas, or geothermal production activities.

The FRAC Act is a potential cause for concern for natural gas operators because not only does the Act require them to disclose the chemical composition of their fracking fluids, but also the exact chemical formula. This information is currently considered a trade secret, and thus is proprietary. The threat of full disclosure may affect the extent to which oil and gas companies decide to invest in the Marcellus Shale. The passage of the FRAC Act also potentially indicates to these energy companies a slippery slope of federal regulatory intrusion into the field. Louis D’Amico, who is the Executive Director of the Independent Oil and Gas Association, in testimony before the Pennsylvania House Environmental Resource and Energy Committee on Marcellus Shale Development, stated that some of the regulatory obstacles, such as the proposed FRAC Act, stand in the way of realizing the full potential of the Marcellus

79 Id. at 7–8.
shale play.\footnote{Reader, \textit{supra} note 75, at 1026.} One scholar even went so far as to say that if the FRAC Act was passed “oil and natural gas trapped in shales, and other unconventional sources of natural gas would remain stranded because of the added regulatory hurdles that the FRAC Act seeks to impose on the domestic oil and gas production.”\footnote{Deweese, \textit{supra} note 78, at 32.} However, proponents of the bill argue that it simply “lifts the veil of secrecy currently shrouding this industry practice,” and that if the industry stands behind their contention that fracking fluids are not dangerous, then they have no reason to hide their chemical composition from the public.\footnote{Jeremy Miller, \textit{Of Hydraulic Fracturing and Drinking Water}, \textsc{New York Times Green Blog} (June 30, 2009, 10:17 a.m.), http://green.blogs.nytimes.com/tag/frac-act/.} This point was reiterated when the FRAC Act was reintroduced to the House of Representatives in March of 2011, when U.S. Representative Jared Polis stated the Act “restores a basic, national safety-net that will ensure transparency within the industry and safeguard our communities. If there is truly nothing to worry about, then this bill will lay the public’s concern to rest through science and sunlight.”\footnote{Jessie Thomas-Blate, \textit{FRAC Act Re-introduced in Congress}, \textsc{American Rivers} (Mar. 24, 2011), http://www.americanrivers.org/newsroom/blog/frac-act-re-introduced-in-congress-3-24-2011.html.}

The fact that many natural gas operators have begun to voluntarily disclose the basic chemical make-up of their fluids\footnote{See, e.g., FracFocus, http://fracfocus.org/ (last visited Jan. 16, 2011).} without the passage of the FRAC Act leads to the conclusion that some of the concerns raised by industry regarding this piece of legislation were overstated. However, the full consequences of the passage of the Act remain to be seen, and will only truly crystallize until such time that the FRAC Act does become law.

An additional regulatory matter that has the potential to greatly influence the development of the Marcellus Shale is the way in which water is distributed. The development of natural gas from tight shale formations, such as the Marcellus Shale, requires the use of massive amounts of water for commercial recovery of the natural
gas. The typical Marcellus Shale well requires nearly four million gallons of water per fracturing job. The Susquehanna River Basin Commission ("SRBC"), DRBC and the Pennsylvania Department of Environmental Protection ("DEP") together regulate the energy companies’ water consumption in the Marcellus Shale region by "requiring permits for water withdrawals and consumptive use over certain thresholds." Combined, the Susquehanna River Basin and the Delaware River Basin provide water for over eighteen million people and overlie significant portions of the Marcellus Shale, and thus the groups have a vested interest in ensuring the conservation and quality of this resource. The SRBC and DRBC have both expressed "concerns about the impact of withdrawals on local public water supplies, possible contamination of groundwater supplies or surface water bodies . . . and fragmentation of wildlife habitat and disturbance of sensitive lands adjacent to water bodies." Industry experts conversely contend that the northeastern states that overlie the Marcellus Shale have an enormous abundance of water, more than enough to satiate the needs of the rapidly growing natural gas extraction industry. Natural gas drilling companies and their supporters often point to the fact that golf courses consume significantly more water than natural gas wells; however, what is conveniently forgotten when making such comparisons is that water used for drilling is forever lost from the hydrogeologic cycle, while the water used in golf courses is not. Researcher Robert Beck asks

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86 Id. at 428.
88 Id.
89 Id.
91 Id. at 3.
Beck argues in the affirmative, stating that the relationship between our water resources and our energy agenda is one such that “if there is a real conflict between life-sustenance uses of water and energy production, life sustenance must prevail. Use of potable water should be prohibited if non-potable water is adequate and available.” More specifically, he argues that if certain natural gas extraction activities are not bound to a particular location, they should be required to locate where there is more, rather than less, water available.

As pressure increases from “existing water users, we should expect to see courts, administrators, and legislators all paying more attention to our water supply as we progress over the next few years.” Some scholars believe that a tension between water demand for consumptive purposes will conflict with its use for oil and gas recovery, and that ultimately the life sustenance uses will prevail. In California, there are already prohibitions on the use of drinkable water; the California Water Code states that, “[a] person . . . shall not use water from any source of quality suitable for potable domestic use for non-potable uses . . . if suitable recycled water is available.” For surface water located in common law riparian doctrine jurisdictions, such as those states overlying the Marcellus Shale, “a riparian landowner may only make a reasonable use of the water, and this is a correlative right, so it is subject to the right of every other riparian to make a reasonable use as well.” Therefore, state permitting agencies in these states have great power as to what allocation of water the operators receive. This could have a great impact on the development of the Marcellus Shale, because if state agencies believe that domestic use of water will suffer if water is diverted to energy development activities, the permitting agency likely will not issue permits.

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92 See Beck, supra note 85.
93 Id. at 423.
94 Id.
95 Id.
96 Id.
97 Id. at 453.
In addition to the use of the water for oil and gas recovery, another problem exists in the disposal of the flowback water that is recovered from the well, which has the potential to pollute other water supplies if not sufficiently treated. The treatment of this flowback water is of particular concern because many rural areas do not have wastewater treatment capacity, and the residents rely solely on well water; therefore, there exists a lot of pressure on local municipalities to make sure that proper regulatory controls are in place for flowback water disposal.

C. Infrastructure Development

The final category of factors that will influence the speed and extent to which the Marcellus Shale is developed is the expansion of distribution infrastructure. This factor may ultimately have the largest impact on shale gas development. There are several

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98 NOTHSTINE, supra note 87, at 8.
99 Beck, supra note 85, at 429.
100 NOTHSTINE, supra note 87, at 9.
significant challenges with regards to infrastructure that industry
must address in order to fully actualize the Marcellus Shale’s
potential. These concerns include the need for new construction
and maintenance of local transportation networks, and the growth
of pipeline delivery systems. Without the requisite expansion of
infrastructure a chokepoint will develop that will ultimately disrupt
market demand.

The existing infrastructure for natural gas extraction in the
Marcellus Shale is the “least developed of major shale basins.”
One problem that has materialized is the impact of drilling activities
on local transportation networks. Natural gas operators need to
transport heavy equipment, pipes, and other construction materials
to well pads in order to construct the drilling rig. Additionally,
large amounts of water and other hydraulic fracturing materials,
such as sand and chemicals, need to be transported. The explosion
in development has resulted in frequent traffic and heavy loads that
have caused “considerable wear and tear on rural roads that were
not built with such activity in mind.” The Executive Director of
the Southern Tier East Regional Planning and Development Board,
who supports a multi-county region in New York that covers the
Marcellus Shale, has raised concerns that local roads are often too
narrow and not strong enough to support the onslaught of trucking
required to effectively develop the region’s natural gas plays. Also,
the massive quantities of sand used in each well, sixteen truck loads
per fracturing operation, need to be imported from New Jersey and
Midwestern states as the sands local to the Marcellus Shale region
are not of the correct size and shape. This added freight traffic
has put a strain on the short line rail infrastructure, as they were not
envisioned to handle this type of heavy freight.

101 Connors, supra note 2, at 63.
102 Nothstine, supra note 87, at 6.
103 Id.
104 Id.
105 Id.
106 Id.
107 Id. at 7 (The sand required is a spherical shape, rather than the angular shape
which is native to Pennsylvania).
108 Id.
The State of Pennsylvania has begun trying to address these local transportation network problems by issuing regulations on the ways in which local roads can be used by drilling operators. The Pennsylvania Department of Transportation ("PennDoT") has "placed weight limits on state roads; companies whose vehicles exceed the limit must post a bond to use the road, which is then used to fund repairs."\textsuperscript{109} For example, Bradford County has seen a fourfold increase in the number of roads that have weight limit signs, raising its total to 130.\textsuperscript{110} In some situations, local officials have even directly negotiated with energy companies to "offset the costs of repairing roads damaged by truck traffic related to the drilling."\textsuperscript{111} Such local cooperation provides an effective model for other rural counties that would like to make their region accessible to drilling operations and the benefits that come along with that access, but that are at the same time concerned about the strain it will put on their public transportation systems. These local transportation networks are currently being stressed in ways that local governments are unable to respond to or alleviate. There is legislation that is pending which would assess an "impact fee" to natural gas operators, which would then be provided to the local municipality where the drilling was taking place in order to help bolster local infrastructure improvement and maintenance projects.

There are a number of challenges facing energy companies in developing a more extensive distribution system. The Marcellus Shale is located among states that are more densely populated and have less experience with natural gas production than states in other major producing shale basins, such as Texas, Louisiana, Alabama, and Oklahoma.\textsuperscript{112} As a result, more roadblocks exist for pipeline companies who want to obtain access to the land necessary to lay their pipes. Additionally, there is a strong possibility of cost increases and time delays in construction due to terrain and weather extremes that require routing reviews, planning and topographical studies.\textsuperscript{113}

\textsuperscript{109} Id. at 6.
\textsuperscript{110} Id.
\textsuperscript{111} Id.
\textsuperscript{112} CONNORS, supra note 2, at 63.
\textsuperscript{113} Derek Weber, \textit{From Drake to the Marcellus Shale Gas Play—Midstream Devel-}
For example, Pennsylvania has some of the highest densities of stream mileage per unit of land in the United States, resulting in complications for constructing water-crossing pipelines.\textsuperscript{114} Furthermore, “Not In My Backyard” concerns also raise problems for the development of the needed pipelines and other facilities to transport the gas to market. With respect to Pennsylvania, the Marcellus Shale Coalition has articulated that the “state is lacking in the infrastructure needed for Marcellus Shale gas to compete with other states and sources of supply.”\textsuperscript{115} Ultimately, insufficient pipeline development leads to price volatility, shrinking markets, stranded gas supplies, and reduced economic activity.

However, the vast potential of the Marcellus Shale has created enormous interest in its development.\textsuperscript{116} One obvious advantage of the Marcellus Shale to pipeline companies is its proximity to the significant markets in the Northeast; it has better “economics” as compared to other gas “plays.”\textsuperscript{117} Lee Van Atta, vice president of an energy consulting firm, believes somewhere between three and four billion dollars will be spent in the next four years on pipeline infrastructure.\textsuperscript{118} Currently, there are several major transmission pipelines either under construction or certified for construction in the region.\textsuperscript{119} These pipelines have the combined capacity to transport over one Bcf/day. Additionally, there are planned extensions of already existing pipelines that would increase capacity another 4.8 Bcf/day.\textsuperscript{120} These improvements are critical as it is estimated that less than half of the current wells in Pennsylvania have pipeline access.\textsuperscript{121} There are also significant amounts of wet gas (“NGL”) wells in southeastern Pennsylvania that currently lack sufficient

\textsuperscript{114}Id.
\textsuperscript{115}CONNORS, supra note 2, at 64.
\textsuperscript{116}Id.
\textsuperscript{117}Id.
\textsuperscript{119}CONNORS, supra note 2, at 64.
\textsuperscript{120}Id.
\textsuperscript{121}Id.
processing capacity and outlets for the gas. This has the potential to restrict wet gas production in the Marcellus Shale.

Industry groups are attempting to open up new markets to natural gas through expanded pipeline construction. One such project involves the construction of two different pipelines, one to Chicago and one to Ontario, which would ease some of the pressure on these NGL outlets. Also, in Canada, TransCanada Corp. and Union Gas Ltd., two major pipeline companies, have recently announced “open season” calls to gauge interest in reversing the flow of their existing export pipelines to change them into import pipelines to receive feeds from the Marcellus Shale and pump that gas into the Ontario market. Ernst and Young’s Jon McCarter estimates that over the next couple of years the available capital for investment purposes in the Marcellus region could be valued at “north of $50 billion,” and potentially as high as $100 billion. Important lessons can be learned from the problems encountered in the development of the Barnett Shale in Texas. It is largely believed that there was simply not enough pipeline capacity built in the Barnett region, and “that in the final assessment not many facilities were too big, but many were too small and that planning will prove critical in the Marcellus.” This very well could be a problem for the Marcellus Shale, in order for the price of natural gas to rise – and thus remain profitable to operators – pipeline capacity must rapidly increase, otherwise a significant glut in the market will keep prices down.

Investor confidence will play a large role in the development of the Marcellus Shale because the infrastructure as it stands now is not adequate to meet the needs of energy companies. While these infrastructure issues certainly pose a significant challenge both environmentally and financially, development will need to continue in order to drive demand.

122 Id.
123 Id.
124 Id.
126 Id. at 20.
127 Id. at 23.
IV. Analysis of the Impact of the Development of the Marcellus Shale on Downstream Natural Gas Energy Markets

The way in which legal challenges, regulatory controls, and infrastructure growth are addressed in the Marcellus Shale region will significantly affect downstream energy markets. Two general models will be discussed below. One possible outcome is a rapid and extensive development of the Marcellus Shale due to the mitigation of significant legal challenges, loose regulatory controls, and significant investment in infrastructure. The second possibility is the inverse, with costly litigation issues, tight regulatory controls, and hesitant investment.

The close physical location of the Marcellus Shale to energy markets in the Northeast, with the implied lower transportation costs, “could translate into lower gas prices for the region’s consumers.”128 This proximity also provides an advantage to Marcellus gas in the marketplace, as gas from other locations might be excluded from the market due to logistics with distance. These markets have traditionally relied upon liquefied natural gas (“LNG”) imports from terminals along the Eastern Seaboard, as well as natural gas via pipeline from Canada and the Gulf of Mexico (“GOM”).129

A recent report by consulting group Bentek, which surveyed the probable impact of the development of the Marcellus Shale, suggested that production would grow from 2.3 Bcf/day in the first quarter of 2010 to somewhere between four and six Bcf/day by 2015.130 This is a massive increase in only five years. Bentek argues that Marcellus gas is well positioned because gas continues to demand a higher price along the East Coast in comparison to other regions. The “break even” price for Marcellus producers is lower than the “break even” prices for other top shale basins such as Haynesville, Fayetteville, and Barnett.131 The report concludes

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128 Connors, supra note 2, at 64.
129 Id.
131 Id.
that “[t]he superior drilling economics of the Marcellus will allow Marcellus production to grow, and will force production from other supply areas to shrink, leading to a major shift in US gas flows and prices.”

Natural gas from the Marcellus Shale also likely will capture some market share from oil in the Northeast from “residential heating conversions and retirement of several large, old oil-fired or dual fuel steam power plants.” That being said, it is likely that Marcellus Shale production will need to competitively displace other gas sources that are currently supplying this region. Some analysts suggest that the seasonal high price premiums in the Northeast above the Henry Hub “will likely decline as utilization of gas supply routes from Western Canada and the Gulf Coast drop.” This ultimately could shift GOM gas from the Northeast to the Southeast, which would be a very attractive development to those consumers, as that region now is on the “high-priced end of the Western coal supply chain.”

Some analysts even suggest that not only will this affect regional and national U.S. markets, but development of the Marcellus Shale could even have a significant impact on international natural gas markets. In fact, Shell, BP, and Exxon have all begun buying up acreage in France, Sweden, Hungary, Poland, and Austria that potentially contain significant shale formations. Modeling from the Baker Institute has found that the development of the Marcellus Shale will have long lasting effects on LNG redirection, which may lead to a lessening of supply and leverage from countries such as Russia and Iran, in part “through the strengthening of European consumer markets.” An additional outlet for all this natural gas will be through LNG export facilities; currently the Federal Energy Regulatory Commission (“FERC”) has identified at least seven

132 Id.
133 Vaezey, supra note 118.
134 Id.
135 Id.
136 Id.
137 Connors, supra note 2, at 64.
different potential or proposed project sites. While exporting natural gas runs counter to the narrative of energy independence fostered by industry groups, if all of the applications for export facilities are approved over a fifth of the natural gas currently being produced in the U.S. could potentially be sent overseas.

However, there is also a possibility that despite being a significant gas play, the Marcellus Shale embodies too many inherent problems, which will ultimately limit its impact on these different markets. A combination of costly legal battles over environmental concerns, tight regulatory controls, and bottlenecks constraining natural gas transportation to the Northeast’s major markets could all coalesce to prevent the Marcellus Shale from reaching its true potential. The decision in the Berish case, and New York’s future regulations will have a profound effect on how the Marcellus is developed. Additionally, while production costs might indicate that the Marcellus shale is a winner, these figures often do not include significant “sunk” costs and fees for infrastructure build outs. For example, it is estimated that in Pennsylvania it may cost up to $12 million per mile of pipeline construction, well above what it would be worth to undertake the construction. Additionally, some analysts say that not enough drilling has been done to exactly pinpoint the estimated rates of recovery, which are necessary to determine the economic viability of the shale. This is particularly important because some states, such as Pennsylvania, do not publish monthly production data for analysts to evaluate. As a result, investors are put in an awkward situation of completely relying on the operators themselves for production reports. This obviously creates a conflict of interest that could result in operators inflating their plays. All of

140 Id.
142 Id.
these factors play into the significant price volatility of natural gas. In the second quarter of 2012, due to low prices, Chesapeake Energy plans on cutting back its dry gas wells in northeastern Pennsylvania, and cut overall production by 0.5 billion cubic feet of gas. In the face of a ten-year low in natural gas prices, some of which is due to the extremely mild winter of 2011–2012, many other companies have also decided to shut in wells and cut down on production in hopes of driving up prices. Despite the condition of the current market, the INGAA predicts that by 2021 natural gas prices will rise to somewhere between six and seven dollars per MMBtu.

While different analysts have released reports supporting both of these two outcomes, most of the experts evaluating the potential of the Marcellus Shale agree that strong growth and rapid development is the more likely scenario despite the current glut in the market. However, if the infrastructure is not developed to increase takeaway capacity and prices for natural gas stay low, there is a reasonable chance that the Marcellus Shale will be “more sizzle than steak.”

**CONCLUSION**

Recent technological innovations, including horizontal hydraulic fracturing methods, have made the development of the Marcellus Shale an exciting prospect in the U.S. energy industry. There exist three important driving factors that will determine what effect this natural gas play has on energy markets both in the United States and abroad. These factors are legal challenges, regulatory controls, and infrastructure development. Studies suggest that the Marcellus Shale will in fact be a “game changer” and will have

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significant ramifications for consumers all across the eastern portion of the United States. While the Northeast does not have the same experience that other major gas producing areas do, it is likely that policy makers will learn from the mistakes and successes of older shale plays and develop the Marcellus in such a way to benefit both industry and consumers alike.

That being said, there are numerous environmental concerns that cannot be ignored. These include concerns over wastewater disposal, subsurface fluid and gas migration, accidents and spills, habitat destruction and forest fragmentation from well pad and infrastructure development, air pollution and particulate deposition from compressor stations and truck traffic, storm water runoff from construction activities, and changes in stream flow volumes adversely affecting water ecosystems. Additionally, the widespread adoption of natural gas will only act to stunt the growth and development of renewable energy options. Ultimately, this issue turns on a number of important decisions that currently lay in the hands of courts, lawmakers, and investors who all have the capability to significantly affect the future of the Marcellus Shale and this form of resource extraction.