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# SHALE GAS DEVELOPMENT: THE IMPLICATIONS OF THE SHALE GAS REVOLUTION FOR THE NATURAL GAS INDUSTRY

# Mark R. Haskell\* Leví McAllíster †

In the last ten years, new extraction techniques including hydraulic fracturing promise to expand domestic natural gas production substantially.<sup>1</sup> Shale gas is currently estimated to account for approximately twenty-five percent of domestic natural gas production.<sup>2</sup>

Shale gas has the potential to create new producing regions,<sup>3</sup> but it requires the creation of new infrastructure or the redesign and redeployment of existing infrastructure

<sup>&</sup>lt;sup>\*</sup> Mark R. Haskell is a Partner with the law firm of Morgan, Lewis & Bockius in Washington, DC. He is a 1982 graduate of the University of Maine and a 1985 graduate of Harvard Law School. His practice has focused primarily on regulatory compliance, enforcement, litigation, and dispute resolution affecting market participants in the natural gas, oil, petrochemical, and electric industries. The views expressed in this article are those of the authors alone and do not necessarily reflect those of the authors' law firm or its clients. The authors and their firm represent, among other clients, natural gas producers and marketers, local distribution companies, end-users, and one developer of an LNG export terminal project.

<sup>&</sup>lt;sup>†</sup> Levi McAllister is an Associate with the law firm of Morgan, Lewis & Bockius in Washington, DC. He is a 2003 graduate of the University of Texas at Austin and a 2008 graduate of American University's Washington College of Law.

<sup>&</sup>lt;sup>1</sup> Elisabeth Rosenthal, U.S. Is Forecast to Be No. 1 Oil Producer, N.Y. TIMES, Nov. 13, 2012, at B6, available at http://www.nytimes.com/2012/11/13/business/energy-environment/report-sees-us-as-top-oil-producer-in-5-years.html?ref=us.

<sup>&</sup>lt;sup>2</sup> DELOITTE CTR. FOR ENERGY SOLUTIONS, PUBLIC OPINIONS ON SHALE GAS DEVELOPMENT 1 (2012), *available at* http://www.deloitte.com/assets/Dcom-UnitedStates/Local%20Assets/Documents/Energy us er/us er ShaleSurveypaper 0412.PDF.

<sup>&</sup>lt;sup>3</sup> See DELOITTE MARKETPOINT LLC & DELOITTE CTR. FOR ENERGY SOLUTIONS, MADE IN AMERICA: THE ECONOMIC IMPACT OF LNG EXPORTS FROM THE UNITED STATES 6 (2011), available at http://www.deloitte.com/assets/Dcom-

UnitedStates/Local%20Assets/Documents/Energy\_us\_er/us\_er\_MadeinAmerica\_LNGPaper\_122011.pdf [hereinafter DELOITTE, MADE IN AMERICA].

to access markets.<sup>4</sup> Shale gas also carries with it the potential for the transformative disruption of existing supply and transportation networks.<sup>5</sup>

This article explores some of the implications of the "shale gas revolution." As explained below, the development of hydraulic fracturing and the production of shale gas fields promise to change the domestic and global natural gas industry in several ways. Due to the increased access to domestic gas resources through shale gas production, the price that gas marketers can receive for the sale of dry natural gas has been declining, which has prompted many marketers to focus increased attention to marketing natural gas globally through natural gas exports. <sup>6</sup> Due to the geographic location of shale gas fields, the historical relationship between natural gas basis differentials is changing, and a need for the construction of new natural gas infrastructure (or the realignment of existing infrastructure) is becoming apparent.<sup>7</sup>

## A. Volatility in Natural Gas Prices

In 2009, as natural gas producers began to produce shale gas by applying hydraulic fracturing extraction techniques, natural gas prices rapidly declined.<sup>8</sup> According to the Energy Information Administration, natural gas prices in the first seven months of 2012 are 70.3% lower than the average annual wellhead price of 2008.<sup>9</sup>

Natural gas now appears to be plentiful and abundant.<sup>10</sup> Utilities, manufacturers and other end users are looking at record low prices.<sup>11</sup> Further, the petrochemicals industry has seen a revival, which is driven in large part by the record low gas prices resulting from the abundance of shale production.<sup>12</sup>

<sup>&</sup>lt;sup>4</sup> See David L. Goldwyn, *Making an Energy Boom Work for the U.S.*, N.Y. TIMES, Nov. 12, 2012, http://www.nytimes.com/2012/11/13/business/energy-environment/making-an-energy-boom-work-for-us.html?pagewanted=all.

<sup>&</sup>lt;sup>5</sup> See DELOITTE, MADE IN AMERICA, *supra* note 3.

<sup>&</sup>lt;sup>6</sup> Daniel Gilbert & Tom Fowler, *Natural Gas Glut Pushes Exports*, WALL ST. J., Oct. 5, 2012, at A1, *available at* http://online.wsj.com/article/SB10000872396390444223104578036403362012318.html.

<sup>&</sup>lt;sup>7</sup> See DELOITTE, MADE IN AMERICA, supra note 3.

<sup>&</sup>lt;sup>8</sup> Matthew Philips, *Is Natural Price Too Cheap to Drill?*, BLOOMBERG BUSINESSWEEK, Apr. 17, 2012, http://www.businessweek.com/articles/2012-04-17/is-natural-gas-too-cheap-to-drill.

<sup>&</sup>lt;sup>9</sup> See ENERGY INFO. ADMIN., U.S. DEP'T OF ENERGY, MONTHLY ENERGY REVIEW NOV. 2012 131 tbl. 9.10 (Nov. 2012), available at http://www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf. Table 9.10 provides the annual average wellhead price of natural gas since 1973 through 2009. *Id.* Table 9.10 also provides the average wellhead price of natural gas for each month during 2010, 2011 and the first seven months of 2012. *Id.* In 2008, the average wellhead price of natural gas was \$7.97. *Id.* In contrast, the average wellhead price of natural gas for the first seven months of 2012 was \$2.37. *Id.* 

<sup>&</sup>lt;sup>10</sup> Gilbert & Fowler, *supra* note 6.

<sup>&</sup>lt;sup>11</sup> Id.

<sup>&</sup>lt;sup>12</sup> See Molly Ryan, Houston Sees Resurgence in Manufacturing Due to Petrochemical Rebirth, HOUS. BUS. J., July 27, 2012, http://www.bizjournals.com/houston/print-edition/2012/07/27/petrochemical-rebirth.html?page=all.

However, the downtrend in natural gas pricing has also been a cause for concern for production companies. Some production companies may have entered into leasing arrangements prior to 2009 when gas prices were at record highs.<sup>13</sup> With low gas prices, many shale gas developers are facing financial challenges, and production companies are finding it unprofitable to pursue shale gas production.<sup>14</sup> As Maynard Holt, co-president of Tudor Pickering Holt & Company reportedly said, "[w]e just killed more meat than we could drag back to the cave and eat."<sup>15</sup> Declining prices can inhibit investment in infrastructure and cause the delay or deferral of drilling programs. Low prices have caused some industry participants to divert investment from shale formations producing dry natural gas liquids.<sup>16</sup>

# **B.** Renewed Interest in Natural Gas Exports

Increased supplies of natural gas resources coupled with declining domestic natural gas prices has created a separate, but related, issue with respect to shale gas development: the possibility of exporting natural gas.<sup>17</sup> Prior to the shale gas revolution, the United States was historically an importer of natural gas.<sup>18</sup> However, that perspective could be changing.

Natural gas may be exported in liquid form if the necessary infrastructure is developed and the required regulatory approvals are obtained. The process of exporting natural gas first requires the gas to be cooled in order to become liquefied natural gas (LNG), which is then pumped into natural gas tankers that are used to ship the LNG overseas.<sup>19</sup> Currently, however, the United States only has one operational processing plant that is able to liquefy gas and load it into such tankers.<sup>20</sup> That facility, the Kenai LNG Plant, is located in Nikiski, Alaska and currently exports LNG to Asia.<sup>21</sup>

The decreased availability of nuclear power post-Fukushima has contributed to an

<sup>&</sup>lt;sup>13</sup> See Clifford Krauss & Eric Lipton, *After the Boom in Natural Gas*, N.Y. TIMES, Oct. 20, 2012, at BU1, *available at* http://www.nytimes.com/2012/10/21/business/energy-environment/in-a-natural-gas-glut-big-winners-and-losers.html?pagewanted=all.

<sup>&</sup>lt;sup>14</sup> *See id.* 

 $<sup>^{15}</sup>$  Id.

<sup>&</sup>lt;sup>16</sup> Valerie Wood, *Natural Gas Price Picture May Change by Late 2012*, PIPELINE & GAS J., Sept. 2011, at 16.

<sup>&</sup>lt;sup>17</sup> Gilbert & Fowler, *supra* note 6.

<sup>&</sup>lt;sup>18</sup> Id.

<sup>&</sup>lt;sup>19</sup> See, e.g., Rebecca Smith & Mari Iwata, Japanese Buyers Line Up for U.S. Shale Gas, WALL ST. J., May 24, 2012, at B8, available at http://online.wsj.com/article/SB10001424052702303505504577406061245167558.html (describing export process, which requires cooling and liquefying gas before loading it onto tankers).

 <sup>&</sup>lt;sup>20</sup> Yereth Rosen, ConocoPhillips Restarts LNG Exports from Alaska, REUTERS, June 14, 2012, available at http://www.reuters.com/article/2012/06/14/us-conoco-lng-idUSBRE85D06C20120614.
<sup>21</sup> Id.

export natural gas.<sup>23</sup> Federal law requires that approval be obtained from the Department of Energy (DOE) prior to exporting natural gas.<sup>24</sup> The authorization necessary to export depends on the country to which the gas will be exported. For example, the DOE possesses no discretion to deny an export application if the natural gas is to be exported to a country with which the United States has a Free Trade Agreement (FTA).<sup>25</sup> In contrast, the DOE performs a broader review of an export application if the natural gas is to be exported to a country with which the United States does not have a FTA.<sup>26</sup>

About a dozen applications seeking authorization to export LNG to non-FTA countries are currently pending before the DOE.<sup>27</sup> Companies seeking export authorization have argued to DOE that exports would lead to more jobs in the United States, and the revenues would help reduce the trade deficit.<sup>28</sup> Despite such possible benefits, the DOE has stated that it will not make any further decision on whether or not to approve such applications until it conducts an analysis into the economic impact of LNG exports.<sup>29</sup> The DOE has been commissioned to examine that impact, and an initial report was anticipated to have been issued in March 2012.<sup>30</sup> The report continues to be delayed.<sup>31</sup>

<sup>27</sup> Office of Oil & Gas Global Sec. & Supply, Office of Fossil Energy, U.S. Dep't of Energy, Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States (as of Nov. 29 2012), http://fossil.energy.gov/programs/gasregulation/reports/Long%20Term%20LNG%20Export%20Concise %20Summary%20Table%2011-29-12.nwood.pdf.

<sup>28</sup> See, e.g., LNG Development Company, LLC; Application for Long-Term Authorization To Export Liquefied Natural Gas Produced From Canadian and Domestic Natural Gas Resources to Non-Free Trade Agreement Countries for a 25-Year Period, 77 Fed. Reg. 55,197-02, 55,198 (Sept. 7, 2012) (describing creation of new construction jobs and projected reduction in trade deficit).

<sup>29</sup> See Susan L. Sakmar, *Politics and US LNG Export Project Heat Up*, NAT. GAS & ELECTRICITY J., Oct. 2012, at 1, *available at* http://www.naturalgaselectricitynews.com/sample-articles/politics-and-us-lng-export-projects-heat-up.aspx.

<sup>30</sup> U.S. Government Further Delays LNG Export Decision, ICIS HEREN (Mar. 30, 2012, 10:51 AM), http://www.icis.com/heren/articles/2012/03/30/9546199/us-government-further-delays-lng-export-decision.html.

<sup>31</sup> *Id*.

2012

<sup>&</sup>lt;sup>22</sup> See Smith & Iwata, supra note 19.

<sup>&</sup>lt;sup>23</sup> *See id.* 

<sup>&</sup>lt;sup>24</sup> 15 U.S.C. § 717b (2006).

<sup>&</sup>lt;sup>25</sup> See U.S. Dep't of Energy, *Fossil Energy: How to Apply*, ENERGY.GOV, http://www.fossil.energy.gov/programs/gasregulation/How\_to\_Obtain\_Authorization\_to\_Import\_an.html (last updated Nov. 6, 2012).

 $<sup>^{26}</sup>$  See id.

## C. A Shift in Basis Relationships

The shale revolution affects not only the absolute level of natural gas prices but the relative locational value of natural gas in local markets. In other words, shale gas development disrupts historical basis relationships.

The term "basis differential" refers to the difference between daily natural gas spot prices at regional hubs compared to the Henry Hub.<sup>32</sup> A large sustained basis demonstrates an opportunity to profitably construct a pipeline. Such differentials can occur due to congestion and bottlenecks between markets, which could be attributed to insufficient supply in a particular market.

Because the majority of domestic natural gas supply originated in the Gulf Coast region, obtaining natural gas in the Northeastern United States, for example, required transporting gas to that region from the Gulf Coast.<sup>33</sup> The price for natural gas in the Northeast United States would often be higher than the price for that same gas in the Gulf Coast region, reflecting, among other things, the cost of transportation and related services.<sup>34</sup> In turn, the basis differential with respect to a Northeastern hub would differ from a differential with respect to a Gulf Coast hub.

The shale revolution changes these historical basis relationships. Significant shale gas resources are located in geographic locations that have not been accustomed to producing natural gas.<sup>35</sup> North Dakota, Michigan, New York, Pennsylvania, Ohio, and West Virginia all hold significant amounts of natural gas that could be extracted through hydraulic fracturing.<sup>36</sup>

Recall that a large sustained basis differential demonstrates an opportunity to profitably construct a pipeline. As basis differentials shift, geographic regions where bottlenecks and/or constraints exist will also shift.<sup>37</sup> As a result, it may no longer be as profitable for a developer to construct a pipeline in a particular location. Instead, new strategies must be considered in light of the changing relationship among differentials.

<sup>&</sup>lt;sup>32</sup> See, e.g., DELOITTE, MADE IN AMERICA, *supra* note 3, at 15 (describing differential between Henry Hub and New York City prices).

<sup>&</sup>lt;sup>33</sup> See id. at 6.

 $<sup>^{34}</sup>$  *Id.* at 13.

<sup>&</sup>lt;sup>35</sup> See, e.g., John A. Sullivan, *Thanks to Bakken, North Dakota Could Surpass California Output*, NAT. GAS. WK., May 31, 2010, at 8, *available at* 2010 WLNR 12262297 (describing North Dakota's rising production of Bakken shale gas).

<sup>&</sup>lt;sup>36</sup> *Id.\_See also* Ben Casselman & Russell Gold, *Cheap Natural Gas Gives Hope to Rust Belt*, WALL ST. J., Oct. 24, 2012, http://online.wsj.com/article/SB10000872396390444549204578020602281237088.html.

<sup>&</sup>lt;sup>37</sup> See DELOITTE CTR. FOR ENERGY SOLUTIONS & DELOITTE MARKETPOINT LLC, NAVIGATING A FRACTURED FUTURE INSIGHTS INTO THE FUTURE OF THE NORTH AMERICAN NATURAL GAS MARKET 14 (2011), *available at* http://www.usea.org/sites/default/files/eventfile/511/Natural Gas Study Presentation for USEA.pdf.

#### D. Infrastructure Development

The production of natural gas resources from shale plays affects the development of natural gas infrastructure in the United States. These implications concern both the need for new infrastructure in certain regions as well as impact on existing infrastructure with respect to the recovery of its costs.

In order to efficiently utilize natural gas extracted from shale plays, the necessary infrastructure must exist. This includes sufficient pipeline capacity to transport the extracted gas to a processing facility, processing facilities to process that gas, and pipeline capacity to transport processed gas to the market.<sup>38</sup> In many plays, this infrastructure has not yet materialized.

For example, Ohio is currently struggling with how to address such challenges with respect to the gas available for extraction from the Utica shale play. <sup>39</sup> Since December 2009, over 320 drilling permits have been issued by the Ohio Department of Natural Resources.<sup>40</sup> However, only slightly more than 110 wells have been drilled and, of those, only fourteen are currently producing natural gas or oil.<sup>41</sup> A lack of processing plants and pipelines has been cited as one of the reasons that production is not rapidly increasing.<sup>42</sup>

The development of new infrastructure comes with its own set of challenges. Depending on the proposal, state and perhaps federal regulatory approvals are required from the applicable regulator.<sup>43</sup> Those approvals relate to, among other things, the siting of the proposed project, an inquiry into whether the public interest requires the proposed project and, whether environmental risks warrant rejection of the proposed project.<sup>44</sup> Collectively, obtaining all required approvals and constructing a project is a time-intensive process that can take several years before the requisite infrastructure becomes operational.

Aside from new infrastructure development, the shale gas revolution creates

<sup>&</sup>lt;sup>38</sup> See Liam Denning, *Pipe Dreams in America's New Energy Landscape*, WALL ST. J., July 30, 2011, http://online.wsj.com/article/SB10001424053111904800304576476154127256730.html.

<sup>&</sup>lt;sup>39</sup> Jeff Bell, *Ohio's Shale Play Delayed by Infrastructure Needs*, COLUMBUS BUS. FIRST, Aug. 10, 2012, http://www.bizjournals.com/columbus/print-edition/2012/08/10/infrastructure-needs-delay-drilling-in.html?page=all.

<sup>&</sup>lt;sup>40</sup> *Id*.

<sup>&</sup>lt;sup>41</sup> *Id*.

<sup>&</sup>lt;sup>42</sup> *Id*.

<sup>&</sup>lt;sup>43</sup> See, e.g., Regulations Implementing the Energy Policy Act of 2005: Coordinating the Processing of Federal Authorizations for Applications Under Sections 3 and 7 of the Natural Gas Act and Maintaining a Complete Consolidated Record, 71 Fed. Reg. 30632-01 (proposed May 30, 2006) (to be codified in 18 C.F.R. pt. 153, 157, 375, 385) (describing collaboration necessary to harmonize regulatory requirements in natural gas projects).

<sup>&</sup>lt;sup>44</sup> See Jeremy Knee, Rational Electricity Regulation: Environmental Impacts and the "Public Interest," 113 W. VA. L. REV. 739, 758 (2011).

challenges for existing infrastructure owners and developers. Because natural gas supplies historically originated in the Gulf Coast region, natural gas was delivered to markets through interstate transportation pipelines.<sup>45</sup> Those pipelines, and the rates that they charge shippers of natural gas on their systems, are regulated by the Federal Energy Regulatory Commission (FERC).<sup>46</sup> The FERC employs a cost-of-service rate design approach whereby a natural gas pipeline is permitted to recover the cost of providing service plus a reasonable return on its investment.<sup>47</sup> As a result, the rates a natural gas shipper pays depend on the cost the pipeline incurs to provide transportation services. As shale gas production increases in geographic regions that historically received gas supplies by interstate transport, those regions will require that less gas be transported via interstate pipelines originating in the Gulf Coast. In turn, owners of existing interstate pipelines could have lower demand for long-haul capacity over time. Changes in usage patterns could in theory change existing pipeline rate structures and lead to the adoption of new rate zones or new rate designs. These changes will pose challenges for pipelines and customers alike and affect depreciation of existing facilities, and increase competition between pipeline primary service offerings and the secondary market for released capacity.

## E. Conclusion

Shale gas production has been heralded as a positive development by many.<sup>48</sup> The existence of previously unanticipated natural gas resources in areas that historically have not been hotbeds for natural gas production creates jobs for those regions and provide financial injections into local economies.<sup>49</sup> Similarly, increased natural gas supplies have resulted in lower natural gas prices for consumers of that gas.<sup>50</sup>

The long-term effective and efficient development of shale gas resources carries with it both opportunity and significant risk. Pipelines, pipeline customers, consumers, and marketers will be coping with the consequences of this fundamental shift in supply conditions over the coming years.

We are in midst of a significant transition of the domestic natural gas industry. Will natural gas development continue at current levels given depressed pricing conditions? Will regulators facilitate the development of a truly international market for

<sup>&</sup>lt;sup>45</sup> See DELOITTE, MADE IN AMERICA, *supra* note 3, at 6, 13.

<sup>&</sup>lt;sup>46</sup> Fed. Energy Regulatory Comm'n, *What FERC Does*, http://www.ferc.gov/about/ferc-does.asp (last visited Nov. 13, 2012).

<sup>&</sup>lt;sup>47</sup> See Knee, supra note 44, at 747.

<sup>&</sup>lt;sup>48</sup> See, e.g., Jim Efstathiou Jr., *Fracking Will Support 1.7 Million Jobs, Study Shows*, BLOOMBERG BUSINESSWEEK, Oct. 23, 2012, http://www.businessweek.com/news/2012-10-23/fracking-will-support-1-dot-7-million-jobs-study-shows (describing President Obama's support of hydraulic fracturing to increase jobs in the United States).

<sup>&</sup>lt;sup>49</sup> *Id*.

<sup>&</sup>lt;sup>50</sup> Gilbert & Fowler, *supra* note 6.

natural gas by approving LNG export projects? How do changes in basis differentials interact with the need for infrastructure development? How will the costs of infrastructure idled by new sources of production be paid? Only when some of these questions are answered can we realistically assess the true impacts of the shale revolution.