NATURAL GAS BRIEFING DOCUMENT #3:

Prevailing Debates Related to Natural Gas Infrastructure

Investments and Emissions

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PREFACE

In May 2011, the Brookings Institution Energy Security Initiative (ESI) assembled a Task Force of independent natural gas experts, whose expertise and insights provided inform its research on various issues regarding the U.S. natural gas sector. In May 2012, Brookings released its first report, analyzing the case and prospects for exports of liquefied natural gas (LNG) from the United States. The Task Force now continues to meet periodically to discuss important issues facing the sector. With input from the Task Force, Brookings will release periodic issue briefs for policymakers.

The conclusions and recommendations of this report are those of the authors and do not necessarily reflect the views of the members of the task force.

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Introduction

Less than one decade ago, it was conventional wisdom that the United States was becoming the largest importer of natural gas in the world. Hundreds of millions of dollars were invested to prepare the country for imports of liquefied natural gas (LNG). Today, because of the large-scale extraction of natural gas from shale rock layers, policy debates in the U.S.—like the industry—have taken a U-turn. Discussions no longer focus on security of supply for the United States, but rather on the question how long domestic prices will remain low and attract energy-intensive industries and jobs, and the lucrative promise of exports of natural gas to Asian and European markets.

The surge in domestic natural gas production does not pass unnoticed. Domestically, two debates have emerged that are linked to natural gas infrastructure. First, and foremost, in some parts of the country investors in infrastructure have difficulty keeping pace with the extraction of natural gas. Though arguably this time lag is part of a regular energy production cycle (put bluntly, it takes far less time to drill a well and produce natural gas than to construct a pipeline to transport that natural gas) recently policy initiatives have been launched to address the continued mismatch between upstream (production) and midstream (transportation). It is worth noting that several long-term uncertainties make it difficult to validate investments in assets which need several decades to make a decent rate of return. Second, and linked to the extraction of shale gas, there is increased attention for fugitive methane emissions. Upstream methane leakage is also one of the major environmental concerns that continue to be linked to shale gas extraction. Recently a number of studies were published regarding methane emissions related to energy transportation (midstream). Subsequently there has been discussion whether additional regulation would be useful and/or appropriate to minimize or prevent methane leakage in the future.

This policy brief discusses both these debates that are linked to natural gas infrastructure. It does so by describing the status quo, the concerns that have come with it, and the recent policy initiatives that have been proposed. The first part of the brief is about investments in natural gas infrastructure, while the second part is on emissions related to natural gas infrastructure. The brief ends with short conclusions, on whether these policy initiatives are expected to be effective, or whether additional policies or research may be helpful. The content of this brief is based on discussions that took place in the Natural Gas Roundtable, held at the Brookings Institution on November 8, 2013. The content cannot be ascribed to any of the participants in the roundtable, except the Brookings scholars.

PART I – Investments in Natural Gas Infrastructure

Natural gas production has soared in the last decade, and conventional wisdom is that in the foreseeable future the United States will become a potential net exporter of the commodity.[1] It is unclear whether the country will in fact become a net exporter however, as the U.S. policy regarding the permission to export natural gas to countries without a free trade agreement continues to raise questions. It seems that both proponents and opponents of exports would benefit from more straightforward policy procedures.[2]

Domestically, the surge of production has motivated market entities to look for new ways to utilize the newly found resources. Also, in cases where natural gas is in fact a byproduct of oil production, such as in the plains of North Dakota, companies find new ways to capture natural gas and get it to the markets.[3] However, most structural changes, for instance using natural gas in the transportation sector, require long-term investments and planning. Therefore, despite ambitious programs in several parts of the country, in the short term no large shifts and impacts on domestic natural gas production and consumption can be expected from the transportation sector. An obvious and much debated option is to increase the share of natural gas in electricity generation. Indeed, in recent years the share of natural gas in electricity generation has risen, contributing to the often lauded reduction of greenhouse gas emissions in the United States.[4] It is worth noting that this shift to natural gas, mostly from coal-fired electricity generation, was facilitated initially because existing natural gas plants were generally operating at low capacity, which allowed for opportunistic market behavior.[5] According to the Energy Information Administration's (EIA) *Electric Power Annual 2009*, in 2008 combined cycle gas-fired power plants operated at 40.6 percent average capacity, in contrast to coal-fired electricity plants, whose average capacity factor was 72.2 percent.[6] Today the market is expressing its increasing belief that natural gas usage in the United States is a long-term phenomenon, as confirmed by the more than 12,500 MW of installed capacity that came into service between January 2012 and October 2013.[7]

Substantial uncertainties regarding the long-term prospects of shale gas production in the United States remain. The 2013 Energy Information Administration forecast suggests that domestic natural gas production is going to increase by 44 percent in the period from 2011 to 2040, from 22 tcf to 33.1 tcf.[8] Yet it is worth keeping in mind that several of the large shale rock formations, particularly the large Marcellus shale, have only partly been extensively production-tested (in the case of Marcellus this is because of the continued ban on hydraulic fracturing in New York State). Also, many of the wells have been drilled only in recent years, and it is therefore

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[1] The most recent EIA energy outlook (2014) suggests that the surge in domestic production is not going to be a short-term phenomenon - http://www.eia.gov/todayinenergy/detail.cfm?id=14211.
[2] http://www.brookings.edu/research/reports/2013/08/19-revising-lng-export-process-ebinger-avasarala.
[3] http://www.nytimes.com/2013/12/18/business/energy-environment/applying-creativity-to-a-byproduct-of-oil-drilling-in-north-dakota.html?hpw&rref=business&_r=0.
[4] http://www.ft.com/intl/cms/s/0/3aa19200-a4eb-11e1-b421-00144feabdc0.html#axzz2CIz0siOk.
[5] Hultman et al., 2011. The greenhouse impact of unconventional gas for electricity generation. Environmental Research Letters, 6, 044008.
[6] http://www.eia.gov/electricity/annual/archive/03482009.pdf.
[7] Federal Energy Regulatory Commission (FERC), Office of Energy Projects Energy Infrastructure Update for October 2013 – Published on FERC website on November 20, 2013.
[8] http://www.eia.gov/forecasts/aeo/er/.

difficult to make predictions about their long-term productivity.[9] The *EIA Annual Energy Outlook 2014* forecasts that despite the significant drop in flow rates after the first years of production, wells tend to stay productive for a long period of time. Therefore, even though the number of wells that is drilled has fallen, production levels have not.[10]

Structurally using natural gas on a larger scale in the United States also requires additional investments in infrastructure. Traditionally domestic natural gas production has taken place in the Gulf Coast and Southwest Regions, and the long distance transportation system has been designed to move gas to markets in the North, Midwest and Northeast of the country. With a significant increase of natural gas consumption however, it could be that the existing more than 300,000 miles of transmission pipelines in the country will prove insufficient.[11] Furthermore, the surge in production of natural gas has taken place partly in areas of the country where traditionally little natural gas has been produced, e.g. Pennsylvania. Therefore, some of the existing infrastructure may have to be redesigned (for instance made bi-directional) to better facilitate the market.

The continued investment in transmission pipelines has also raised the interest of the U.S. Congress in this topic, and the role of the federal government in the permitting process of interstate (transmission) pipelines.[12] On November 21, 2013 the U.S. House of Representatives passed legislation H.R. 1900, the Natural Gas Pipeline Permitting Reform Act (vote tally 252-165), that aims to speed up natural gas pipeline approvals. Republican sponsors of the bill argued that the Federal Energy Regulatory Commission (FERC) should be required to make a decision about proposed pipelines within 12 months after submission, because currently natural gas cannot flow freely throughout the country, leading for instance to higher prices for natural gas in New England. Supporters of the bill, such as the INGAA, argued that although the FERC approval procedure generally works well, other permitting agencies (both at the federal and the state level) routinely ignore the deadlines that FERC sets.[13] Most Democrats opposed the legislation, saying that FERC already approves 92 percent of the proposed projects within 12 months, and that this legislation was not going to solve the problem of higher gas prices in the Northeast of the country.[14]

It is worth noting that during winter in New England, as in large parts of the country, demand for natural gas peaks, and therefore there may not be a business case to construct pipelines to facilitate this short period of peak demand. It also seems that requiring the regulatory authorities to decide within a 90 days period of time can have potentially negative effects. Most fundamentally, the 90 days requirement does not acknowledge the fact that decisions about constructing pipelines can be complex and delicate, due to a variety of reasons, such as population density, as well as security concerns, and environmental concerns. In these cases having a 90-day maximum consideration period may only force the regulatory authorities to make a negative decision, because they want to avoid making an uninformed decision or one that lacks public acceptance.

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[9] http://www.eia.gov/forecasts/aeo/er/.
[10] http://www.eia.gov/todayinenergy/detail.cfm?id=14211.
[11] http://www.aga.org/Kc/analyses-and-statistics/statistics/annualstats/disttrans/Pages/default.aspx.
[12] See Paul Performak, Congressional Research Service (2013) - https://www.fas.org/sgp/crs/misc/R43138.pdf.
[13] http://www.ingaa.org/Filings/11520/20863.aspx.
[14] http://thehill.com/blogs/e2-wire/e2-wire/191065-house-votes-to-speed-up-natural-gas-pipeline-approvals.

It is our impression that trying to design policy or regulations to address the investment gap does not appreciate where this problem originates. It takes roughly 30–45 days to move a drilling rig and start producing natural gas elsewhere. In contrast, one needs years to construct a pipeline and transport natural gas. In addition, with the surge in production there are reports of a lack of a qualified workforce to construct gathering lines and pipelines. Considering the rapid pace at which U.S. natural gas production has increased, it was never realistic to expect that infrastructure investments could keep up. In addition, there are no clear studies that have laid out how substantial this problem of lack of investment really is. Therefore, we are not certain whether the proposed policies can help solve the issue. In fact, it would be wise to first appreciate the origins of the perceived lack of investments, and to conduct more research on how long it takes the pipeline industry to catch up. By now, in some areas where production has increased so rapidly, one can expect that prices have stabilized, as an indicator that pipeline construction may have caught up. The bottom line we think is that more understanding of the basic problem would be helpful, and more analysis should be done before policies are amended.

PART II – Emissions Related to Natural Gas Infrastructure

Fugitive methane is the gas that is leaked during the complete fuel cycle, in other words from extraction to burning. Methane as a greenhouse gas is roughly 20 times more damaging than carbon, though it stays considerably shorter in the lower atmosphere.[15] In recent years these emissions have received increased attention. One of the reasons is likely to be the increased use of hydraulic fracturing in the U.S. The U.S. Environmental Protection Agency in 2012 estimated that 58 percent of the fugitive methane emissions come during field productions, for instance from the wells, gathering pipelines or at gas treatment facilities.[16] Other reasons for the increasing attention to methane emissions are the growth of concern about methane in general, and the prevailing question about what natural gas' place in the energy mix is or should be.

Emissions related to natural gas infrastructure received more attention, following the publication of a study that indicated that the urban gas systems in the city of Boston, Massachusetts, may suffer from substantial methane leakage. In Boston, researchers mapped over 3,300 cases of methane leakage linked to natural gas in the 785 road miles under study. They concluded that repairing leaky natural gas distribution systems will reduce greenhouse gas emissions, and moreover increase consumer health and safety, and save money.[17] In the summer of 2013 a similar study found substantial methane leakage rates from the gas distribution systems in Washington, D.C., which certainly contribute to climate change, with some even forming a safety hazard.[18] While these leaks from—often typically old—urban distribution systems may well be more widespread, and fixing them has obvious benefits, cities in particular are often places where financial means to address these issues are scarce.

In September 2013, the Environmental Defense Fund published its first in a series of 16 studies addressing methane emissions through the entire fuel cycle.[19]

[15] http://www.pnas.org/content/early/2012/04/02/1202407109.abstract.
[16] For more studies and information, visit http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html.
[17] Phillips et al., 2013. Mapping Urban Pipeline Leaks: Methane Leaks Across Boston. Environmental Pollution, 173, 1 – 4.
[18] http://www.scientificamerican.com/article.cfm?id=is-natural-gas-more-climate-friendly-washington-dc.
[19] http://www.pnas.org/content/110/44/17768.

Some analysts have been optimistic that these studies can help pinpoint where exactly fugitive methane emissions come from, subsequently helping to draft potential regulation to address the leakage. Others however, including one of the authors of the study, have pointed out that there are substantial limitations to the scope of the study and questioned how representative this case study is: there were a limited number of wells, all of them had green completions technology, and they were all agreed upfront by the industry. As a result, the outcomes will be best case data, which may not represent realistic emissions adequately. All studies observe how remarkably little is known about methane emissions, and where in the gas fuel cycle they in fact occur. While some of the upstream emissions will be addressed further following EPA regulations that take effect in 2015, more research is needed to establish whether, and if so, how regulations can help further reduce emissions from gas systems.

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