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The Strategic Importance of Shale Gas

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We have not adequately advanced priorities like education, energy, science and technology, and health care. We must transform the way we use energy—diversifying supplies....By doing so, we will enhance energy security, create jobs, and fight climate change.

—2010 U.S. National Security Strategy

Fuel powers the industrial production that strengthens the economy and provides the means to project national power. Reliable sources of energy are imperative to the security of the United States. Aside from coal, conventional natural gas deposits have been the most practical and easiest to recover. Approximately 24% of the United States energy is supplied by natural gas.[1] Broken down by sector, it is a major fuel source for a wide range of industries to include paper, metals, chemicals and food processing.[2] In addition to its industrial uses, natural gas is used to heat, cool, and cook in the residential and commercial sectors of the United States.[3] Due to its cleaner-burning properties, economic availability, and equivalent power to quantity ratio, it has become a favored alternative.[4] In terms of energy output natural gas provides one and one-third times as much energy as gasoline, which is very important in considering alternative fuel sources.[5] However, natural gas supply has been overtaken by the demand of the U.S. economy.

Approximately 30% of the global natural gas supply is now traded internationally, mostly within regional markets; this figure represents an increase from 2005 to 2010.[6] In 2009, the United States imported 3.7 trillion cubic feet (tcf) of its 24 tcf consumption, most of which was from Canada.[7] While this figure is not alarming, the future geopolitical implications of an increased need to import natural gas as a result of the widening disparity between domestic supply and demand causes some concern. The conflict with the conventional natural gas supply lies not in the present but the future. This increased reliance on foreign sources could pose at least two problems for the United States: it would decrease U.S. energy security; and it could create a "multi-billion dollar outflow of U.S. wealth to foreign interests," thus, increasing the U.S. balance of payments deficit and increasing the power of producing countries.[8] In addition, there is concern that strong dependence on coal for electricity production causes environmental problems due to the large amounts of CO_2 emissions that are reduced with natural gas.

1. *Natural Gas Facts. About Oil and Natural Gas.* American Petroleum Institute at www.api.org/aboutoilgas/natgas/ (accessed 25 June 2011)
2. *Ground Water Protection Council. Modern Shale Gas Development in the United States: A Primer.* U.S. Department of Energy Office of Fossil Energy. April 2009. 4
3. Ibid 4
4. Ibid 3
5. Muller, Richard. *Physics for Future Presidents: The Science Behind the Headlines.* (New York: W.W. Norton & Co., 2008), 69.
6. Ratner, Michael, *Global Natural Gas: A Growing Resource.* Congressional Research Service. 22 December 2010. www.crs.gov (accessed 23 June 2011), 7.
7. Ratner, Michael, *Global Natural Gas: A Growing Resource*. Congressional Research Service. 22 December 2010. www.crs.gov (accessed 23 June 2011), 18.
8. Ground Water Protection Council. *Modern Shale Gas Development in the United States: A Primer*. U.S. Department of Energy Office of Fossil Energy. April 2009. 4

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Energy security is the primary theme in discussing why increased domestic production of fuel is important in both geopolitical and international relations theory. The energy market within the scope of 21st century globalization is increasingly affected by global interdependence.[9] As a result, "small perturbations in one area can rapidly spread throughout a whole system."[10] Thus, the same structure that has the potential to unify nations has an equal if not greater chance of causing disruption to the global supply chain. This is especially true considering that a majority of the countries with large amounts of fuel reserves, be it oil or natural gas, lie in the developing world or in the United States.[11] One only has to look back to 2009 when Russia cut off gas to Ukraine to note how potentially detrimental globalization of fuel supply is to a nation's energy security.

While the international relations theory of realism suggests that countries tend to be in constant competition for resources and power, Daniel Yergin, in his April 2006 *Foreign Affairs* article, explains that in order to maintain energy security countries must understand how their interests are affected by several principles.

> *The first and most familiar is…diversification of supply. Multiplying one's supply sources reduces the impact of a disruption in supply from one source by providing alternatives…A second principle is resilience, a 'security margin' in the energy supply system that provides a buffer against shocks and facilitates recovery after disruptions…the third principle [is]recognizing the reality of integration. There is only one…market, a complex and worldwide system.…A fourth principle is the importance of information.*[12]

All of these principles are involved in the explanation of why it is important to develop alternative fuel supplies such as shale gas. Shale gas in particular, adds to diversity to the United States' energy, and enhances fuel supply resilience. This type of gas falls within the category of unconventional natural gas, which is defined by the National Petroleum Council as gas that comes from "a low permeability reservoir that produces mainly dry natural gas."[13] Also included in this class are tight gas sands, coal bed methane and gas hydrates.[14] It is shale gas that has proven to be the most productive thus far. Two factors have combined to promote the current development and production of shale gas.[15] The first is that economic conditions for natural gas have improved; and the second is the new application of directional drilling coupled with Hydraulic Fracturing ("hydrofracking").[16] This process involves steering a vertical well horizontally and then utilizing a water based mixture of chemicals to fracture the shale and allow natural gas trapped in the rock to flow to the well.[17]

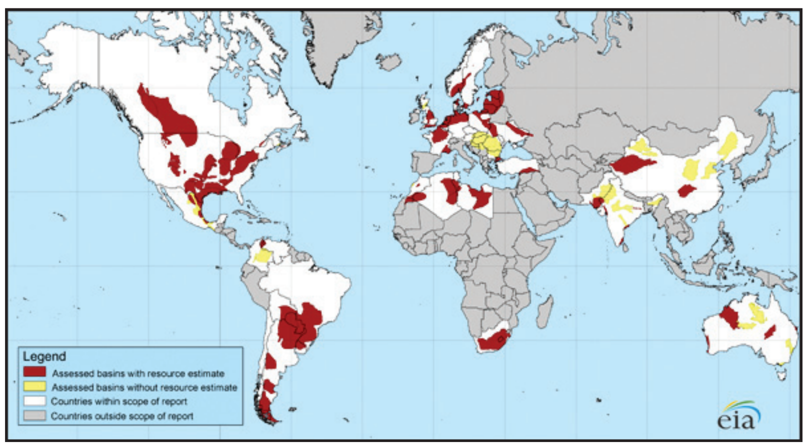

Figure 1: EIA's World Shale Gas Map

Spurred by the success of extracting gas in the Barnett Shale of north-central Texas, the exploration and mapping of other potential shale formations containing natural gas in the United States and the world has been conducted.

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9. Nye Jr., Joseph S. *Understanding International Conflicts: An Introduction to Theory and History*. 6th ed Pearson New York 2007. 207.
10. Ibid 208
11. Sloan, Geoffrey., "Sir Halford J Mackinder: The Heartland theory then and now," Journal of Strategic Studies 22:2-3 (24 Jan 2008), http://dx.doi.org/10.1080/01402399908437752 (accessed 29 June 2011)
12. Yergin, Daniel., "Ensuring Energy Security" *Foreign Affairs,* March/April 2006, http://www.lexisnexis.com/lnacui2api (accessed 5 July 2007) 3.
13. Lee, John., Perry, Kent. *Topic Paper #29: Unconventional Gas Reservoirs-Tight Gas, Coal Seams, and Shales.* National Petroleum Council Committee on Global Oil and Gas. 21 February 2007. At http://www.npc.org/Study_Topic_Papers/29-TTG-Unconventional-Gas.pdf (accessed 7 July 2011)4
14. "The rise of unconventional gas". *Natural Gas*. 26 March 2010. Industrial fuels and power at http://www.ifandp.com/article/003225.html (accessed 20 June 2011).
15. Soeder, Daniel J., Kappel, William M., *Water Resources and Natural Gas Production from the Marcellus Shale.* USGS. May 2009. At http://md.water.usgs.gov (accessed 23 June 2011).3
16. Ibid 3
17. Ibid 3

This map (Figure 1) from the Energy Information Administration (EIA) shows the locations of additional shale gas reserves.

There are positive prospects for the future of shale gas. From 2000 to 2006 U.S. production of gas from shale grew by an average of 17% per year.[18] Furthermore, from 2006 to 2010 productivity grew to an average of 48% each year. Figure 2 graphically depicts the dramatic increase in production of U.S. shale beds.

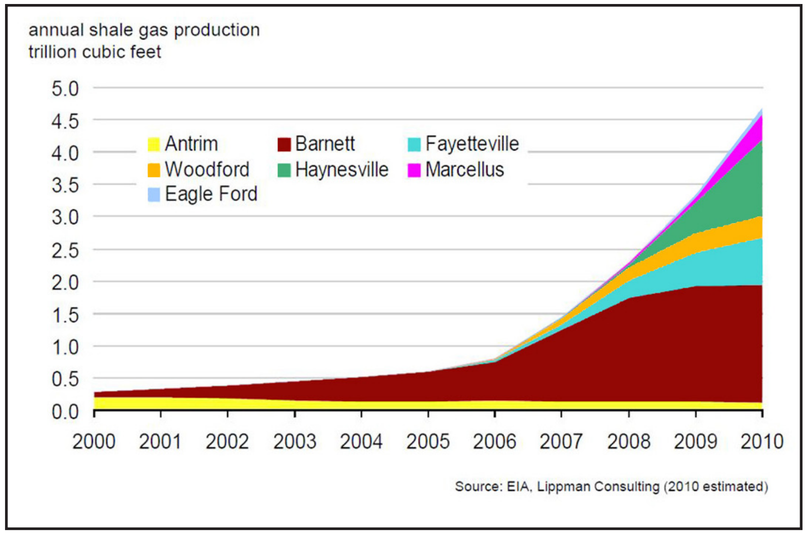

Figure 2: Annual Shale Gas Production in the United States. Source: EIA.

What makes shale gas look increasingly promising, in addition to its rapid production rate, is the assessment of the technically recoverable reserve by the EIA. The numbers from the most recent measurements in 2009 suggest that the total technically recoverable amount of shale gas in the United States is 861.7 tcf.[19] Assuming that consumption rates remain at the 2009 level of 24 tcf then this supply is estimated to last 34 years.[20] However, there are several variables in assessing the potential of the reserve. First is knowledge of the definitions of terms that comprise the total technically recoverable amount. Second, it is important to understand that these future estimations of amount and length of time can only be based on past figures and conceptual modeling. Thus, they may change and act as a dynamic system not isolated from regional and global economic effects.

Proved reserves are estimates of the quantity of natural gas that is recoverable with reasonable certainty under existing economic and operating conditions that can be demonstrated through the analysis of site geologic and engineering data. The location, quantity, and grade of the energy source are usually considered to be well established in such reserves.[21]

Total Technically Recoverable	861.7
Proved Reserves	35.1
Unproved Reserves	826.6
Inferred Reserves	770.6
Undiscovered resources:	56.0

Figure 3: Breakdown of quantity of shale gas in the United States (tcf). EIA's data group estimates that proved shale gas reserves as of the end of 2009 are 60.6 tcf.

Inferred resources are a little less certain than proved reserves as they are in unexplored extensions of the known field, with estimates of the quality and size based on geologic evidence and projection. Quantitative estimates are based largely on broad knowledge of the geologic character of the bed or region and based primarily on an assumed continuation from demonstrated areas for which there is geologic evidence.[22] Undiscovered technically recoverable resources are those deposits that have not been pinpointed but are generally expected to exist based on geological conditions and that are believed to be technically (but not necessarily economically) recoverable.[23]

These results speak as a positive attribute of shale gas, but there are potentially negative environmental effects of extracting the gas. Concern stems over the process of "hydrofracking" and how it impacts the region surrounding the drill site.[24] Hydraulic Fracturing requires shooting millions of gallons of water mixed with small amounts of sand and chemical additives into the underlying strata. Environmental activists are concerned that contamination of

18. *Annual Energy Outlook 2011 with Projection to 2035*. U.S. Energy Information Administration. April 2011 at www.eia.gov/forecasts/aeo/ (accessed 23 June 2011).37
19. Aloulou Fawzi (EIA), email message to author, 1 July 2011.
20. Ibid
21. Ibid
22. Ibid
23. Ibid
24. Walsh, Brian. "The Gas Dilemma," *Time*. 11 April 2011. 46

ground water may be caused by the leaching of the fracking fluid into aquifers and/or streams.[25] While proponents of shale gas defend the practice by saying that the chemicals in the fluid only make up roughly 0.5 percent of the total solution. However, it is difficult to determine the composition of the additives, because the industry treats the mixture as proprietary and isn't required to release the exact makeup.[26] According to a 2009 study by the Ground Water Protection Council, the chance of aquifer contamination was extremely low.[27] There have still been documented cases of fluid being leaked into the water system through streams and other surface water features, which causes concern about mishandling close to or at the surface.[28] Improper sealing of the cement base or leaks caused in the transfer of the fracking liquid to storage or transport containers is rare but still an issue that many in the vicinity of the wells and some government officials feel need to be addressed.[29] The state of New York has ordered a halt to shale gas operations until there is solid evidence that it is safe.[30] In spite of these concerns there remains strong support for shale gas.

At the strategic level, shale gas may have significant geopolitical impacts. Several key areas in the 2010 National Security Strategy are geared toward the very principles of diversification and resiliency, which Yergin suggests should be involved in the new framework of energy security. Efforts to invest "more heavily in research, improving education in science and math, [and] promoting developments in energy" are reflected through Congressional budget allocations.[31] Typically this support is in the form of credits such as the Energy Policy Act's Section 1345, which extended and modified Section 29, which had originally spurred the growth of unconventional gas.[32] This national endeavor as stated in the security strategy has already begun to trickle through the multiple levels of government. The U.S. Army has launched research and policy initiatives in order to better understand how alternatives such as shale gas can have an impact on future warfighting. In the April 2011 issue of the Torchbearer National Security Report produced by the Army's Institute of Land Warfare, a stated goal is to "build resilience through renewable [and] alternative energy."[33]

Expanding international cooperation is another strategic justification of shale gas.[34] The United States leads the world in commercial production, producing 20.6 tcf as of March 8, 2011 with its nearest rival being Canada, which extracted 5.63 tcf.[35] The difference is that domestic production in the United States is still 2.8 tcf short of consumption at the date reference point of the EIA report.[36] This deficit could be corrected easily as more drilling operations come online. United States domestic production of shale gas creates a diplomatic opportunity. As the United Stats continues to develop its technological capabilities and production data, it will have the means to encourage diplomatic relations by assisting other countries shown in Figure 1, which have the resources but not the means of production. It is imperative to remember that this fuel source has the potential to lessen strain on the global energy market, which can lead to economic stability and thus, greater regional security. Such a capacity is not inconsequential in an era of heightened competition with China and others for influence in the developing world.

The Unites States should recognize the geopolitical importance of energy production in a world characterized by an imbalance of energy supply and demand. The domestic production of shale gas reduces U.S. import supply vulnerabilities and creates opportunities for environmental diplomacy and low cost foreign assistance. That said, allowing uncontrolled exploitation of this resource without proper knowledge or supervision could make the process unsustainable and threaten the availability of the most precious human security resource of all, water. A national level review of the international and domestic implications of shale gas development and technology seems a necessary first

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25. Ibid 46
26. Ibid 46
27. Ibid 46
28. Ibid 47
29. Ibid 46
30. Ibid 47
31. *National Security Strategy 2010*. 30
32. *Nonconventional Fuels Tax Credit.* Independent Petroleum Association of America. February 2005. At http://www.ipaa.org/issues/factsheets/tax_capital/NonconventionalFuelsTaxCredit.pdf (accessed 7 July 2011)
33. *U.S. Army Energy Security and Sustainability: Vital to National Defense.* Torchbearer National Security Report April 2011. Institute of Land Warfare. Association of the United States Army. 7
34. *National Security Strategy 2010*. 30
35. *World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States.* U.S. Energy Information Administration April 2011. At http://www.eia.gov/analysis/studies/worldshalegas/pdf/fullreport.pdf (accessed 7 July 2011). 4
36. Ibid 4

step in understanding the potential for this resource to favorably impact U.S. national security for this and future generations.

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