Chapter Ten

Unconventional Gas Resources: A Transatlantic Shale Alliance?

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Although transatlantic cooperation on energy policies has been on the common agenda since the first oil crisis in 1973-74 and led to the creation of the International Energy Agency (IEA) in Paris at that time, the transatlantic partners hardly addressed energy security together throughout the 1980s and 1990s. In the light of liberalized market economies, European governments have mostly seen energy resources only as an economic and not a strategic good. Consequently, the supply of oil, gas and coal resources, and thus energy supply security, has been left largely in the hands of private European companies. Only oil and gas storage was seen as an area where European governments have direct responsibilities. These prevailing assumptions were bolstered by the fact that until recently Europe had not experienced any major energy crisis since the 1970s. As a result, and in contrast to the U.S., where oil supply security in particular has always been a major concern of U.S. government, industry and business circles, European governments did not view energy security as a strategic issue or a challenge.

These circumstances changed with the first Russian-Ukrainian gas crisis in 2006, when EU governments recognized that energy supply security was becoming a major policy challenge, given rising fossil fuel imports and dependencies.[1] A year later, in March 2007, EU member

[1] The following analysis is based on Maximilian Kuhn and Frank Umbach, "Strategic Perspectives of Unconventional Gas: A Game Changer with Implications for the EU`s Energy Security." A EUCERS Strategy Paper, Vol. 01, No. 01, May 2011 (London: EUCERS/King's College, 2011). (available at: http://www.eucers.eu/wp-content/uploads/EUCERS_Strategy_Paper_1_Strategic_Perspectives_of_Unconventional_Gas.pdf)—and new information and insights from recent analyses and

states were able to agree on the world's most ambitious "integrated energy and climate policy," which also envisages a proactive energy foreign policy of the EU-27 to promote energy partnerships around the globe with other countries and regions.[2] These energy partnerships also seek to promote the diversification of rising oil and gas supplies from new producer and exporter countries as well as related new transmission supply projects of pipelines, oil and LNG terminals. The *Southern Corridor* project and the *Nabucco* gas pipeline, for instance, are aimed to increase gas imports from the Caspian region as well as from the Middle East in order to reduce the European gas dependency on Russia and its monopoly supplier Gazprom.[3] In this context, transatlantic cooperation on various energy issues, such as oil and gas pipelines, energy efficiency, technology innovations, carbon capture and storage projects, smart grids, energy storage, e-mobility and related climate protection policies have increased since 2006, even though the U.S. and the EU as well as their private energy companies are simultaneously competitors around the globe. Transatlantic cooperation between both sides of the Atlantic has also been institutionalized with the EU-U.S. Energy Council, which has established many common expert working groups and generated transatlantic conferences between official and private actors.[4]

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conferences, including an expert hearing on the prospects for shale gas in Europe in the European Parliament on September 20, 2011 in Brussels.

[2] See also European Commission, "The EU Energy Policy: Engaging with Partners beyond Our Borders. On Security of Energy Supply and International Cooperation." Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee of the Regions, SEC(2011)1022/1023 final, COM(2011) 539 final, Brussels, 7 September 2011; and F. Umbach, "Global Energy Security and the Implications for the EU," Energy Policy, Vol. 38, Issue 3, March 2010, pp. 1229-1240.

[3] See also F. Umbach (2011), 'The Black Sea Region and the Great Energy Game in Eurasia', in: Adam Balcer (Ed.), *The Eastern Partnership in the Black Sea Region: Towards a New Synergy*, demosEUROPA, Warsaw 2011, pp. 55-88; and idem (2011), "Energy Security in Eurasia: Clashing Interests," in: Adrian Dellecker/Thomas Gomart (Eds.), *Russian Energy Security and Foreign Policy* (Routledge: Abingdon-New York, 2011), pp. 23-38.

[4] See, for instance, Franklin Kramer/John R. Lyman, *Transatlantic Cooperation on Sustainable Energy Security. A Report of the Global Dialogue between the European Union and the United States*, The Atlantic Council/Centre for Strategic & International Studies (CSIS), Washington D.C., February 2009 and Richard L. Lawson/John R. Lyman/

The global energy future is shaped by unprecedented uncertainties, however, ranging from mitigating climate change to building the right energy mix for each country with the objective of reducing dependencies and gaining energy security. In light of such uncertainties, the emerging global gas market can be summarized in one word: volatile.

As a cleaner-burning alternative to coal and oil for electric power generation, natural gas is an attractive "transition fuel" towards a low-emission global energy mix, a potential which may or may not be fully realized, depending on the evolution of the structure of the gas market itself, as well as on energy policies by key players. Today's distinct regional gas markets—where demand is more or less fully satisfied by national or regional supply—will become more integrated under the impact of the present "gas glut," with more flexible forms of trade, such as liquefied natural gas (LNG), and through the continuing liberalization and integration process of the EU energy markets. Traditional views on geographic distribution and "energy security" are increasingly being challenged, and will require continuous adjustments from industry, governments and new technology providers. Players will need to understand more intimately rapidly changing markets and pricing structures and will have to invest in diversification for both supply and demand to achieve greater strategic flexibility. Changes—irrespective of the outcome—will have a significant impact on transatlantic relations, national economies and, ultimately, on consumers.

In this complex setup it makes particular sense to analyze unconventional gas more closely, not only as the one issue of most interest, but also because it is relatively new to the concept of transatlantic cooperation. Both continents—the U.S. and Europe—have had disconnected and independent natural gas markets in the past, with their own history and industry structure, in which natural gas has been historically transported by pipeline and only since the late 1990s transports from producing regions by ship through liquefaction (LNG) became more common. With the growing role of LNG in the natural gas markets, the U.S. and European markets became more interconnected, especially in their efforts to secure resources in producing

Mihaela Carstei, *A Shared Vision for Energy and Climate Change. Establishing a Common Transatlantic Agenda*. A Joint Project of the Atlantic Council of the United States and Clingendael International Energy Program, in cooperation with the Institute for the 21st Century Energy, Washington D.C., March 2010.

countries. Overshadowed by growing LNG markets, further pushing globalization, however, a national development had been ignored by most of the major IOCs until around 2006-2007: the development of unconventional gas in the U.S., in particular shale gas.

Unconventional gas (shale gas, tight gas and coal-bed methane) development is not a revolution but rather an evolution of utilizing modern techniques and combining two key technologies—horizontal drilling and "slick water" hydraulic fracturing—which eventually cracks shale rock and thus cracked the code for opening up major North American shale gas resources. However, the release of unconventional gas resources triggered what can rightly be called a revolution in global gas markets. Unconventional gas not only transformed the U.S. energy market, and in particular the natural gas market, but it was also the tipping point of a fundamental change in global gas markets. An increase in incremental U.S. non-conventional shale gas production coincided with other critical economic, political, and technological factors—the drop of demand linked to the global recession and the arrival of new LNG delivery capacity—which all together created a sudden global "gas glut" and, thus, laid the groundwork for an expanded role of natural gas in the world economy,[5] or a "Golden Age of Gas," as the International Energy Agency (IEA) put it.[6]

In early June 2010, the Bureau of Intelligence and Research in the U.S. Department of State and the U.S. National Intelligence Council invited European energy experts and representatives of European gas companies to Vienna to introduce the American shale gas revolution, its new drilling technologies, and to debate its impact on the European gas market. Since that time, transatlantic discussions and cooperation on shale gas in Europe have increased, and U.S. energy companies increasingly invest in potential European unconventional gas fields. But unlike the North American case, the development of natural gas in Europe and Eurasia depends on the development of a com-

[5] For a detailed report comparing U.S. and European unconventional gas development, including its historic development, see Kuhn and Frank Umbach, op. cit.

[6] IEA, "Are We Entering a Golden Age of Gas?". Special Report. *World Energy Outlook 2011*, Paris 2011.

plex set of cross-border relationships for the build-up of pipelines at the intergovernmental, regulatory and corporate levels.[7]

The following analysis examines the rapidly changing natural gas markets and the role of unconventional gas as well as its impacts on European energy security and transatlantic energy policies. It will highlight in particular the geo-economic and geopolitical implications and discuss whether a "Transatlantic Shale Alliance" is possible.

Why Look at Global Natural Gas Markets?

For decades to come natural gas will be a critical element in the fundamental climate, economic and political calculations made by all major economies, primarily as a transition fuel for a renewable energy mix. Natural gas is and will remain an essential component of the energy mix for a variety of reasons: massively increased global and regional established gas reserves; competitive economic costs; a relatively favorable carbon footprint when properly developed and transported; and a natural synergy with the large-scale development of intermittent electricity sources. Most recently, gas has provided a partial substitute for the loss or delay of (new) nuclear power generation after the Fukushima disaster.

The growth of commercial gas reserves by almost 30% over the last decade is due to the fact that oil companies have begun to search, explore, and produce gas, as well as to technological advances in developing and transporting natural gas. Moreover, natural gas will become more relevant for the renewable energy industry because "Green Gas," or SNG (Synthetic or Substitute Natural Gas), can both provide storage and transport energy by using already existing infrastructure. Natural gas will provide a balancing option for renewable energy and the possibility to store and save electricity through conversion into natural gas. Thus, gas will not only be a bridge to a sustainable future

[7] See also David Victor, Amy M. Jaffe and Mark H. Hayes (eds.), *Natural Gas and Geopolitics. From 1970 to 2040* (Cambridge-New York: Cambridge University Press, 2006) and Paul Stevens, *The 'Shale Gas Revolution': Hype and Reality*. A Chatham House Report, London, 2010.

energy mix, but also remain a systematic component in the provision of energy security.[8]

Natural gas is currently the world's third largest source of primary energy and gas reserves are more geographically dispersed than oil, with many of the world's top consumers holding significant domestic reserves—especially when taking into account unconventional gas like shale gas, coal bed methane (CBM), tight gas and others. The fact that 63% of gas reserves is located in regions other than the Middle East makes gas more attractive to governments wishing to reduce their energy (i.e. oil) dependency on this presumably unstable region. According to the 2010 BP Statistical Review, proven global (conventional) natural gas reserves in 2010 amounted to 187.1 trillion cubic meters (tcm) with a reserve-to-production (R/P) ratio of 59 years, compared with 46 years (including Canadian oil sands, based on 2010 production levels) for oil.[9] Natural gas may become the fastest growing fossil fuel until 2035, increasing by up to 2% annually.[10]

Natural gas is increasingly seen as a viable source of energy due to improvements in technology, changed regulatory frameworks, and the fact that gas is seen as the "greenest" fossil fuel.[11] Until a few years ago, however, declining indigenous production in the U.S. and Europe, and consumer markets increasingly seeking more distant supplies, meant that LNG deliveries from often remote sources, had became more prevalent. Future dependencies on a few countries—notably Russia,

[8] For further reading on the future potential of natural see Robert A. Hefner III, *The Age of Energy Gases: The Importance of Natural Gas in Energy Policy*, speech and paper by Robert A. Hefner III at the Aspen Institute's Aspen Strategy Group's conference "The Global Politics of Energy," Aspen, Colorado, August 2007. Available at: http://www.ghkco.com/downloads/ASG-ImportanceofNaturalGasinEnergyPolicy 08.07.doc

[9] See BP, op. cit., p. 7 and 20.

[10] See IEA, op. cit.

[11] However, even though a new study by the *National Center for Atmospheric Research* has concluded that a greater reliance on natural gas will emit far less CO_2 than the use of coal (up to 50% higher), it would fail to slow down climate change significantly. While coal use and CO_2 emissions are detrimental to the environment, release of comparatively large amounts of sulfates and other particles from natural gas cools the planet by blocking incoming sunlight. Furthermore, analyses of climate change are also complicated by the uncertainty regarding the amount of methane (often seen as much more dangerous than CO_2 for climate change) that leaks from natural gas operations—see "Switching from Coal To Natural Gas Would Do Little for Global Climate, Study Indicates," *European Energy Review*, 12 September 2011.

Qatar, Iran, Turkmenistan, and Australia—that control the bulk of conventional gas reserves would have become more dominant. Energy security issues arose out of concerns over energy imports and threatened independent decision-making mainly of European countries, thus posing a threat to transatlantic strategies. The use of the energy weapon as a political tool created tensions between supplier and consuming countries. But unconventional gas is not only abundant and available all over the world, it also challenges the market power of producer countries as well as potential supplier cartels (such as the Gas Exporting Countries Forum/GECF), and thus strengthens the position of consuming countries.

A New Gas World Arising—Unconventional Gas as a Major Driver

The advantage of unconventional gas is that it is a domestic source of fuel supply that enhances the energy security of the respective country. As pointed out before, the U.S. unconventional gas success story has been a paradigm shift that has turned expectations upside down. It has essentially been a "game changer" for the emerging world gas market. Developing unconventional gas reserves attracts foreign direct investment (FDI), creates new jobs, and helps to diversify away from other imported fuels, or, in the case of the U.S., help the country gain energy independence.

The reward of accessing these very large unconventional gas volumes is that their potential is vast—it is a resource several times greater in magnitude than that of conventional sources. Estimates of recoverable resources are growing at a greater pace as technological advances permit access to gas from "unconventional" resources. The most prolific shale reservoirs are relatively flat, thick, and predictable; the formations are so large that, once drilled, the wells are expected to produce gas at a steady rate for decades. Generally, it is assumed that shale gas wells flow rates are considerably lower than their conventional peers, but once production stabilizes, a well could produce consistently for 30 years or more.[12]

[12]Joseph H. Frantz and V. Jochen, *When Your Gas Reservoir Is Unconventional, So Is Our Solution—Shale Gas*, Schlumberger, October 2005.

While recoverable conventional gas resources are estimated to amount to 404 tcm, unconventional gas resources are estimated at over 900 tcm (according to the US Geological Survey (USGS) and the German Federal Institute for Geosciences and Natural Resources (BGR).[13] From these 900 tcm, at least 380 tcm appear to be recoverable, which brings the total recoverable conventional and unconventional gas resources to nearly 800 tcm—equivalent to about 250 years of current production.[14] In addition to the U.S., the biggest potential of unconventional gas is currently seen in the region of the former Soviet Union (CIS), Central Asia and China. But given the lack at present of sufficient geological information and credible exploration drilling test data outside of the U.S., prospects for unconventional gas production are likely to remain uncertain for at least the next 2-5 years.

Nevertheless, exploration drilling for shale gas and coal-bed methane has already begun in China, India, Canada, Australia (i.e. coal bed methane production) and Europe (tight gas has been identified in Poland, Hungary and Germany).[15] The U.S. Energy Information Administration (EIA), in its *International Energy Outlook 2010*, estimated that the unconventional gas production of Canada and China will amount to 63% and 56%, respectively, of their total domestic gas production in 2035 (Reference Scenario).[16] The Paris-based IEA, being rather conservative regarding estimates for future worldwide unconventional gas production, expects that around 35% of the global increase in gas production—from 3,149 bcm in 2008 to 4,535 bcm in 2035 (44% in the timeframe)—will come from unconventional gas sources.[17]

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[13]United States Geological Survey, "World Petroleum Assessment," Boulder, Colorado, 2000; BGR, "Reserves, Resources and Availability of Energy Resources" (Hannover: *German Federal Institute for Geosciences and Natural Resources*, 2009).

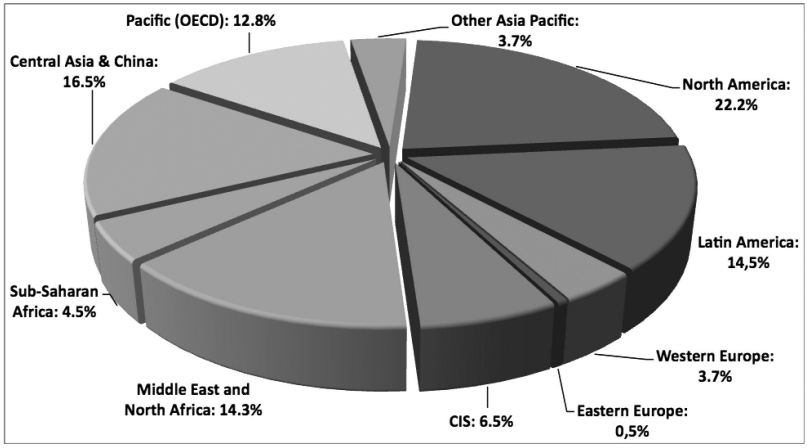
[14]IEA (2010), *World Energy Outlook 2010*, Paris (OECD/IEA). See also Alex Forbes, "The Great Potential of Unconventional," *European Energy Review*, December 9, 2009.

[15]IEA, Ibid; BGR, op. cit.

[16]EIA, *International Energy Outlook 2010* (Washington D.C.: EIA, 2010).

[17]IEA, *World Energy Outlook 2010*. An even more conservative outlook is presented by the World Energy Council, "Survey of Energy Resources: Focus on Shale Gas" (London: WEC, 2010).

Figure 1. Regional Distribution of Tight and Shale Gas Resources



Source: BGR, Reserves, Resources and Availability of Energy Resources. Hannover/Germany 2009, p. 93.

In April 2011 EIA published a commissioned report offering a new assessment of worldwide shale gas resources. The report analyzed 48 shale gas basins in 32 countries, containing almost 70 shale gas formations. However, it excluded other potential regions such as Russia, the Middle East, Southeast Asia, and Central Africa because they either have large conventional gas reserves (i.e. Russia and the Middle East) or lack sufficient information to carry out an initial assessment. Although the report represents "a moderately conservative 'risked' resource" assessment for basins, the findings of the initial assessment conclude that the worldwide shale gas resource estimate adds another 40% to the world's total of technically recoverable gas resources, representing an increase from 16,000 to 22,600 trillion cubic feet (tcf).

The EIA report also concluded that surprisingly China holds technically recoverable assets of around 50% more than the U.S. Although some important regions have not been included, the report's evaluation shows that the assessed worldwide shale gas resources are already

[18]See EIA, *World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States* (Washington D.C.: U.S. Department of Energy, April 2011).

significantly larger[18] than assumed in the only previous study conducted by H-H. Rogner in 1997.[19]

The IEA expects that total gas production In China will rise from 80 bcm in 2008, to 140 bcm in 2020 and 180 bcm in 2035 and that the "bulk of the increase" in tight gas, coal bed methane and shale gas is expected within this timeframe. In November 2009 China signed a cooperation agreement with the United States on shale gas development projects. China's National Energy Administration (NEA) is currently drafting a national shale gas development plan that aims for commercial production as early as possible in order to (1) increase cleaner energy consumption and (2) reduce reliance on carbon-intensive coal. Shell is cooperating with PetroChina on this and is currently drilling 17 wells, including some for tight gas and shale gas; BP is also seeking to cooperate with Sinopec on joint shale gas development projects in China. The government has set up special research projects in Beijing focusing on shale gas exploration and development technologies, and plans to invest $1 billion a year over the next five years into shale gas development if the exploration test drilling underway proves to be successful.[20] China's Ministry of Land and Resources has estimated its total unconventional gas reserves at 15-30 tcm, in contrast to the more optimistic EIA estimate of 36 tcm. In June 2011 it held its first auction for domestic gas producers to bid on exploration rights for four shale gas blocks. While domestic gas consumption already surged to 110 bcm in 2010, the NEA plans to double the natural gas share in its energy mix from presently 4% to 8% by the end of 2015.[21]

China is also paying special attention to coal-bed methane (CBM) due to the lower capital requirements, the technological entry barriers in comparison to tight or shale gas exploration and production, and the involvement of many more players. But, while CBM production capacity was only 2.5 bcm in 2009, production volumes are even lower at 0.7 bcm. At present, production targets for CBM were 5 bcm by the end of

[19]H.-H.Rogner, "An Assessment of World Hydrocarbon Resources," *Annual Review of Energy and the Environment* 22, 1997, pp. 217-262.

[20] "China Energy Authority Drafting Shale Gas Development Plan: NDRC," Reuters, March 28, 2011.

[21]See Victor Wang, *Shale Gas to Play a More Prominent Role in China's Energy Mix*, Interfaxenergy.com, September 14, 2011.

2010, and are 30 bcm by 2020 and 50 bcm by 2050. Present production costs are about 50% higher than those of conventional natural gas.[22] Global resources of CBM alone amount to 135.5 tcm—372.5 tcm.[23] While India has also estimated 1.8 tcm of recoverable shale gas reserves and conducted its first exploratory drilling of shale in northeast India last January and plans an additional three in March 2012, experts see unconventional gas as a long-term option rather than an immediate energy source. Like many other countries interested in exploiting their unconventional gas resources, India currently still lacks a regulatory framework for unconventional gas exploration.[24]

Global Foreign Policy Implications of Unconventional Gas

The shale gas buzz is not only about its the radical change it is causing to the energy industry, but also about the its political and international ripple effects. Unconventional gas has become the new 'elephant in the room,' with global geopolitical implications that have caused a chain reaction: European gas prices are being renegotiated and revised. It has also caused an average of 15% of Gazprom's supplies to be delinked from oil-indexation in 2010. But the implications are greater still: relatively cheap and abundant gas, along with the carbon advantage of gas, makes nuclear power and coal relatively more expensive than currently assumed. Indeed, making gas a major transition fuel through 2030 will help renewable energy efforts to reduce emissions, at a lower cost in order to mitigate the impact of climate change.[25]

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[22] "China Gas Sector. Key Takeaways from the Asia-Pacific Unconventional Gas Summit," Yuanta-Industry Update, April 1, 2010.

[23] BGR (2009), op. cit., p. 95.

[24] See Sara Stefanini, "India's Shale Gas Potential Raises Excitement, but Gas Is Still a Long Way Away,", September 13, 2011, and idem, "India Needs Regulations for Successful Unconventional Gas E&P," *Interfaxenergy.com*, September 14, 2011.

[25] Dieter Helm, *The Coming of Shale Gas: the Implications for Oil and Energy*, http://www.terrafirma.com/Alternative-perspective-page/articles/295.html. This is in contrast to a report from the Tyndall Centre arguing against shale gas in particular as a transition fuel and highlighting the potential risks to human health and the environment. See Wood. R., Gilbert P., et al., *Shale gas: a provisional assessment of climate change and environmental impacts*. A report commissioned by the Cooperative and undertaken by researchers at the Tyndall Centre, University of Manchester, 2011. See also Robert W. Hogath, Renee Santoro, Anthony Ingraffea, *Methane and the*

Unconventional gas has helped to shift the balance from a seller-dominated market to one dominated by buyers, in contrast to the global oil market. Unconventional gas is nowadays the "new policy" option for European countries, giving buyers more leverage to renegotiate high Russian oil-indexed gas price demands that are included in long-term contracts. Thus, unconventional gas, even without being produced in Europe, puts a certain price cap on high Russian gas prices, as it can become a potential source of diversification, particularly if Russian gas prices are higher than the break-even point for European unconventional gas. All this has the potential to make unconventional gas development economically feasible and, politically speaking, more appealing. Unconventional gas, and shale gas in particular, has already become a negotiating tool for Europe in a changing gas market that is enhancing the region's energy supply security by diversifying energy sources and enabling the prioritization of a domestically-located resource. Furthermore, the carbon footprint of domestically-produced shale gas in Europe is estimated to be 30% lower than Russia's long-distance pipeline gas.[26]

The increasing self-reliance of the U.S. energy market—due to unconventional gas and natural gas liquids (NGL) production—has another important economic effect on global competiveness. The widening gap between the North American and the European oil and gas market widens is accentuating competitive differences between the two continents. This could be seen in the recent unrest in the Middle East and North Africa (MENA), which affected the European oil and gas market to a greater extent than it did the U.S. As the U.S. becomes almost self-reliant through unconventional gas production, it becomes

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Greenhouse-Gas Footprint of Natural Gas from Shale Formations, Climate Change (Springerlink.com), April 12, 2011; critical comments on this "biased" study by other environmental experts and new research projects—see 'Five Things to Know About the Cornell Shale Study', *European Energy Review*, April 27, 2011 (originally in: *Energy in Depth*); Gregory C. Staple and Joel N. Swisher, "The Climate Impact of Natural Gas and Coal-Fired Electricity: A Review of Fuel Chain Emissions Based on Updated EPA National Inventory Data," *American Clean Skies Foundation* (www.cleanskies.org), April 19, 2011; and Mohang Jiang et. al., "Life Cycle Greenhouse Gas Emissions of Marcellus Shale Gas," *Environmental Research Letters*, 6 (July-September 2011).

[26]See House of Commons, *Shale Gas* (London: Energy and Climate Change Committee, 2011), ch. 6, point 154.

increasingly unaffected by world market volatility.[27] As the price dynamics are decoupling, pushed by unconventional gas developments, they are pulled by the developments on the LNG market. With possible future exports of unconventional gas by LNG to Europe or Asia, the hitherto set gas prices would become more connected, transparent and eventually lead to a truly connected global gas market, similar to the oil market, from which all gas consumers will benefit. A global gas market is in line with U.S. foreign policy and its transatlantic allies' interest.[28]

Unconventional Gas Development as a Foreign Policy Tool—the U.S. Global Shale Gas Initiative (GSGI)

With the huge success story of the unconventional gas industry in the U.S., the U.S. Department of State launched the Global Shale Gas Initiative (GSGI) in April 2010 in order to promote its technology and to help countries seeking to utilize their unconventional natural gas resources identify and develop them safely and economically. The GSGI helps countries assess their shale gas potential and provide regulatory guidance on its development. Under the GSGI the U.S. has established partnerships with China, India, Poland, Ukraine, Jordan and other countries.

Hence, energy, and in particular unconventional gas, is becoming a foreign policy tool for the U.S. administration. The U.S. is attempting to achieve various goals at the same time: to promote American technology and gain market shares in other countries; to ally with strategic partnering countries and help them reduce import dependencies; and to push natural gas as a more environmentally friendly fuel, thus supporting U.S. and global efforts to address climate change.

Energy security has been the "Achilles heel" of many countries by forcing them to cooperate with unstable states or rough-regimes and thus limiting the foreign policy leverage of the international community vis-à-vis these mainly rent-driven countries. Unconventional gas

[27]See Ruud Weiermars, "Transatlantic Energy Prices Show Need for Realignment," *Oil & Gas Journal* 2011.

[28]See also John Deutch, "The Good News about Gas: The Natural Gas Revolution and Its Consequences," *Foreign Affairs* 90, 2011, p. 82.

changes this picture. By making abundant unconventional gas resources (which can be found close to many demand centers) available, it reduces such dependencies through diversification, and in addition creates and supports national and local industries. With such a powerful tool at hand, it reduces the need of the U.S. to consult with countries on their energy import strategy from the Middle East and Russia. Instead, the U.S. can promote its technology to help these countries gain more energy independence and help replace coal with natural gas as a cleaner fuel and reduce emissions from coal use. As David Goldwyn, the then State Department's coordinator for international energy affairs, told the *National Journal*: "For energy-security reasons, we're interested in having countries like China and India and Eurasian countries develop their own means so they don't get it from countries of concern for the U.S."[29]

The new U.S. administration's foreign policy of promoting unconventional gas poses a threat for Russia, the world's largest natural gas resource holder. The current gas market situation—marked by a global "gas glut," a de-linkage of gas prices from oil prices, and European pipeline prices being temporarily three times that of LNG spot market prices—already poses a severe problem for Gazprom and, more importantly, for its long-term gas importers. Unconventional gas, furthermore, has the potential to remove Gazprom's near-monopoly of European gas supplies. In the fourth quarter of 2010, for example, Russia's gas exports to Europe declined by 17% owing to market oversupply due to redirected LNG cargoes and unseasonably warm weather. Unconventional gas development could reduce Russia's market share in Europe from its recent peak of 26% in 2007 down to just 13% by 2040.[30]

Therefore, Gazprom needs to diversify as its European export model suffers. It is expected that Gazprom will operate in three distinct markets: (1) the traditional European market; (2) a de-regulated and mixed domestic market; and (3) a new Asian market.[31] However,

[29]*National Journal*, November 18, 2010.

[30]See Kenneth B. Medlock III, Amy Myers Jaffe, Peter R. Hartley (2011), *Shale Gas and U.S. National Security* (James A. Baker III Institute for Public Policy, Rice University), p. 45 f.

[31]Kushnir and Kapustina, *Natural (Gas) Partners—One Step at a time for Russian Energy to China* (Frankfurt/M.: Deutsche Bank Research, 2010).

indications for a new eastern strategy for gas supplies to China—a new, big, growing market—might not solve the problem Gazprom might be facing. China is already moving towards a more gas-dependent economy due to several reasons previously mentioned associated with gas as a clean and relatively cheap fuel. But Petrochina's estimates of 45 tcm of Chinese unconventional gas are more than Russia's proven conventional reserves. China also seems more likely to dictate low prices connected to coal or hub pricing than to pay a high premium for Russian gas as the Europeans do.

Consequently, with the high cost of building new infrastructure in China and developing expensive new upstream projects in East Siberia and the Russian Far East, diversification of gas deliveries to China will not allow Gazprom to reduce its exposure to Europe. China's energy security policies have been driven less by short-term profit or value-aggregation objectives than by long-term principles of a sustainable energy security and diversification. Thus, the U.S.-China Shale Gas Resource Initiative—an initiative dedicated to enabling the U.S., as "a leader in shale gas technology and developing shale gas resources,"[32] to help China pursue its diversification objectives for its energy mix and imports in the future. In short, China is far more likely to support its local economy by producing domestic unconventional gas than increase its dependence on very expensive Russian pipeline gas.[33]

The GSGI also affects Iran, the second largest natural gas resource holder, since the U.S. strategy is to encourage other countries, such as China, not to breaking sanctions against Iran and instead to still their hunger for new energy resources by producing their own local unconventional gas resources. It seems that the U.S. strategy is working, as China is delaying its projects in Iran, slowly withdrawing from the Iranian energy sector, and vigorously pushing for unconventional gas exploration and production domestically.[34]

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[32]The White House, "Statement on U.S.-China Shale Gas Resource Initiative", Washington D.C., 2009.

[33]For a detailed report on China´s unconventional gas exploration and prospects see: Aizhu Chen, "RPT-SPECIAL REPORT: China set to unearth shale power," April 20, 2011, *Reuters* (available at: http://r.reuters.com/jub29r).

[34]E. Downs and S. Maloney, "Getting China to Sanction Iran: The Chinese-Iranian Oil Connection," *Foreign Affairs* 90, No. 2, March 2011, pp. 15-21; and Medlock III, Jaffe and Hartley, op. cit.

Developing unconventional gas resources worldwide increases overall energy security for importing countries with unconventional resources and reduces competition over Middle Eastern resources and over LNG. As a local, decentralized source of fuel, unconventional gas is evolving as a factor balancing potential supplier monopolies and alleviating geopolitical tensions.

Prospects, Challenges and Constraints for Europe

> Given the early stages of unconventional gas development, contract rigidities in European gas markets and an insufficiently integrated transportation network, it is too early to determine the magnitude and pricing impact of unconventional gas on individual EU Member States. What is certain is that approaches to unconventional gas will vary widely between Member States, which are setting their own priorities on energy developments.[35]

While initial assessments of Europe's unconventional gas potential were rather skeptical and very conservative, thereby also focusing on different circumstances for specific countries,[36] Europe also has depositories of significant unconventional gas resources, with estimated total recoverable reserves between 33 to 38 tcm, according to new U.S. estimates.[37] An IHS CERA study of 2010 even concluded that the geological potential in Europe for shale gas, and to a lesser extent for coal-bed methane, may even compare to North America's

[35]R.Lawson, W.Ramsey, John R. Lyman, Mihaela Carstei, *European Unconventional Gas Developments. Environmental Issues and Regulatory Challenges in the EU and the US* (Washington D.C.: Atlantic Council, June 2011), p. 4.

[36]Paul Stevens, *The 'Shale Gas Revolution': Hype and Reality*. Rik Komduur (2010), "Europe Not Ready for Unconventional Gas, Yet," *European Energy Review*, June 21, 2010; and Roderick Kefferpütz, "Shale Fever: Replicating the US Gas Revolution in the EU?," *CEPS Policy Brief*, No. 210, June 2010. See also Karel Beckmann, "Shale Gas Will Not Be as Important in Europe as in the U.S." (Interview with Jean-Francois Cirelli, President of Eurogas and President of the French company GDF-Suez)', *European Energy Review*, May 9, 2011.

[37]EIA, *World Shale Gas Resources: An Initial Assessment of 14 Regions Outside the United States*, 2011.

potential and, thus, be "far greater than is commonly understood."[38] Although an unconventional gas boom in Europe is not guaranteed at present, the IHS CERA study expects a reasonable minimum level of 60 bcm of an annual production, whereas the also plausible high scenario could reach even 200 bcm shortly after 2025.[39]

Concessions for shale gas test drilling have already been granted, with the Netherlands, France, Germany, UK, Sweden, Hungary, Switzerland, Ukraine, and Poland at the forefront. But it is presently unclear how much shale the rock formation contains and at what cost the gas can be produced. Meanwhile, fears of contaminating drinking water and other environmentally-related concerns have led to declarations of a moratorium for drilling unconventional gas resources in France, the Netherlands and Germany,[40] whereas Poland, Great Britain, Bulgaria and Ukraine are going ahead with test drillings of their own unconventional gas resources.[41] These declared moratoriums and their justifications are based not only on understandable environmental concerns, but also on myths, misinformation and vested interests and lobbyism of other energy industries (renewables, nuclear, conventional gas etc.):

- most environmental concerns in the U.S. arise from a lack of environmental stewardship from small independents combined with ineffective state regulatory framework and monitoring; EU regulation is more robust and European shale gas

[38]IHS CERA, *Rising to the Challenge: Turning North America's Unconventional Gas Supply Potential into Reality*, 2010.

[39]Ibid.

[40]See also Yves de Saint Jacob, "France's 'Green Vote' Kills Shale Gas—and Targets Nuclear Power as Well," *European Energy Review*, July 21, 2011; Peggy Hollinger, "France to Ban Fracking of Fossil Fuels," *Financial Times*, May 11, 2011; David Jolly, "French Lean Toward Ban of a Controversial Gas Extraction Technique," *New York Times*, May 10, 2011 and Stefan Nicola, "German Shale Gas Faces Uphill Battle," *European Energy Review*, April 11, 2011.

[41]See also Katarzyna Kacperczyk, "Shale Gas Development: Polish Perspective," Wilton Park Conference, June 16, 2010; Jan Cienski, "Poland Hopes to Tap Big Reserves of Shale Gas," *Financial Times*, August 9, 2011, Ekke Overbeek, "Shale Gas Doesn't Make Poland the New Norway Yet," *European Energy Review*, June 14, 2011; and Atanas Georgiev, "Shale Gas Battle in Bulgaria—High Stakes for Europe," *European Energy Review*, September 1, 2011.

is more likely to be developed by international oil companies, which have a much better track record in managing environmental impacts, albeit this will come at a certain cost. A European regulatory framework is under way, though it may take some time and might be outpaced by national regulatory frameworks.

- Given the fact that the gas-bearing and water-bearing layers are widely separated below the surface (with the gas being much deeper), hydraulic fracturing of shale gas is unlikely to contaminate drinking water as long as continued care and independent regulation is guaranteed. Up to now there is not one documented case of groundwater contamination due to hydraulic fracture stimulation itself.
- Over time, new well and reservoir management technologies are making it possible to significantly reduce the number of well pads required. Furthermore, those new technologies will widen the production base of unconventional gas all the time, while "weakening the strategic importance of conventional reserves and the power of those who hold them."[42]
- As U.S. experiences indicate, deep shale gas uses four times less water than coal and up to two thousand times less than biofuels.[43]

In the forthcoming years, unconventional gas could also become a very important factor for Ukraine's efforts of diversifying its gas imports in order to reduce its high dependencies on Russia. In November 2010, the Ukrainian Ministry of Environment and Natural Resources and the National Joint Stock Company (NAK) "Nadra of Ukraine" declared to have the biggest, or one of the biggest, shale gas deposits in Europe. The Ukrainian government seeks to investigate the potential volume of shale gas by mid-2012, assumed to be between 10-30 trillion cubic meters (twice as large as those of natural gas), and has invited international investors to analyze and develop the Ukrain-

[42] "Coming Soon To a Terminal Near You," *The Economist*, August 6, 2011.

[43] See Wolf Regener, "BNK's Shale Gas Projects in Europe," BNK Petroleum, Wilson Park Presentation, June 2010, p. 15.

ian shale gas deposits.[44] In February 2011, at the Strategic Partnership Commission meeting of the U.S.-Ukraine Energy Security Working Group, both sides signed a 'Memorandum of Understanding' to establish a framework for technical cooperation that will assess the unconventional gas resource potential in Ukraine. This agreement includes the involvement of the U.S. Geological Survey (USGS), which is currently undertaking a global unconventional gas resource assessment.[45] Meanwhile, Total, Eurogas (a U.S. company), and Royal Dutch Shell have announced to conduct test explorations and feasibility assessments.

Against this background, together with the fear in Moscow of losing further markets shares in its most important export market for conventional Russian gas, as well as the geopolitical games resulting from Gazprom acting as the spearhead of Russian foreign policy, it is hardly surprising that representatives of the Russian government and Gazprom try to downplay the importance of shale gas in Europe and point to negative implications of unconventional gas production in Europe for its environment and the EU's climate mitigation efforts.[46]

Summary and Perspectives for a Transatlantic Shale Alliance

Given worldwide and European prospects for unconventional gas production, it is evident that the availability of even a fraction of unconventional gas potential for European and other energy markets makes it unrealistic to argue that the EU, at present, needs all the gas pipelines (i.e. Nabucco and Whitestream) currently being discussed or new LNG-terminals. Both the European gas industry and the EU member states need to prioritize the most economical and energy

[44]"Ukraine Claims to Possess World's Biggest Shale Gas Deposits," *PR Newswire*, November 29, 2010.

[45]"U.S.-Ukraine Unconventional Gas Resource MOU Signed," *Embassy of the United States*, Kyiv, Ukraine, February 15, 2011.

[46]"Alexander Medvedev Answers Your Questions—Part One," *Financial Times*, February 18, 2011; "Gazprom Chief Steps Up Attacks on Shale Gas," *Financial Times*, February 18, 2011, "Gazprom Chief Calls Shale Gas a 'Bubble," *Financial Times*, February 18, 2011, and Andrey Konoplyanik, "The Economic Implications for Europe of the Shale Gas Revolution," *Europe's World*, January 13, 2011.

security enhancing pipelines, while at the same time following the same rationale when considering the options for the new re-gasification terminals that would facilitate higher and more flexible LNG imports during times of crisis. In this regard, unconventional gas as a domestic source may definitely further enhance the EU's future energy supply security, although the prospects for significant unconventional gas production presently do not appear to be a concrete option before 2020.

The U.S. unconventional gas success story represents a paradigm shift that has turned expectations upside down. In essence, it has been a game changer for the emerging world gas market. The historic development of both the U.S. and the European gas market has shown that the markets are becoming interconnected and globalized through LNG, and that unconventional gas provides the local content to the equation. But the U.S. experience also underlines the fact that the U.S. shale gas revolution, or at least its huge impact, is only possible with a liberalized gas market and "would not have occurred in North America if access to market was blocked by pipeline transportation monopolies."[47]

The U.S. shale gas boom enabled a revolutionary domino effect on the European market, with the contractual structure, based upon 25-year long term take-or-pay oil, and linked natural gas contracts that had hitherto dominated the market being re-negotiated. Consequently, shale gas is already having an increasing influence on European gas prices and is expected to continue doing so through 2015. By taking a more strategic perspective, unconventional gas in Europe also serves the three major objectives of the "energy triad" or "energy trilemma":

- Energy Supply Security: As a domestically-produced energy resource, unconventional gas is increasing national and EU-wide energy security by diversifying the national and EU energy mix as well as by decreasing gas imports from unstable or politically problematic suppliers. But even in the case that no unconventional gas will be produced in Europe itself, its expected increased production outside of Europe will offer

[47]Kenneth B. Medlock III, "Impact of Shale Gas Development on Global Gas Markets," *Natural Gas & Electricity*, April 2011, pp. 22-28(23).

many more LNG options for future EU gas imports and, thus, also contribute to Europe's future energy security.

- Economic Competitiveness: The present situation implies that unit supply costs will likely be higher in Europe than in the U.S., but also much lower than Russia's future long-distance pipeline gas from new and very expensive gas fields in the high north (such as Yamal) or even the Barents Sea and the Arctic, based on long-term contracts with inflexible price adaptation mechanisms and highly problematic third-party clauses. Furthermore, with continuous technology innovations of hydro-fracturing technologies in the years ahead, production costs in Europe will also go down as predicted by all historical experience with new energy resources and drilling technologies.
- Environmental/Climate Protection: Given the conclusions of new environmental studies and in contrast to populist environmental myths and ill-informed public opinion, shale gas—like conventional gas—produces equally lower CO_2 emissions than coal. Moreover, the carbon footprint of domestically produced unconventional gas is also approximately 30% lower than long-distance Russian pipeline gas if one includes full life-cycle emissions. Negating domestically produced shale gas means higher imports of pipeline gas and LNG, which neither increase energy supply security nor contribute much to climate mitigation efforts. In addition, domestically produced unconventional gas is both technologically and environmentally less risky than the increased drilling of conventional gas resources in ever deeper seas or even in the environmentally most sensitive Arctic and Antarctic regions.

Nonetheless, unconventional gas exploitation is still at an embryonic stage and needs further development. But European governments should not focus just on myths and misinformation as well as short-sighted considerations, but rather take a longer-term strategic perspective by assessing and recognizing the full potential of the global geoeconomic and geopolitical impacts on their own energy security, such as the many benefits for their economic competitiveness.

Regardless of how the concrete outlook for European unconventional gas development looks—and whether or not unconventional gas will become affordable and sustainable in the mid-to-long term in Europe—shale gas has already changed the European market, even before a single well has been drilled or a single molecule of unconventional gas extracted from European basins.

In light of this situation, a reaffirmation of a transatlantic energy alliance would symbolize the continuation of a long history of transatlantic energy cooperation, which includes the nuclear energy cooperation in the 1960s and 1970s and the close ties regarding the hydrogen-based economy in the 1980s. EU-U.S. energy cooperation has always been mutually beneficial and has reminded both sides of their common interests. A new transatlantic shale gas alliance would reconnect this tradition and could contribute to a whole set of policy issues: new sources of foreign direct investment, creation of new jobs and infrastructure, diversification of gas imports in Europe, and in the case of the U.S., help to become more energy self-sufficient.

But U.S. and European energy policies also need to recognize that they can also clash with each other on unconventional gas because European countries, leading in renewable industries (such as Germany), are promoting these industries not just for their own internal market, but also increasingly abroad as part of their future export and industrial strategies. A transatlantic shale gas dialogue will inevitably flesh out the contrasting evolution between both continents. Energy dependency has shaped and influenced foreign, economic and domestic policy on both sides of the Atlantic. However, there has been one major difference in the EU energy policy approach compared to the U.S. approach: the EU has focused more on the collective and demand-side, whereas the U.S. has rather focused on the supply-side.

Given the dual challenge to global energy security and climate change, however, both sides need both to promote renewables and to develop unconventional gas. Thus, a transatlantic strategy should focus on a combined promotion strategy to cope with the dual challenges ahead. Policymakers from the EU and the U.S. will need to reconcile their domestic political agendas with their economic interests for their future gas market policies and their energy security strategies.