New Energy, New Geopolitics

Balancing Stability and Leverage

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As part of this report, CSIS will publish three additional "contributing reports"— one on energy, one on geopolitics and national security, and one on scenarios, strategies, and pathways. These contributing reports will offer greater detail to the analysis presented in this report. They will be posted on the CSIS website (http://csis.org/program/geostrategic-implications-unconventional-oil-and-gas-revolution) in spring 2014.

Summary for Policymakers

In the last ten years, U.S. shale gas and tight oil production has skyrocketed. Between 2005 and 2014, U.S. production of crude oil and natural gas has risen by nearly 65 and 34 percent, respectively, due to tight oil and shale gas development.[1] The shale gas supplies from Pennsylvania alone equal the entire natural gas export capacity of Qatar, the world's second largest natural gas exporter in 2012.[2] And the increase from light tight oil production in places like North Dakota and Texas over the last five years is equivalent to Iraq's current production levels. These increased energy supplies have fed not only national but global markets, helping to offset other market disruptions and stabilize prices, to the benefit of many.

The benefits thus far could pale in comparison to those that might arise in the future. New production techniques have meant that resource deposits around the world previously considered uneconomic to access have become "technically recoverable," significantly adding to the global resource balance sheet. According to one preliminary assessment, 137 shale formations in the United States and 41 other countries hold around 10 percent of technically recoverable global crude oil and 32 percent of global natural gas.[3] Deposits beyond the countries examined increase these recoverable amounts still further. For a world increasingly dependent on energy to drive economic growth and prosperity, this is a good-news story.

For those who look at the world through a geostrategic lens, however, assessing the impact of these new resources is more complex. They raise questions about who stands to gain, who stands to lose, and what opportunities for advantage might emerge in both the energy and geopolitical realms. Since the advent of the so-called "shale gale" or "unconventionals revolution," myriad energy analysts, geopolitical strategists and foreign policy experts, industry titans, and government officials, including heads of state, have offered their views on the potential strategic impact of the changing energy landscape on global economic and geopolitical relations. Some see limited significance, while others predict profound and radical change.

** In addition to the full report, CSIS will publish three additional "contributing reports"—one on energy, one on geopolitics and national security, and one on scenarios, strategies, and pathways. These contributing reports will offer greater detail to the analysis presented in this report. They will be posted on the CSIS website in spring 2014 (http://csis.org/program/geostrategic-implications-unconventional-oil-and-gas-revolution).

1. Calculations based on U.S. Energy Information Administration (EIA). 2014 projections from EIA, *Short-Term Energy Outlook (STEO)* (Washington, DC: EIA, November 2013), http://www.eia.gov/forecasts/steo/archives/nov13.pdf; data for 2005 is from EIA, *Short-Term Energy and Summer Fuels Outlook (STEO)* (Washington, DC: EIA, April 2014), http://www.eia.gov/forecasts/steo/index.cfm.

2. BP, *BP Statistical Review of World Energy 2013* (London: BP, 2013),http://www.bp.com/content/dam/bp/pdf/statistical-review/statistical_review_of_world_energy_2013.pdf .

3. EIA, "Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States," June 13, 2013, 10, http://www.eia.gov/analysis/studies/worldshalegas/. Notably, this assessment captures only a portion of the new energy potential, as it does not include some of the most hydrocarbon-rich countries in the Middle East and elsewhere.

Given the scope and intensity of the discourse surrounding this new source of energy production and its potential effects, the Center for Strategic and International Studies (CSIS) believed its expertise in energy, regional affairs, and national security could provide a useful and unique synthesis of the complex interactions under debate. Assembling a broad multifunctional team, CSIS undertook a year-long exploration of the potential geostrategic implications of shale gas and tight oil, with the intention of providing policymakers with a structured way to consider the potential risks and rewards of the new shale gas and tight oil resources.[4] The analysis does not span the entire globe, but represents an overarching survey across categories of key international players, with deeper analysis in certain cases.[5]

Energy Impacts to Date

Though still relatively new, the U.S. shale gas and tight oil revolution is leading to major changes in the energy landscape, the most significant of which are summarized below.

SHIFTING ENERGY MARKETS, TRADE FLOWS, AND INVESTMENTS

U.S. tight oil and shale gas production along with slower demand growth has decreased the United States' need for imports. As a result, traditional U.S. suppliers are increasingly servicing other markets.[6] At the same time that U.S. energy imports are falling, its exports are rising. New sources of energy are also altering commercial competitiveness and investment decisions for both companies and countries. As a result, the hierarchy of energy projects is being reordered, at least temporarily shifting capital investments to the U.S. energy sector and away from more expensive and/or risky locations. The sudden surge in U.S energy supply and consequent reduction in natural gas prices have made North America among the most attractive and competitive places in the world to locate energy-intensive endeavors.

CAUTION ABOUT FORECASTING FUTURE PRODUCTION

It is risky business to extrapolate long-term conclusions from a resource with such a short production history. While the resource potential is large, there remains considerable uncertainty regarding any given reservoir's ultimate production. Thus far, however, technology and production practices have exceeded expectations, resulting in higher and higher production estimates as experience grows.

4. For the purposes of this report, when we discuss unconventional oil and gas in the context of the United States, we use the terms shale gas and tight oil as they are at the heart of the U.S. oil and gas production surge under examination and are responsible for much of the impacts analyzed in this report. When we discuss the potential for the production of unconventional resources outside of the United States, we use the term unconventionals because the authors recognize that oil sands, heavy oil, coal bed methane, and other types of unconventional oil and natural gas have significant potential around the world and are often included under the "unconventional" category. Similarly, when discussing the future trajectory of production, we use the term unconventionals because future assessments look at the global potential in addition to the United States.

5. This report focuses on North America, Asia, Europe, the Middle East, and Russia. Though it does not go in depth on Africa, Latin America, or Southeast Asia, these regions are touched on throughout the report.

6. Imports of gas and oil are down 28 and 16 percent, respectively, since 2005, based on calculations data from EIA.

ADDING URGENCY TO ALREADY-ONGOING REEXAMINATIONS OF ENERGY POLICY

The massive potential for additional development of unconventional oil and gas resources is prompting many countries to rethink their energy policies to either take advantage of their own unconventional resource base or respond to some of the changes brought about by the impact of the U.S. oil and gas production surge.

REORDERING OPTIONS TO DEAL WITH CLIMATE CHANGE

Many in the public and private sector alike are seeking ways to prioritize the role that natural gas plays in the energy economy, and proponents of the "green agenda" have split over whether to endorse or resist natural gas as a possible "bridge fuel" that promotes near-term emissions reduction as cleaner energy solutions are developed. Natural gas substitution in some economies is driving higher coal usage elsewhere, complicating previous positions on how best to navigate a path to a lower-emission future.

The Geopolitical Impacts of Global Energy Shifts

While concrete geostrategic impacts thus far have been limited, there have clearly been changes in national and international perceptions that may or may not align with new realities. Big energy producers like Russia and Saudi Arabia, producers aspiring for a greater role in world markets like Iran, Iraq, and Mexico, revenue-dependent countries like Nigeria, Yemen, and Algeria, large energy consumers like China, Europe, and Japan, and, as already discussed, the United States, have all shifted their domestic or foreign policies in response to perceived changes in strategic context resulting (or expected to result) from tight oil and shale gas development.

BIG PRODUCER: RUSSIA

- Reinforces pre-existing reorientation toward Asian markets
- Adds to existing energy-sector pressures, reinforcing the necessity of reform
- Lessens others' interests in the Arctic, to Russia's possible advantage

BIG PRODUCER: SAUDI ARABIA

- Reinforces a reorientation toward Asian markets that were already underway
- Complicates Saudi Arabia's role as a market balancer
- Feeds a broader concern over the United States' continued commitment to stability in the Middle East

REENTRANTS: IRAN, IRAQ, AND MEXICO

- Raises the stakes for each of the reentrants to get back on the market

- Puts increased pressure on Organization of the Petroleum Exporting Countries (OPEC) cohesion
- Accelerates internal pressures for reform

REVENUE-DEPENDENTS

- Raises concern for potential modest future price decline and risks of instability

CONSUMER: CHINA

- Enhances China's energy security position but does not alleviate its overall vulnerability
- Dampens China's "United States in decline" narrative
- Offers new possibilities to shift the U.S.-China energy conversation from competition to cooperation

CONSUMER: EUROPE

- Helps the United States to rebound economically in ways that widen the gap with Europe and exacerbate competitiveness concerns
- Increases pressures on Europe's green agenda
- Does little to alleviate concerns with unpredictable suppliers in Russia and the Middle East and North Africa

CONSUMER: JAPAN

- Aided Japan after Fukushima, but unlikely to offer long-term price relief
- Complicates intra-Asian dynamics

The Shale Gas and Tight Oil Revolution and U.S. National Security

The link between energy and national security is multifaceted, complex, and often opaque. In general terms, there are two broad areas where the shale gas and tight oil revolution has raised questions at home and abroad: those relating to changed perceptions and those relating to changed realties.

PERCEPTIONS

- Presents limited examples of a greater ability for the United States to exercise global leadership due to the shale gas and tight oil revolution
- Raises questions around the world about U.S. willingness to exercise global leadership

REALITIES

- Has done little to relieve pressures on traditional allies and partners in Europe and Asia
- Increases the potential for market instability, strained governance, and unrest for energy import- and export-dependent states
- Exacerbates the gap between U.S. national and popular interests

Scenarios, Pathways, and Policy Recommendations

The evolution of shale gas and tight oil production has occurred at such a rapid pace that U.S. policymakers have been challenged to respond with a largely unexpected new energy posture for the United States. The difficulty of setting a clear path is compounded by the uncertainty around the future of unconventional oil and gas development: Will it remain essentially a U.S. phenomenon, or will other countries begin to realize their own production potential? How long might production continue to rise, how long would it take to decline? To craft an energy strategy moving forward, the study team evaluated a range of potential futures in regard to global unconventional oil and gas production to better inform assessments of the most robust strategy going forward.

SCENARIOS

The study evaluated detailed models for four potential futures out to 2025,[7] augmented by a higher-level projection of how each might extend through 2040. The scenarios are illustrative and not meant to encompass the full range or complexity of possible energy futures. Their basic features are as follows:

Baseline Scenario: This scenario assumes that unconventional oil and natural gas production is basically and predominantly a U.S. (in the case of oil) and North American (in the case of natural gas) story.

Breakthrough Scenario: This scenario assumes that the U.S. experience continues apace, but also that the vast stores of unconventional oil and gas around the world are unlocked as other nations successfully overcome the cost, technological, and environmental barriers inhibiting current production.

Failure Scenario: In this scenario, unconventional oil and gas around the world remain undeveloped, and the success experienced in the United States begins to reverse itself toward the end of this decade. By 2025, the United States is back to an oil and gas production profile that looks very similar to what was expected before the current boom took off (i.e., the strategic outlook of 2005–08).

7. For the purposes of this analysis, the study team, in cooperation with the original authors, used modified versions of scenarios proposed in Energy Research Institute of the Russian Academy of Sciences (ERI RAS), *Global and Russian Energy Outlook up to 2040* (Moscow: ERI RAS, 2013), http://www.eriras.ru/files/Global_and_Russian_energy_outlook_up_to_2040.pdf ; and International Energy Agency (IEA), *World Energy Outlook 2011: Are We Entering a Golden Age of Gas?* (Paris: IEA, 2011), http://www.worldenergyoutlook.org/goldenageofgas/.

Gas Breakthrough Scenario: Finally, this scenario assumes that unconventional gas production increases globally, but that tight oil maintains a minimal share of global oil production.

Each of these scenarios could arise from a variety of factors and trends, and could be significantly altered by factors that include national policies, political instability, economic shifts (either global or regional), and technological advances.

SCENARIOS' IMPLICATIONS

The four scenarios collectively portray a wide range of potential outcomes for unconventional production, with different implications and potential winners and losers.

Overarching Insights:

- A natural gas breakthrough scenario could be transformative
- The variation in unconventional oil outlooks is not that significant
- The shift toward markets in the East is the defining feature of every possible future
- A failure scenario is most likely to create additional impetus for conflict or tension
- Climate goals must be more actively pursued no matter how the future unfolds

Producers:

- The United States is most sensitive to alternative futures
- The next decade will prove critical for Russia
- Implications for OPEC countries vary

Reentrants, new entrants, and resource-dependents:

- Shale failure is preferable for certain producers if unconventionals don't exist at home
- New Africa production will face near-term challenges but is likely to work out in the long run

Consumers:

- All major consumers benefit from abundance
- Promoting unconventional oil and gas development could reduce import dependence in some places, especially China
- Resource competition in Asia could intensify and shift to the Indian Ocean over time
- Europe will continue to face challenges in every possible scenario explored

PATHWAYS

U.S. policymakers face a choice between two paths for managing this new energy posture—what this report terms "energy stability" or "energy leverage." The energy stability pathway suggests the United States' energy advantage should be used to enhance energy security around the world, on the theory that more stable energy markets will foster strong economies and enhance geopolitical stability. The energy leverage pathway views the energy advantages presented by the U.S. oil and gas production as tools that can be employed in the service of broader geopolitical or economic objectives.

Ultimately, either by design or by accident, the United States and other countries are unlikely to pursue a purely energy-stability or leverage-oriented pathway. This is because energy policy is a mix of complex domestic and international factors, and geopolitics is even more complicated by the larger universe of energy- and non-energy-related elements that influence the relationships among countries. Rather than all this uncertainty leading to stasis, however, it is precisely the unknown nature of energy developments, geopolitical forces, and national security interests that argues for steering as much as possible toward an energy-stability pathway.

Recommendations

U.S. policymakers should take the following actions to implement this approach:

1. Promote greater production and more efficient energy use at home and abroad. The United States has a well-established track record of promoting common energy principles, albeit with mixed success. The recommendation points to direct U.S. support for energy reform among the big-producer, reentrant, revenue-dependent, and consumer countries outlined in this report (and others).

2. Further encourage, beyond current activities, production of unconventional oil and gas abroad. Indeed, the United States has already been active in this area of diplomatic and technical engagement since the early days of shale gas development. These efforts are most effective when they involve companies that are on the front line of developing these new resources.

3. Encourage trade in energy resources to promote flexible, adaptable, and efficient markets. Ideally this would include an expansion of natural gas exports, as well as the initiation of exports of crude oil, at the very least it requires a more flexible and expeditious approach to exports and a more direct explanation of the country's longer-term policy on the export of these commodities.

4. Maintain continued and clear U.S. commitment to protect sea lanes of communication. In the near term it is important to instill confidence in both the willingness and the capability of the United States to maintain its role as lead provider of this global common good, while working toward more collective approaches to the greatest possible extent over the longer term.

5. Scale back domestic rhetoric on the "independence" afforded by new energy posture. Public appreciation for the United States' continued reliance, both direct and indirect, on global energy markets is critical if efforts to deter threats to regional stability, or to respond to instability if necessary, are to be successful.

6. Bolster commitment to a culture of innovation. The United States should continue to support investment in and application of new technologies that helped to make this and other types of frontier energy "breakthroughs" possible, including clean and efficient energy technologies that will be central to a long-term strategy on climate change.

7. Utilize the opportunity to bolster foreign policy ties or geopolitical dynamics where energy has traditionally played a central role. This new energy trend alters energy-related trade ties. To the extent that those trade shifts are disturbing or even potentially destabilizing to certain relationships or regional dynamics, seek out opportunities to shore up new areas of cooperation and ways to deepen engagement despite the shifts in commercial trade ties.

Introduction

In the last ten years, U.S. shale gas and tight oil production has skyrocketed. Between 2005 and 2014, U.S. crude oil production rose nearly 65 percent and natural gas production was up 34 percent—both increases a result of tight oil and shale gas development.[1] The shale gas supplies from Pennsylvania alone equal the entire natural gas export capacity of Qatar, the world's second largest natural gas exporter. And the increase from light tight oil production in places like North Dakota and Texas over the last five years is equivalent to that of Iraq's current production levels. All things being equal, this surge in supply has helped to suppress prices for both oil and natural gas that would likely have been higher due to other supply disruptions. (This effect has been most pronounced in North America, where gas prices in particular have been lower than elsewhere in the world.)

New production techniques have meant that resource deposits around the world previously considered uneconomic to access have become "technically recoverable," significantly adding to the global resource balance sheet. According to one preliminary assessment, 137 shale formations in the United States and 41 other countries hold around 10 percent of technically recoverable global crude oil and 32 percent of global natural gas.[2] Deposits beyond the countries examined increase these recoverable amounts still further. For a world increasingly dependent on energy to drive economic growth and prosperity, this is a good-news story.

For those who look at the world through a geostrategic lens, however, assessing the impact of these new resources is more complex. They raise questions about who stands to gain, who stands to lose, and what opportunities for advantage might emerge in both the energy and geopolitical realms. Since the advent of the so-called shale gale or unconventionals revolution, myriad energy analysts, geopolitical strategists, foreign policy experts, industry titans, and government officials, including heads of state, have offered their views on the potential strategic impact of the changing energy landscape on global economic and geopolitical relations. Some see limited significance, while others predict profound and radical change.

1. Calculations based on U.S. Energy Information Administration (EIA). 2014 projections from EIA, *Short-Term Energy Outlook (STEO)* (Washington, DC: EIA, November 2013), http://www.eia.gov/forecasts/steo/archives/nov13.pdf; data for 2005 is from EIA, *Short-Term Energy and Summer Fuels Outlook (STEO)* (Washington, DC: EIA, April 2014), http://www.eia.gov/forecasts/steo/index.cfm.

2. EIA, "Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States," June 13, 2013, 10, http://www.eia.gov/analysis/studies/worldshalegas/. Notable, this assessment includes only 41 countries around the world and does not include some of the most hydrocarbon-rich countries such as those in the Middle East and the Caspian region.

Given the scope and intensity of the discourse surrounding this new source of energy production and its potential effects, the Center for Strategic and International Studies (CSIS) believed its expertise in energy, regional affairs, and national security could provide a useful and unique synthesis of the complex interactions under debate. Assembling a broad multifunctional team, CSIS undertook a year-long exploration of the potential geostrategic implications of shale gas and tight oil, with the intention of providing policymakers with a structured way to consider the potential risks and rewards of the new shale gas and tight oil resources.[3] This analysis is not meant to be regionally comprehensive; rather, it represents an overarching survey across categories of key international players, with deeper analysis in certain cases.[4]

The first part of the study outlines the changes that have taken place in U.S. and global energy markets thus far, including a description of U.S. tight oil and shale gas production and the domestic impacts, how the shifts in the U.S. energy posture (i.e., slowing consumption and increasing production) are affecting global energy markets, and the challenges faced by other countries that seek to replicate the U.S. experience.

The second portion of the report lays out some of the geopolitical adjustments being made around the world in response to energy changes (both actual and perceived), and what these adjustments—in terms of energy markets and geopolitics—have meant for U.S. national security. So far, perception is leading reality when it comes to the geopolitical and associated national security impacts that have resulted from tight oil and shale gas. Many countries and companies are acting on early interpretations of this trend. Some will be rewarded, while others may lose out (especially on the investment side).

The final part of the report examines how the U.S. government is attempting to incorporate shale gas and tight oil developments into current U.S. energy and national security strategy. This strategy is still evolving and many view policy statements thus far as unevenly connected to actions. Going forward, U.S. policymakers face a choice between two strategic paths for managing shale gas and tight oil resources—what this report terms "energy stability" or "energy leverage." The energy stability pathway suggests that the United States' energy advantage should be used to enhance energy security around the world, on the theory that more stable energy markets will foster strong economies and enhance geopolitical stability. The energy leverage pathway views the energy advantages presented by U.S. oil and gas production as tools that can be employed in the service of broader geopolitical or economic objectives.

3. For the purposes of this report, when we discuss unconventional oil and gas in the context of the United States, we use the terms shale gas and tight oil as they are at the heart of the U.S. oil and gas production surge under examination and are a key driver for many of the impacts analyzed in this report. When we discuss the potential for the production of unconventional resources outside of the United States, we use the term unconventionals because the authors recognize that oil sands, heavy oil, coal bed methane, and other types of unconventional oil and natural gas have significant potential around the world and are often included under the "unconventional" category. Similarly, when discussing the future trajectory of production, we use the term unconventionals because future assessments look at the global potential in addition to the United States. For more detail, see Appendix 1.

4. This report focuses on North America, Asia, Europe, the Middle East, and Russia. Though it does not go in depth on Africa, Latin America, or Southeast Asia, these regions are touched on throughout the report.

The difficulty in deciding on a way ahead is complicated by the uncertainty about the future of unconventionals themselves. This report posits a range of possible futures in that regard, in order to inform risk judgments associated with the potential strategic pathways. Ultimately, the report concludes that energy stability is most prudent and robust against a range of possible outcomes, and makes recommendations for how such a strategy could be implemented.

New Production in a Changing Landscape

The shale gas and tight oil revolution, at present largely confined to the United States but with global potential, has already impacted global energy markets. Energy trade flows have been rerouted and market and investment patterns have been modified, some of which has added to existing impetuses for many nations to reconsider their energy policies. Shale gas and tight oil have also reconfigured climate change discussions. How this continues to unfold, however, is less certain, as the production of shale gas and tight oil resources is at an early stage. A great deal is still unknown when it comes to long-term production profiles, business cases, and ultimate potential of these resources.

U.S. Tight Oil and Shale Gas

In a short period of time, tight oil and shale gas[5] have taken on a prominent role in U.S. energy production. Shale gas production increased by almost 900 percent between 2006 and 2013.[6] U.S. tight oil has taken off more recently, primarily concentrated in North Dakota (the Bakken) and Texas (Eagle Ford and Permian),[7] and represents a rising proportion of total U.S. crude production. The United States is now producing more natural gas than ever before and is on track to meet its historical oil production high previously achieved in 1970.

Domestically, a combination of factors has allowed U.S. oil and gas producers to develop and refine the previously uneconomic production processes now being used to unlock the abundant hydrocarbon resource.[8] The resulting transformation has been overwhelming and continues to this day. In 2013 alone, U.S. crude oil production increased by nearly 1 million barrels per day—more than the combined increases in the rest of the world that year, and the largest annual increase ever observed in U.S. history.[9] According

5. It is important to note that despite both being hydrocarbons, the markets, uses, and handling of petroleum/oil and natural gas are distinctly different.

6. Production levels rose from 3 billion cubic feet per day (2006) to almost 27 billion cubic feet per day in 2013. Adam Sieminski, "Outlook for U.S. shale oil and gas" (presentation, Argus Americas Crude Summit, Houston, Texas, January 22, 2014), 4, http://www.eia.gov/pressroom/presentations/sieminski_01222014.pdf.

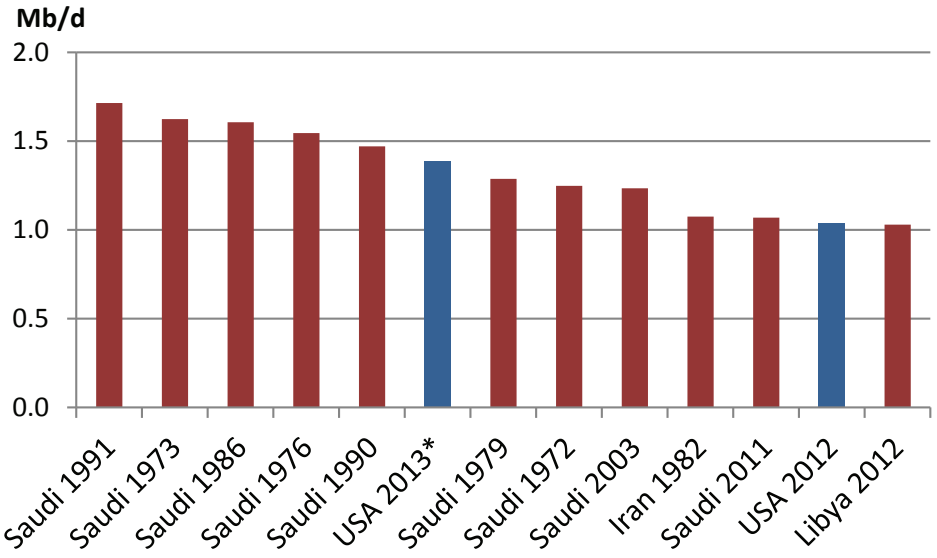
7. Three main areas for aggregation are the Permian, Williston, and Gulf Coast basins. The Bakken and the Eagle Ford and Permian are the major players producing tight oil.

8. These include high natural gas prices, especially in the 2006–08 timeframe, a permissive regulatory and resource ownership structure, technological know-how, and the overall compensation of the oil and gas industry.

9. EIA, "U.S. Crude Oil Production Growth Contributes to Global Oil Price Stability in 2013," January 9, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=14531.

to the BP Statistical Review of World Energy, the U.S. oil production increase in 2013 is the sixth largest of any country ever.[10] Perhaps even more exciting is the remaining resource potential. According to the U.S. Energy Information Administration (EIA), the United States has 58 billion barrels of technically recoverable tight oil (17 percent of world totals) and 665 trillion cubic feet of technically recoverable shale gas (9 percent of global totals).[11]

Figure 1: Largest Oil Production Increases[1]



[1] Includes crude, condensates, and natural gas plant liquids

Source: BP, *BP Statistical Review of World Energy 2013* (London: BP, 2013), http://www.bp.com/content/dam/bp/pdf/statistical-review/statistical_review_of_world_energy_2013.pdf. Data based on U.S. Energy Information Administration, *Petroleum Supply Weekly*, January 3, 2013, http://www.eia.gov/petroleum/supply/weekly/archive/2014/2014_01_03/pdf/table1.pdf.

A New Energy Posture for the United States

The emergence of shale gas and tight oil has resulted in a drastic change in the U.S. energy outlook. According the latest *World Energy Outlook 2013* from the International Energy Agency (IEA), the United States has been the largest producer of natural gas since 2012, is expected to become the world's largest oil (crude, unconventionals plus natural gas liquids) producer in 2015, and is expected to remain so through early 2030.[12] Even more conservative estimates from the EIA recognize a substantial shift.[13] The EIA forecasts a future where the United States moves from a net importer of 50 percent of liquids (a combination of crude oil, oil products, and biofuels) in 2010 to 32 percent by 2035. On the gas side, the EIA estimates

10. Christof Rühl, "Producing oil history in America," LinkedIn, February 12, 2014, http://www.linkedin.com/today/post/article/20140212113621-259060403-producing-oil-history-in-america?trk=mp-reader-card.

11. EIA, "Technically Recoverable Shale Oil and Shale Gas Resources," 10.

12. International Energy Agency (IEA), *World Energy Outlook 2013* (Paris: IEA, 2013), 73, 480, 76, http://www.worldenergyoutlook.org/publications/weo-2013/.

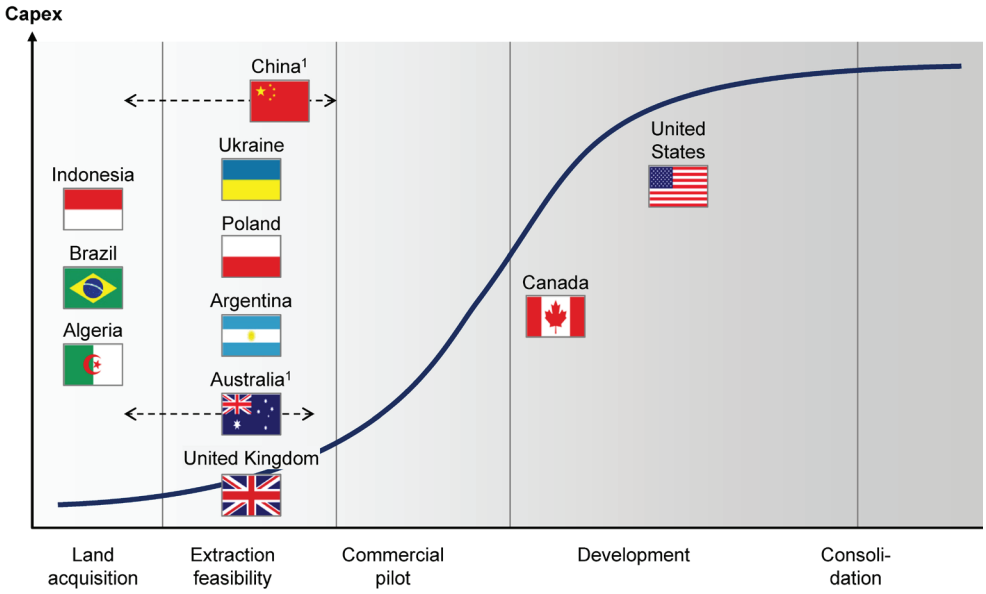
13. For example, EIA forecasts a future where U.S. imports of liquids (crude oil, oil products, and biofuel) fall from 50 to 32 percent by 2035, and where the United States becomes a net gas exporter by 2018. EIA, *Annual Energy Outlook 2014* (Washington, DC: EIA, 2014), http://www.eia.gov/forecasts/aeo/er/pdf/tbla14.pdf.

that the United States will be a net gas exporter by 2018.[14] These forecasts represent a dramatic change from previous projections in which the United States remained a major natural gas importer. Now, the Department of Energy is in the midst of reviewing a long line of applications for the export of liquefied natural gas (LNG). A similar phenomenon is underway on the oil side[15]: in 2011, the export of refined petroleum products[16] exceeded imports for the first time in over six decades, and became the top U.S. export commodity.

Global Potential

Given the U.S. experience, there is acute global interest in determining whether others might be able to produce their own unconventional oil and gas resources. As noted above, some estimates project that just some of the known basins could hold the equivalent of around 10 percent of technically recoverable global crude oil and 32 percent of global natural gas.[17] However, there remains considerable uncertainty about the ability for other countries to replicate the U.S. unconventional experience. The resource estimates and assumed recovery rates in other basins cannot be proven until production wells begin operation. Moreover, a host of above-ground conditions (e.g., legal structures, infrastructure) may limit the economic production of unconventionals elsewhere. To date, only Canada and China have begun production, though many other countries are in the resource exploration phase of development.

Figure 2: Current Position of Select Countries on Shale Gas and Oil Production[1]



[1] Flags based on most advanced basins in China (Sichuan basin) and Australia (Cooper basin). Other basins are still land acquisition stage.

Source: Lund et al., *Game changers: Five opportunities for US growth and renewal* (United States: McKinsey Global Institute, July 2013), 26, http://www.mckinsey.com/insights/americas/us_game_changers.

14. Ibid.
15. Note that the United States cannot export crude oil.
16. Refined petroleum products include but are not limited to gasoline, kerosene, distillates (including No. 2 fuel oil), liquefied petroleum gas, asphalt, lubricating oils, diesel fuels, and residual fuels.
17. According to these estimates, shale oil (including tight oil) resources add 11 percent to just over 3 trillion barrels of proved and unproved technically recoverable nonshale oil resources identified in recent assessments and approximately 47 percent to the 15,583 trillion cubic feet of proved and unproven nonshale technically recoverable natural gas resources. It is important to note that these are assumptions and won't be verified until production wells begin actual operations. EIA, "Shale oil and gas resources are globally abundant," January 2, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=14431.

Energy Impacts to Date

There is no question that the shale revolution has profoundly shifted the energy production profile within the United States. But the effects of this production have extended around the world. Considerable changes have already taken place, despite the ultimate magnitude and longevity of the trends driving those changes being highly uncertain. Significant questions exist about how shale gas and tight oil will evolve in the United States where production is already well underway. There is even greater ambiguity about whether the U.S. experience can be replicated elsewhere, and if so, to what degree and over what timeframe.

Shifting Energy Markets, Trade Flows, and Investment Decisions

One of the most obvious adjustments in the wake of U.S. tight oil and shale gas production has been a shift in previous producer-supplier relationships, and associated changes in energy trade flows. Drops in U.S. imports of both gas and oil[18] mean energy supplies once destined for the United States are now servicing other markets. The U.S. surge in oil production, primarily of light tight crude, has displaced imports of light oil from places like Nigeria, Angola, Libya, and Algeria. Despite rhetoric implying that domestic oil production might free the United States entirely from Middle Eastern oil imports, this has not happened and is unlikely to in the future. Contractual and industrial relationships remain, as does the need for the medium-quality crude that comes from the region.

At the same time that U.S. energy imports are falling, its exports are on the rise. As natural gas displaces coal for power generation, for both economic and environmental reasons the United States is exporting more coal to places in the world where coal demand continues to increase and prices are more attractive. U.S. exports of refined petroleum products and petrochemicals are also on the rise. Projections of stagnant or declining U.S. demand for petroleum products means U.S. refiners will continue to focus on exports, which will increasingly reach traditional European market strongholds in Africa and Latin America, causing Europe to seek out new markets for their exports, primarily in Asia.[19]

New sources of energy are also altering commercial competitiveness and investment decisions for both companies and countries. The hierarchy of energy projects is being

18. Imports of gas and oil are down 28 and 16 percent, respectively, since 2005, based on calculations derived from U.S. Energy Information Administration data.

19. Amrita Sen, *US Tight Oils: Prospects and Implications* (Oxford: Oxford Institute for Energy Studies, September 2013), http://www.oxfordenergy.org/wpcms/wp-content/uploads/2013/10/WPM-51.pdf.

reordered, shifting capital investments to the U.S. energy sector and away from more expensive and/or risky locations. Projects in locations as diverse as the Arctic, deep-water Brazil, Australia, Turkmenistan, and offshore east Africa are being reexamined, and, at a minimum, may have longer commercial timeframes than previously thought.[20]

Finally, industries such as petrochemicals and energy-intensive manufacturing are modifying decisions on production locations and supply chains. The sudden surge in U.S energy supply and consequent reduction in prices has made North America among the most attractive and competitive places in the world to locate such energy-intensive endeavors. The comparative advantage afforded the United States by low-cost domestic shale gas and tight oil resources is a source of real concern in several countries, particularly in Europe.

U.S. Shale Gas and Tight Oil Production is Adding Urgency to Many Countries' Already-Ongoing Reexaminations of Energy Policy

Not surprisingly, unconventional oil and gas resource potential is prompting many countries to rethink their energy policies to either take advantage of their own unconventional resource base or respond to some of the changes brought about by the impact of the U.S. oil and gas production surge.

In most countries there are compelling reasons to develop potential unconventional oil and gas resources. Some in Europe are looking for cheaper energy alternatives (either to contractually high gas prices or traditionally higher renewable energy prices) to help restore competitiveness and salvage environmental policies. In China, energy demand continues to rise, and environmental and social pressures are increasingly prodding Beijing to explore cleaner avenues of energy production than the traditional widespread use of domestically sourced coal. Given the sheer amount of energy China will require, its leaders are also wary of finding themselves wholly dependent on the market, and are seeking a greater sense of energy security by developing domestic resources. And finally, energy demand in oil-exporting countries across the Middle East is projected to rise. This reality places a new impetus behind finding ways to satisfy that demand without sacrificing exports, whose revenues comprise major portions of regional economies.

The Prospect of Abundant Oil and Gas Supplies Has Reordered Options to Deal with Climate Change

From an environmental perspective, shale gas can play a role in a transition to a low-carbon economy. Natural gas emits fewer greenhouse gases (GHG) than does coal (half the carbon dioxide of coal when used in power generation, for example), reduces conventional pollution,[21]

20. Sylvia Pfeifer, "Exploration: Rising cost of complex projects hits majors," *Financial Times*, September 8, 2013, http://www.ft.com/intl/cms/s/0/99622e42-13cd-11e3-9289-00144feabdc0.html#axzz2vN8V41LL.

21. For example, nitrogen oxides, sulfur oxides, sulfur dioxide, mercury. U.S. Environmental Protection Agency (EPA), "Air Emissions," http://www.epa.gov/cleanenergy/energy-and-you/affect/air-emissions.html.

and is compatible with the intermittency of renewables.[22] Many in the public and private sector alike are seeking ways to prioritize the role that natural gas plays in the energy economy, and proponents of the "green agenda" have split over whether to endorse or resist natural gas as a possible "bridge fuel" that promotes near-term emissions reduction as cleaner energy solutions are developed.[23]

Despite the potential of cheap natural gas to reduce emissions in the near term, some environmentalists note that it disadvantages renewable, nuclear, and clean coal energy sources by making them less price competitive. The emergence of an economic way to produce greater supplies of oil, the most efficient and energy-dense source of energy, also makes diversification of the transportation sector more difficult. It could also extend the timeframe for implementation or diminish the economic attractiveness of technologies, research, and investment in alternative transport fuels and vehicles. Moreover, there remains uncertainty regarding the amount of methane (a potent GHG) released during production.

In general, less focus on the resource-scarcity impetus to switch away from fossil fuel use has meant attention is now more squarely on other reasons to address climate change—namely its economic, national security, health, and other societal impacts.

Caution about the Future Is Warranted: It Is Risky Business to Extrapolate Long-Term Conclusions from a Resource with Such a Short Production History

Early on, the unanticipated and fast-moving resurgence in domestic gas production gave rise to questions about the long-term viability of the resource base and the production potential. In the United States, markets and infrastructure had to adjust to large and geographically dispersed production increases. This reorientation was further complicated by a dynamic commercial environment in which price fluctuations, industry mergers and acquisitions, continual technological and production improvements, and changing regulatory frameworks made it difficult to assess the production dynamics of unconventional oil and gas.

While the resource potential is large, there remains considerable uncertainty regarding any given reservoir's ultimate production. Thus far, however, technology and production practices have exceeded expectations, resulting in higher and higher production estimates as experience grows.

22. Many sources of renewable energy, such as solar or wind, do not generate energy continuously. Given the current lack of battery storage that might help mitigate this problem, natural gas is often considered a compatible baseload source of energy for renewable sources, as it can quickly be scaled up when the wind is not blowing or the sun is not shining. Molly A. Walton, "Environmental Concerns: How Clean Is Clean?," CSIS, September 2012, http://csis.org/files/publication/120918_Walton_EnvironConcerns.pdf.

23. Natural gas can lead to near-term reduction of greenhouse gas emissions through use in the power sector (by switching from coal to gas or by building new natural gas power-generation facilities in lieu of coal power), and thus can start "bridging" the world onto a lower-carbon pathway. The bridging idea has become quite popular.

Price Impacts and Perceptions about Future Impacts

Shale gas and tight oil have influenced trade, investment, and the climate change debate in unforeseen ways. They have also affected price formulations. And just as countries with unconventional basins look to unlock that potential, they and every other country around the world are anticipating how potential production might additionally influence price, a complex dance with widespread effects. Even if analysts were able to correctly predict future unconventional production, this would still be just one component of anticipating that production's effects on global prices. This is a significant strategic concern, as one of the most direct ways that energy influences governments, both at home and in their dealings abroad, is through its price effects on individual economies.

Natural Gas

Even before the onset of shale gas development in the United States, global gas markets were changing. There was speculation about how and when these markets might evolve to look more like global oil markets (i.e., more widely traded with more competitive pricing and development of a spot market). The shale gas revolution in the United States has accelerated this conversation and encouraged widespread theorizing over how the introduction of a North American export market for low-priced gas would impact gas markets elsewhere in the world, both structurally and in overall price levels.

Three major gas markets—the United States, Europe, and Asia—have already undergone significant change. Prior to 2010, natural gas prices that were formally delinked from oil markets still tended to move in concert with one another in North America. They have now become much more independent. In Europe, long-term oil-linked contracts have shifted to toward gas-on-gas pricing, and the volume of spot trading is on the rise. In Asia, LNG contracts are being revised to include greater discounts between oil and natural gas pricing, shorter-term contracts, and more destination flexibility. Interregional trade of gas continues to increase, which suggests the evolution of pricing structures will likely progress as well. Whether this will lead to lower gas prices on net, however, will be driven primarily by supply-and-demand balances and the cost of bringing new supplies to market.

Tight Oil

Despite early speculation that U.S. tight oil production would bring global prices down or even precipitate a price collapse, to date the price impact has been relatively muted and limited to crude quality differentials within the United States.

Oil analysts asses the likelihood of a precipitous decline in oil prices resulting from U.S. tight oil production based on several variables: 1) projected oil demand; 2) projected tight oil production; and 3) projected oil supply.[24] Invariably, given refining configurations and prod-

24. A fourth variable is economics. It is, of course, impossible to know whether or precisely when a global or regional economic downturn will occur, and if so what its impact on demand for oil would be. Sources include: BP, *BP Statistical Review of World Energy 2013* (London: BP, 2013), http://www.bp.com/content/dam/bp/pdf/statistical-

uct demand, such discussions must also include considerations of crude oil quality in addition to volume/quantity. With respect to the first variable, energy demand projections are not as strong as they were prior to the global economic crisis. The United States is expected to add an additional 3 million barrels per day of crude oil and liquid fuels production to global oil supplies between 2013 and 2015.[25] Total production levels are expected to increase to levels that would more than make up for expected oil demand increases over the next couple of years. Over the longer run, significant uncertainty about production levels in Iraq, Iran, Mexico, Libya, Venezuela, Nigeria, and elsewhere—including Saudi Arabia's desire to continue to operate as swing producer and holder of global spare production capacity (oil production that can be brought to market relatively quickly)—significantly cloud the outlook for oil markets. On balance, then, there is more oversupply risk in the medium term than there was before the onset of tight oil production.

While the onset of tight oil production alone will not likely lead to a significant reduction in oil prices, it (along with demand suppression from the economic downturn) suggests a much softer oil market outlook over the next 10 to 15 years than had previously been expected. The reaction of major global oil producers to the perceived risk of an oversupplied global oil market is significant, and is a key factor in much of the geopolitical context for major oil-producing and oil-consuming countries alike.

MAJOR GAS MARKETS

Oil and gas are used differently within the global and regional economies, which contributes, among other factors, to differences in how each commodity is priced. Oil is generally traded on the global market, with various crude oils discounted depending on quality characteristics. Natural gas markets, on the other hand, remain more regional.

UNITED STATES: Prices are deregulated and natural gas is sold through a series of pricing points or hubs, most notably Henry Hub in Louisiana.

EUROPE: Prices are deregulated but hub-based pricing has not yet been universally adopted. Natural gas continues to be sold on both the spot market at hub-based prices and through long-term contracts under oil-linked prices.

ASIA: Natural gas is traded primarily under long-term contracts with oil-linked prices. Asian markets generally lack the infrastructure and contract flexibility of North American and European markets, though volumes of LNG bought and sold on the spot market have increased over the last several years.

review/statistical_review_of_world_energy_2013.pdf; EIA, *International Energy Outlook 2013* (Washington, DC: EIA, July 2013), http://www.eia.gov/forecasts/ieo/pdf/0484%282013%29.pdf; and Bassam Fattouh, "Shifting oil and oil product markets and the impact on the Middle East" (presentation at Centre international d'études pédagogiques, The Hague, November 5, 2013), http://www.clingendaelenergy.com/inc/upload/files/2._Oxford_Middle_East_presentation_secured.pdf.

25. EIA, *Short-Term Energy Outlook* (Washington, DC: EIA, February 2014), http://www.eia.gov/forecasts/steo/report/global_oil.cfm.

The Geopolitical Impacts of Global Energy Shifts

The energy changes spurred by the shale gas and tight oil revolution have had broader geopolitical effects. It is important not to overstate the geopolitical impacts of energy changes that have occurred to date or what might happen in the future. The geopolitical impacts to date cannot be rigorously quantified and are, more often than not, but one element of a complex network of domestic and international factors influencing decision-making. CSIS's analysis indicates that while concrete geostrategic impacts thus far have been limited, there have clearly been changes in national and international perceptions that may or may not align with new realities. Big energy producers like Russia and Saudi Arabia, producers aspiring for a greater role in world markets like Iran, Iraq, and Mexico, revenue-dependent countries like Algeria, Nigeria, and Yemen, large energy consumers like China, Europe, and Japan, and, as already discussed, the United States, have all shifted their domestic or foreign policies in response to perceived changes in strategic standing resulting (or expected to result) from tight oil and shale gas development.

Big Producer: Russia

Russia is an energy titan on the global stage, exporting almost 70 percent of its crude oil production[26] and 27 percent of its natural gas production[27] in 2013. These levels earn it the position of the world's second-largest oil exporter, and the largest exporter of natural gas. These exports are central to the Russian economy; the revenue they generate accounts for between 40 and 50 percent of Russia's total budget revenue (80 percent from oil and 20 percent from gas) and over 70 percent of its total export revenue.[28] But while Russian oil and gas production continues to rise, the sector faces steep challenges ahead. Despite vast domestic energy resources, current production levels cannot be maintained without substantial reinvestment in existing production areas or the development of new ones.[29]

Market shifts fed by the shale gas and tight oil revolution have reinforced the rationale for Russia's "look East" energy strategy.

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26. Exports of crude oil amounted to 7.4 million of 10.97 million barrels per day in October 2013. IEA, *Oil Market Report* (Paris: IEA, 2014).

27. Exports of natural gas, 2012 average. EIA, "Russia Country Analysis Brief," http://www.eia.gov/countries/country-data.cfm?fips=rs.

28. Figures for 2012. "Russian tax breaks for shale, offshore oil seen on Jan.1," Reuters, March 18, 2013, http://www.reuters.com/article/2013/03/18/russia-oil-tax-idUSL6N0C7FLT20130318.

29. Thane Gustafsen, *Wheel of Fortune: The Battle for Oil and Power in Russia* (Boston: Harvard Publishing, November 6, 2012).

Over the last few decades, Russia had viewed the West (especially Europe) as its primary energy market. In recent years, however, it has pursued a more deliberate strategy of exporting to the region that represents "the locus of future demand," Asia. A decline in European demand growth (with or without European shale gas production) and a lost potential of a U.S. export market has placed a greater imperative for Russia on solidifying more oil and gas export deals with Asia. Many of the trends pointing in this direction were well underway before shale gas and tight oil became an economic reality. But they have had an effect. More adequate supplies on the global market may mean that Asian economies have more options, forcing Russia to make its terms more attractive.

Russia is also squeezed on the investment front. The U.S. ascent as a potential competing energy supplier to Asian markets may significantly alter the commercial viability of some projects in Eastern Siberia and the Far East. In its favor, however, Russia is a massive resource holder and can be a low-cost producer if it chooses to be, which, coupled with geographic proximity, increases its attractiveness to Asian consumers. Ultimately, then, the success of Russia's energy reorientation has been complicated but not derailed by the shale gas and tight oil revolution.

The shale gas and tight oil revolution adds to existing pressures on Russia's energy sector, reinforcing the necessity of reform.

Russia's success in both European and Asian markets relies not only on price, but also on whether it is seen as a stable and reliable supplier. There are significant hurdles to overcome if Russia hopes to accomplish this over the medium and long term. Declining production in Russia's conventional fields raises questions in this regard. Perhaps even more importantly, world leaders view the dominance of Russia's energy sector in its overall economy and the challenges of corruption as deeper structural concerns. Currently, Russia's energy sector is run according to domestic political needs. Averting significant decline will require new investments, new technology, and rationalization. In this sense, the shale gas and tight oil revolution in the United States has added impetus for reform. Russia's unclear prospects for domestic reform of its energy sector and its strategy in response to perceived downward price pressure loom over the future of its role in the world. On the other hand, lower oil and gas prices may finally force Russia to address other sectors in its economy, which have been crowded out by oil and gas, leading to overall more balanced economic growth.

The shale gas and tight oil revolution may be lessening others' interests in the Arctic to Russia's advantage.

The opportunities presented by new shale gas and tight oil projects have changed the economics not only of Far East gas projects, but of those in the Arctic as well. Large projects to export Russian gas to the United States (such as the Shtokman project) have been postponed. International companies deferred Arctic development due to environmental and reputational risk. Independent companies that conducted initial offshore exploration off the west coast of Greenland did not find commercially viable quantities of natural resources. And the last remaining company actively pursuing Arctic development in U.S.-claimed waters recently delayed those plans.

Despite this, Russia and Norway continue to devote significant investment funds toward the development of the oil and gas resources in the Barents and Kara Seas. Russia sees Arctic resource development as essential to its future economic development, while Norway seeks Arctic natural resources to replace diminishing North Sea oil assets. Russia's continued pursuit of Arctic projects is recognition not only of the potential economic benefits but also of the wider range of interests Moscow believes a strong position in the Arctic will support.[30] Thus far, the Arctic remains a region of international cooperation. Other Arctic nations, including the United States,[31] continue to work through intergovernmental forums such as the Arctic Council on developing a stable international legal framework for addressing commercial and environmental issues in the Arctic region. But Russia's broader involvement there may give it an advantage in shaping that future going forward.

Big Producer: Saudi Arabia

Though Saudi Arabia's role in energy markets is different than Russia's, as another large producer many of the implications of shale gas and tight oil production are similar. Saudi Arabia is the world's largest producer and exporter of petroleum liquids, and is home to the largest proven conventional oil reserves in the world.[32] The Saudi economy remains heavily dependent on petroleum and petroleum-based fuels and liquids, both for internal consumption and, more importantly, for meeting its revenue needs. In 2011, for example, petroleum exports accounted for almost 90 percent of the kingdom's export revenues.[33] Saudi Arabia is also the largest consumer of petroleum in the Middle East, with oil used both in the heavily subsidized transportation sector as well as for power generation, cooling, and desalinization, among other uses.[34]

Declining U.S. markets reinforce a reorientation toward Asia that was already underway.

Although a trend long in the making, the new U.S. energy posture further shifts markets, and thus Saudi Arabia's focus, to the east. Saudi Arabia has carefully tried to balance its commercial need to fill market demand in the East with maintaining strong commercial ties with the West, as evidenced by joint ventures such as the Motiva oil refinery in Texas.[35] With fewer oil exports destined for the United States, the growth market for Saudi Arabia is even more focused on China and other Asian economies.[36] Saudi Arabia has approximately 2 million

30. Russian Arctic projects are extremely expensive. Russia itself does not have enough competence in Arctic offshore hydrocarbon production, so all these projects could be developed only in strong cooperation with the majors (which have necessary technologies and experience).

31. The U.S. Coast Guard, for example, recently released an entire strategy.

32. EIA, "Saudi Arabia Country Analysis Brief," http://www.eia.gov/countries/analysisbriefs/Saudi_Arabia/saudi_arabia.pdf.

33. Organization of the Petroleum Exporting Countries (OPEC), *Annual Statistical Bulletin 2012* (Vienna: OPEC, 2012), http://www.opec.org/opec_web/static_files_project/media/downloads/publications/ASB2012.pdf.

34. EIA, "Saudi Arabia Country Analysis Brief."

35. Clifford Krauss, "Texas Refinery Is Saudi Foothold in U.S. Market," *New York Times*, April 4, 2013, http://www.nytimes.com/2013/04/05/business/texas-refinery-is-saudi-foothold-in-us-market.html?pagewanted=all&_r=0.

36. Arguably there is a floor to how low they can go because of purchasing commitments associated with Motiva, as well as Aramco's pricing structure, which takes into account competitively priced alternative crudes.

barrels per day of refining capacity outside of its borders through joint ventures and equity investments not just in the United States, but also in China, Japan, South Korea, and the Philippines.[37] These refineries are designed to run Saudi crude as part of their feedstock stream, ensuring the need for exports to those destinations.

Soft markets fed in part by tight oil complicate Saudi Arabia's role as a market balancer and add an additional impetus for domestic reform.

Saudi Arabia has built up significant spare capacity over the last five or so years to help protect the market from unmanageable price spikes.[38] The combined slowdown in growth and rise in supply (including from U.S. tight oil) means that it could be in a position to hold more spare capacity relative to overall market size than it has in a long time. Such a position forces Saudi leaders to think about how to manage ample, rather than limited, spare capacity in global oil markets.[39]

Revenue dependence is one of the many reasons for Saudi Arabia to undertake domestic energy pricing and subsidy reform. Though reform efforts had been recognized priorities before the surge in U.S. oil production, the shale gas and tight oil revolution has reinforced the case for change. Because it increases the potential for soft oil markets, the threat to Saudi Arabia's domestic economy is bigger. (Many argue, however, that this risk is manageable, as Saudi Arabia has sufficient resources to weather hard times for both the short and medium term.) Shale gas and tight oil have also confirmed Saudi Arabia's decision to focus on developing its own unconventional gas, both to illustrate that it can and to improve its domestic economy by using natural gas instead of oil for power generation and seeding new gas-driven industrial enterprises.[40]

Weakening energy ties help feed a broader concern over the United States' continued commitment to stability in the region.

As energy markets shift, this helps to feed a perception that the Middle East's (and Saudi Arabia's by extension) centrality to U.S. interests is increasingly being challenged. The U.S. military withdrawal from Iraq and drawdown in Afghanistan, a reduced dependence on oil and gas imports, budget cuts, a strong domestic policy focus, the announced U.S. "rebalance to Asia," a complex evolution of policy on Syria, and ongoing negotiations with Iran are all identified as contributors to the current period of tense relations between the United States and Saudi Arabia. In response to this development, the Obama administration has taken great pains to reemphasize U.S. policy and doctrine that has guided U.S. involvement in the Middle East (first expressed by President Roosevelt at Yalta in 1945), as well as a continued commitment to keeping global trade routes open and safe (the Carter doctrine of 1980). Whether those measures are sufficient remains an open question, but it is a major dynamic during a time of enormous tension in the region.

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37. EIA, "Saudi Arabia Country Analysis Brief."

38. Oil production that can readily be brought online.

39. Some have speculated that Saudi Arabia might become so threatened by weak markets that they could try to flood the market, driving down prices. This could "kill off" tight oil development, and/or preclude the emergence of other major oil producers trying to reenter the market (specifically Iran). Others argue such action is implausible either because of the kingdom's domestic budget pressures or because they couldn't sustain it long enough to achieve the desired effects.

40. Saudi Arabia's strategy is to increase gas production as a substitute for oil in power generation. It also wants to use gas to fuel the on-shoring of energy-intensive manufacturing as a way to increase employment.

Reentrants: Iran, Iraq, and Mexico

If the shale gas and tight oil revolution has put pressure on the world's largest oil and gas producers, its implications for smaller, but still significant, producers who are seeking to re-enter or expand their market presence are similarly important.

Softer markets raise the stakes for reentrants to get back on the market, putting increased pressure on OPEC cohesion.

The overall softness of oil markets has presented a serious challenge to OPEC, which aims to regulate production to manage price levels. The rush on the part of Iraq (and the anticipated rush, in the case of Iran) to recapture market share represents a direct challenge to this central tenet, and would likely further threaten the group's cohesion. OPEC has a spotty record of group coherence and discipline, and its power rests in the few key producers (mostly Saudi Arabia) with the ability to influence price through the size of its spare capacity. One or more of these countries returning to the market, or not, is a significant factor for oil price outlook. Iraq has officially been out of the OPEC quota system for some time and Iran's production is well below its quota. Should one or both countries succeed in producing significantly more oil it will cause tension between OPEC members. This tension has already been on display at the last couple of OPEC meetings (including with "revenue-dependents" below). In short, U.S. tight oil production has already begun to widen existing rifts within OPEC, which would be exaggerated still further as member countries Iran and Iraq attempt to recapture market share.

The new energy landscape accelerates internal need for reform.

For formerly significant hydrocarbon producers who are reemerging after years of isolation (Iraq), are excluded from international energy markets (Iran), or are suffering from steep production declines and underinvestment (Mexico), the shale gas and tight oil revolution has served as a further impetus for change. All three countries have a need to increase production and all three are world-class resource holders with, under the right circumstances, the potential to bring on a great deal of conventional oil and gas supplies over the next 10 to 15 years. In order to attract investment over that timeframe, each has to undertake significant economic, political, and security reforms. The act of such reforms, or lack thereof, will feed into regional and global relations, the stability of the countries, etc. The impact that energy sector reform may have on these countries is not just about the market. The liberalization of the oil sectors in these countries could provide the impetus to broader reform and have geopolitical impacts.

Revenue Dependents

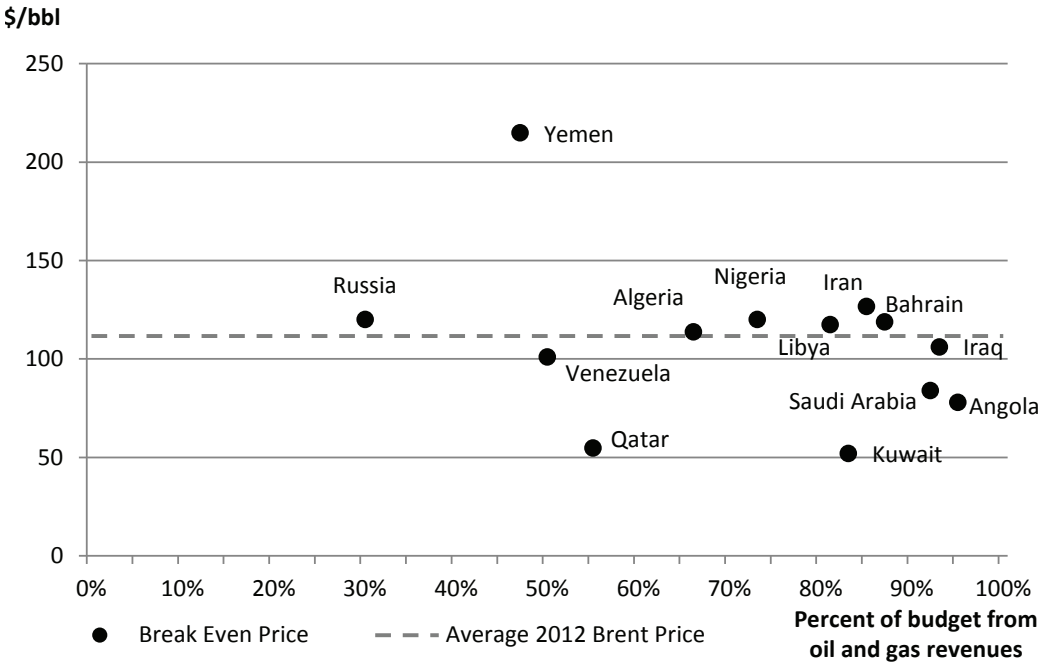
In addition to the producers discussed above, there are numerous other contributors to global oil and gas markets whose economies are particularly sensitive to changes in energy prices. Most members of the Gulf Cooperation Council (GCC) (which includes Saudi Arabia, Kuwait, the United Arab Emirates, Qatar, Bahrain, and Oman) fall into this category, as do Libya, Algeria, Yemen, Venezuela, and others. For most of these countries, hydrocarbon price fluctuations cut both ways. On the one hand, many countries use oil and gas export revenues

to support high levels of government patronage. In this sense, these countries benefit from high global prices. On the other, many countries in the region highly subsidize internal energy consumption or import fuel, and they benefit from low global prices.[41]

Potential for modest future price decline raises risks of instability.

While the tight oil revolution has not brought about the large drop in oil prices some expected, it is changing the economics of planned development, production, and infrastructure projects in multiple countries that are highly dependent on energy revenues. Many countries in this basket (Algeria, Nigeria, Libya, Yemen, and Venezuela) are living well beyond their oil revenue budget, and as it stands at current prices, their ability to maintain the basic structure of their economies is already under threat. Many of them are also, to varying degrees, politically unstable. There is no concrete evidence that a loss of oil-derived revenue will cause instability, but as softer energy markets narrow the margin for finding the proper balance between revenue, production, and stability, risks are rising.

Figure 3: Breakeven Prices for Revenue Dependent Countries



Sources: Breakeven price data for Angola, Venezuela, and Nigeria: Ali Aissaoui, "MENA Lingering Turmoil and its Effect on Energy Investment Climate: A Reassessment," APICORP [Arab Petroleum Investments Corporation] Economic Commentary 8, no. 8-9 (August-September 2013), http://www.apicorp-arabia.com/Research/Commentaries/2013/Commentary_V8_N12_2013.pdf; Breakeven price data for Qatar, Kuwait, Saudi Arabia, Libya, Iraq, Bahrain, Algeria, Iran, and Yemen: "IMF Regional Economic Outlook: Middle East and Central Asia," International Monetary Fund, November 2013, http://www.imf.org/external/pubs/ft/reo/2013/mcd/eng/pdf/mreo1113.pdf; Breakeven price data for Russia: *Global and Russian Energy Outlook up to 2040* (Moscow: Energy Research Institute of the Russian Academy of Sciences, 2013), http://www.eriras.ru/files/Global_and_Russian_energy_outlook_up_to_2040.pdf; Revenue data for Venezuela: "Venezuela Industry Report: Energy," Economist Intelligence Unit, November 2013; Revenue data for all other countries: latest available International Monetary Fund Article IV Report, http://www.imf.org/external/country/index.htm; Average Brent price data: U.S. Energy Information Administration, *Short-Term Energy Outlook* (Washington, DC: EIA, February 11, 2014), http://www.eia.gov/forecasts/steo/report/prices.cfm.

41. These structural sensitivities exist beyond producers. Egypt, for example, spends roughly 30 percent of its government budget on fuel subsidies; cheaper oil and gas means those costs fall. And Jordan, which imports more than 95 percent of the energy it consumes, would face a significantly reduced bill if prices fell (or a much greater one should they rise).

Consumer: China

China has become one of the fastest-growing economies in the world, as exemplified by an average annual GDP growth of 10 percent over multiple decades. Notwithstanding several indications of a subsequent slowdown, today China is the world's second-largest economy and destination of foreign direct investment as well as the largest manufacturer and merchandise exporter in the world. These trends are propelling China to become one of the most significant forces in the global energy market. China recently became the largest energy consumer in the world,[42] and is projected to consume more than twice as much energy as the United States by 2040.[43]

Greater energy supplies enhance China's energy security position but do not alleviate its overall vulnerability.

Better supplied energy markets help to improve China's sense of energy security by increasing the overall availability of oil and natural gas. From a security-of-supply vantage point, the U.S. shale gas and tight oil revolution and the unfolding impact on traditional producers in the Persian Gulf is a main factor prompting China to take stock of its relationship with the Middle East and North Africa. China's dependence on Middle Eastern energy supplies is growing, and it is increasingly concerned about the implications of a potential reduction of U.S. presence in this region. As a result, Chinese leaders are facing questions about what they can and should do to protect the security of that supply.

China's broader strategy has been to pursue supply diversity in order to hedge against regional security concerns and transportation risks.[44] Shale gas potentially gives China a previously unforeseen domestic option for improving its supply security. Given that China is home to the largest volume of technically recoverable shale gas resources in the world at 1,115 trillion cubic feet,[45] it hopes to develop its unconventional resources to reduce its import dependence. However, China is at an early stage in unlocking its shale resource potential and faces challenges stemming from a lack of adequate technology and technical expertise, necessary infrastructure, water (in some locations), and market conditions.

The shale gas and tight oil revolution has dampened China's "United States in decline" narrative.

As the United States has reoriented to focus on the Pacific, the shale gas and tight oil revolution has turned down the volume on the "United States is in decline" narrative that emerged after the economic recession of 2008.[46] By delivering a range of macroeconomic benefits

42. EIA, "China Country Analysis Brief," http://www.eia.gov/countries/cab.cfm?fips=CH.

43. EIA, *International Energy Outlook 2013*.

44. Jian Zhang, "China's Energy Security: Prospects, Challenges, and Opportunities," Brookings Institution, July 2011, http://www.brookings.edu/research/papers/2011/07/china-energy-zhang.

45. EIA, "Technically Recoverable Shale Oil and Shale Gas Resources."

46. While many Chinese thinkers adhered to the view that U.S. power had waned, they were not the primary authors of the argument. Instead, they pointed to multiple assessments, to include those done by entities such as the United States' own National Intelligence Council, that the relative advantage in global power the United States had enjoyed was shrinking. National Intelligence Council (NIC), *Global Trends 2025: A Transformed World* (Washington, DC: GPO, November 2008), http://www.aicpa.org/research/cpahorizons2025/globalforces/downloadabledocuments/globaltrends.pdf.

like GDP growth and job creation, the United States' new energy posture has challenged the view held by many Chinese elites that economic recession augured waning U.S. influence.[47] The "declining U.S." narrative was further contradicted by the prospect of U.S. shale gas and tight oil production eventually enabling exports to countries in Asia. As U.S. policymakers announced the "rebalance" to the region, China initially argued to its East Asian neighbors—with some justification—that the rebalance was unduly focused on military and security elements. The prospect of U.S. shale gas exports to the region has helped to undermine that argument, adding a strategic dimension to the obvious economic benefits for Asian consumers.

The shale gas and tight oil revolution offers new possibilities to shift the energy conversation between the United States and China from one of competition to one of cooperation.

In the recent past, Chinese international energy policy has been portrayed as anticompetitive and a possible threat to U.S. soft power influence. Despite ample evidence that increased investment and production from Chinese energy companies has added to the global balance of resources rather than subjugated them to Chinese strategic aims, the often opaque relationship between Chinese companies and their government, and state-to-state agreements that often accompany commercial energy deals, stokes suspicion about deeper Chinese strategic motives. This suspicion extends to Chinese companies' involvement in investments in the U.S. energy sector.

The changing U.S. energy profile has allowed for new areas of energy collaboration. In the commercial arena, the Chinese have invested heavily in the United States with almost no U.S. political backlash. The investment has been a two-way street though more limited on the Chinese side. To U.S. oil and gas companies and oilfield service companies that wish to capitalize on their shale gas expertise, the Chinese shale gas sector presents significant commercial opportunities. At the government-to-government level, cooperation between the two countries to promote greater and environmentally safe shale gas production has been a high priority, as exemplified by the United States-China Shale Gas Resource Initiative launched at the end of 2009.

Consumer: Europe

If China's energy demand growth can be characterized as voracious, Europe's could be seen as anemic. Both, however, share a heavy dependence on imports to meet their oil and natural gas needs. In 2009, the European Union[48] imported 11.2 billion barrels of oil and 14.5 trillion cubic feet of gas per day. These numbers have either remained constant or increased

47. Kenneth Lieberthal and Wang Jisi, *Addressing U.S.-China Strategic Distrust*, John L. Thornton China Center Monograph Series no. 4 (Washington, DC: Brookings, March 2012), 9, http://www.brookings.edu/~/media/research/files/papers/2012/3/30%20us%20china%20lieberthal/0330_china_lieberthal.pdf.

48. Defined here as the 27 member states of the European Union (EU-27) excluding Croatia, which joined the Union on July 1, 2013, and is not represented in EU statistical information.

only slightly in the years since.[49] Russia is the primary source of these imports,[50] supplying 33 percent of all European Union crude oil; 25 percent of its natural gas, and 23 percent of its solid fuels in 2011.[51] Norway also supplies a substantial amount of gas to Europe, providing almost 30 percent in 2013.

The shale gas and tight oil revolution has helped the United States to rebound economically in ways that widen the gap with Europe and exacerbate competitiveness concerns.

At the same time that U.S. industry and consumers are benefiting from lower natural gas prices, Europe continues to face higher domestic energy costs that are already high due to climate change policies. These costs are placing pressure on an already weak European economy that is struggling to recover, and the growing worry over falling competitiveness has become the dominant preoccupation in many European capitals. Industrial end-user electricity prices per kilowatt hour in Europe are around double those in the United States, largely as a result of government policy and the economic downturn.[52] These high prices place pressure on industry, and several European companies operating in sectors that are especially energy-dependent (e.g., steel, cement, petrochemicals) are investing in projects in the U.S.[53] With European demand for fuel dropping to a 19-year low as a result of Europe's prolonged economic crisis, high unemployment, and energy-efficiency measures, profit margins for Europe's refineries have also dramatically diminished. European refineries are oriented primarily for diesel and gasoline fuel production, and must compete with newly constructed, state-of-the-art refineries in the Middle East, the United States, Asia, and Russia. The problem of plummeting profits will likely worsen as Europe's fuel demand continues to drop, down almost 2 million barrels a day in 2013 from 2008 levels.[54] The EU is attempting to save refineries from additional closures with a plan to invest $30 billion into the industry throughout Europe by 2020. However, experts are already predicting that these plants will require an additional $21 billion just to stay in business, let alone generate returns.[55] As these U.S. refineries increase product exports, they will further undercut traditional European markets in West Africa and Latin America. The prospect of losing additional export markets has exacerbated the troubles of European refineries.[56]

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49. EIA, "International Energy Statistics: Imports of Crude Oil Including Lease Condensate," http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=5&pid=57&aid=3&cid=CG1,&syid=2009&eyid=2010&unit=TBPD; EIA, "International Energy Statistics: Imports of Dry Natural Gas," http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=3&pid=26&aid=3&cid=CG1,&syid=2009&eyid=2012&unit=BCF.

50. Eurostat, "Main origin of primary energy imports, EU-27, 2002-2010," http://epp.eurostat.ec.europa.eu/statistics_explained/index.php?title=File:Main_origin_of_primary_energy_imports,_EU-27,_2002-2010_(percent25_of_extra_EU-27_imports).png&filetimestamp=20121012131852.

51. European Commission, Eurostat, "Imports (by country of origin)—solid fuels—annual data (nrg_122a)," "Imports (by country of origin)—oil—annual data (nrg_123a)," and "Imports (by country of origin)—gas—annual data (nrg_124a)," http://epp.eurostat.ec.europa.eu/portal/page/portal/energy/data/database.

52. International Energy Agency, *World Energy Outlook 2013,* 273.

53. Sylvie Cornot-Gandolphe, *The Impact of the Development of Shale Gas in the United States on Europe's Petrochemical Industries* (Paris, France: Institut français des relations internationals (IFRI), November 2013), 24.

54. Konstantin Rozhnov, "Europe to Shut 10 Refineries as Profits Tumble," Bloomberg, April 5, 2013, http://www.bloomberg.com/news/2013-04-04/europe-to-shut-10-refineries-as-profits-tumble.html.

55. European Commission, Directorate-General for Energy, "Summary and Conclusions of the EU Refining Roundtable Held in Brussels on the 15th of May 2012," June 1, 2012, http://ec.europa.eu/energy/observatory/oil/doc/refining/20130505_summary_and_conclusions.pdf.

56. Ron Bousso and Jonathan Saul, "European refiners squeezed in Africa by rising U.S. exports," Reuters, July 22, 2013, http://www.reuters.com/article/2013/07/22/europe-refinery-idUSL6N0FP2OV20130722.

This has already led to tension within the Transatlantic Trade and Investment Partnership negotiations, with Europeans requesting a special energy chapter to seek greater guaranteed access to U.S. crude oil and natural gas exports.

Coupled with broader energy price challenges, the shale gas and tight oil revolution has increased pressures on Europe's green agenda.

As Europe's economic struggles persist, the conflict between recovery and environmental policy objectives is increasingly evident. Europe recently announced its post-2030 environmental and energy goals and they are less ambitious than one would have expected given their position of the last five or so years. There is a great deal of pressure on the green agenda within Europe as the block continues to try reviving their domestic economies. The U.S. hydrocarbon revival adds pressure both domestically and within global negotiations on climate change.

Shifting energy markets do little to alleviate concerns with unpredictable suppliers in Russia and the Middle East and North Africa.

Another major preoccupation in European energy discussions is the continued reliance on imports. As markets work through the changes brought by the onset of shale gas, Europe sees no short-term relief from its dependence on Russian imports— a contentious issue even before the Ukrainian crisis erupted in March 2014. Some analysts project that Russia will continue to be the lead supplier of gas to the EU over the next decade, with a 30 percent share of Europe's gas market through 2023.[57] After two Russian gas supply shutdowns in 2006 and in 2009, Europe has sought to diversify its energy supply with limited success. Europe's greatest leverage over its Russian gas dependence may be its ability to adjust its long-term Russian gas contracts and price structure as well as potentially break Russian requirements that the price of oil and gas remain linked. Given Europe's dependence on energy imports from Russia, Southern and Central Europe are concerned about two main things. The first is that Russia's internal political system will unravel (either because of energy breakdowns or for other reasons), sparking unrest that could disrupt supplies. The second is that Russian leaders will continue to exercise a strong hand over energy exports, using them as a tool in support of their broader strategic goals rather than in concert with free-market principles.[58] Europeans are also troubled by the state of Russia's energy sector writ large. The ability for Russia to sustain production or offset declines is important for Europe, even as Russia turns its focus elsewhere.

A desire to diversify has led Europe to seek new supplier relationships, especially from North Africa and the Middle East, though these options may not offer greater predictability—given ongoing instability in the Middle East and North Africa, these supply relationships are not without risk.

Europe's energy dependence also raises a series of complex geopolitical calculations. For example, Europe's supply of energy from the Middle East has been reduced by self-imposed

57. Henning Gloystein, "Analysis—Little chance of Europe breaking Russia's gas dominance," Reuters, July 18, 2013, http://in.reuters.com/article/2013/07/18/energy-gas-europe-idINL6N0FN2RA20130718.

58. Theresa Sabonis-Helf, "Russia's Evolving Energy Sector," in *New Realities: Energy Security in the 2010s and Implications for the U.S. Military*, ed. John R. Deni (Carlisle, PA: U.S. Army War College, January 2014), 4.

and unilateral restrictions on imports of Iranian oil and gas. Europe has joined the United States in imposing a series of harsh economic sanctions against the Iranian regime, reducing the country's exports of crude oil by roughly 1 million barrels a day.[59] Should Europe seek to reverse their embargo on Iranian crude imports prematurely to both mitigate their energy dependence and decrease short-term energy costs, it would likely be another source of possible geopolitical tension.

Consumer: Japan

For Japan, energy scarcity has always been an Achilles' heel; the country meets only 15 percent of its own total primary energy needs with domestic sources.[60] The virtual lack of indigenous fossil fuel resources propelled nuclear energy to become a centerpiece of Japan's energy security strategy. In the aftermath of the Fukushima disaster, Japan shifted toward greater use of fossil fuels in power generation, especially natural gas—where Japan has already been the world's largest LNG importer for some decades. Japan is also the world's second-largest importer of coal and third-largest net importer of oil.[61]

Better-supplied markets fed by U.S. shale gas and tight oil production helped after Fukushima, but may not offer long-term price relief.

Japan was perhaps the most immediate and concrete benefactor to more global gas supplies. Cargoes that would otherwise have been destined for the United States were rerouted to Japan in the wake of Fukushima. This helped cushion the price impact but came at a high cost to Japan's overall economy.

Consequently, the Japanese have begun seeking cheaper LNG sources around the world, assessing the potential for LNG and pipeline gas projects from Russia, natural gas in East Africa, and LNG projects in Australia and North America. Nevertheless, the Japanese view the U.S. shale gas revolution as a key way to advance their own supply security by diversifying both their sources of supply and the associated transportation routes.

While U.S. LNG represents an attractive opportunity for Japan in the short term, it is far from assured that it would retain its cost advantage over time. As a series of export projects come to fruition later this decade, the gap between the Henry Hub price and delivered prices of LNG supplies from non-U.S. sources may narrow to the point where the price differential no longer offsets the costs of liquefaction and transportation from the United States. In fact, many Japanese suggest that importing U.S. LNG is only a means to an end: the true value of importing the Henry Hub-based LNG is the leverage it may accord to Japanese buyers in their future contractual negotiations with other suppliers.

59. EIA, "Sanctions reduced Iran's oil exports and revenues in 2012," April 26, 2013, http://www.eia.gov/todayinenergy/detail.cfm?id=11011.

60. EIA, "Japan Country Analysis Brief," October 29, 2013, http://www.eia.gov/countries/cab.cfm?fips=JA.

61. Data from EIA, "Japan Country Analysis Brief."

The shale gas and tight oil revolution is another complicating factor in intra-Asian dynamics.

Despite the explicit U.S. strategy of rebalancing to Asia, rhetoric around U.S. "energy independence" and the implied U.S. isolationist sentiment it entails may feed Japan's anxieties about growing Chinese regional and global presence. In its ongoing efforts to secure energy supplies, Japan has put a premium on a commercial gas deal with Russia, though there is a high degree of skepticism over the ability of Russia to deliver a fair deal. The potential for stronger U.S.-Japanese energy ties could provide both security and leverage for the Japanese as they pursue negotiations with Russia. In Japan's more immediate neighborhood, looming anxieties over future economic competitiveness in light of power-supply uncertainty heightens Japan's sense of economic rivalry with South Korea. Unlike most other major LNG consumer countries around the world, South Korea already has a free-trade agreement with the United States, making it eligible to receive LNG exports. To ensure that it can secure some portion of future exports and stave off the possibility of losing significant economic ground to its neighbor to the west, Japan has invested in U.S. shale gas and LNG export ventures.

The Shale Gas and Tight Oil Revolution and U.S. National Security

The link between energy and national security is multifaceted, complex, and often opaque. In general terms, there are two broad areas where the shale gas and tight oil revolution has raised questions at home and abroad: those relating to changed perceptions and those relating to changed realties.

Perceptions

Examples of a greater ability for the United States to exercise global leadership due to the shale gas and tight oil revolution are limited.

Some perceive that shale gas and tight oil resources have offered the United States some additional room to maneuver on national security issues. That perception is consistent with the broadly accepted proposition that economic power contributes to the U.S. ability to influence world events in its interests, enhancing America's ability to shepherd international consensus on common security concerns.

An obvious example of this is the recent Iran sanctions: American officials and others argue that better-supplied oil markets, in part a function of tight oil production, contributed to the United States' ability to shape and maintain an international consensus on sanctions against the Iranian government.[62] One other instance in which the new U.S. energy posture appears to have enhanced U.S. leadership opportunities is with respect to the U.S. "rebalance" toward Asia. It is likely that the new energy production and the greater U.S. economic strength they portend (not to mention the possibility for natural gas and possibly oil exports) have contributed to the United States' ability to draw Asian nations into the trade negotiations for the Trans-Pacific Partnership (TPP), which is a component of America's broader strategy to shape a peaceful evolution within Asia Pacific.[63]

Yet these examples, important as they are, must be balanced against the scant evidence of enhanced U.S. leverage in Syria, Libya, Mali, South Sudan, and the Central African

62. Tom Donilon, "Energy and American Power: Farewell to Declinism," *Foreign Affairs*, June 15, 2013, http://www.foreignaffairs.com/articles/139509/tom-donilon/energy-and-american-power.

63. Mark Drajem and Edward Klump, "Japan's Bid to Enter Trade Talks Opens Route for U.S. LNG," Bloomberg, March 13, 2013, http://www.bloomberg.com/news/2013-03-17/japan-s-bid-to-enter-trade-talks-opens-route-for-u-s-lng.html.

Republic, among others. The United States has been involved diplomatically, and sometimes militarily, but in general, neither the United States' strengthened economic position, nor its increased production of shale gas and tight oil, has afforded much discernible additional influence to the United States and its ability to influence the actions of other nations in these instances. Even in the case of Iran sanctions and ongoing trade negotiations, neither has conclusively produced desired outcomes for the United States.

The shale gas and tight oil revolution has raised questions around the world about U.S. willingness to exercise global leadership.

If the shale gas and tight oil revolution has, at least in some instances, enhanced the United States' ability to lead internationally, it has at the same time created questions about whether the United States will continue to *want* to assume as much of a leadership role. This concern has manifested itself most frequently with respect to U.S. intentions in two key areas: maritime trade and the broader Middle East.

SEA LANES OF COMMUNICATION (SLOCS)

The shale gas and tight oil revolution has spurred a debate about whether the United States, increasingly less dependent on sea-based energy imports, will continue to play such a prominent role in SLOC protection going forward.[64] While further shifts in trade routes from shale gas and tight oil production are still possible (thus affecting who wins and loses most directly from maritime disruptions), under any scenario the current geographic choke points will remain critical.[65] The U.S. government broadly has appreciated this fear and has taken increasingly active steps to reassure the international community that the free movement of goods by sea will remain a core national interest.[66]

U.S. INTEREST IN GLOBAL STABILITY

There is a rising perception that the United States, in part because of the shale gas and tight oil revolution, is, and will increasingly become, less interested in the Middle East and North

64. Tim Johnson, "Rising 'Saudi America' will alter globe, prolong U.S. superpower role," McClatchydc.com, November 28, 2013, http://www.mcclatchydc.com/2013/11/28/209033/rise-of-saudi-america-will-alter.html.

65. Oil trade "chokepoints" include the Strait of Hormuz, Suez Canal, Bab el-Mandab, Strait of Malacca, Turkish Straits, Danish Straits, and the Panama Canal. EIA, "World Oil Transit Chokepoints," August 22, 2012, http://www.eia.gov/countries/analysisbriefs/World_Oil_Transit_Chokepoints/wotc.pdf.

66. See, for example, the Defense Department*'s latest strategy document,* which states that U.S. economic strength is tied to international stability, which is "underwritten by the U.S. military's role and that of our allies and partners in ensuring freedom of access and the free flow of commerce globally." U.S. Department of Defense (DoD)*, Quadrennial Defense Review 2014* (Washington, DC: DoD, March 4, 2014); President Obama's introduction to the 2012 Defense Strategic Guidance, which cites U.S. core interests as including "the prosperity that flows from an open and free economic system," as well as the U.S. Navy's 2007 strategy, which states that "[c]redible combat power will be continuously postured in the Western Pacific and the Arabian Gulf/Indian Ocean to protect our vital interests, assure our friends and allies of our continuing commitment to regional security, and deter and dissuade potential adversaries and peer competitors." DoD, *Sustaining U.S. Global Leadership: Priorities for 21st Century Defense* (Washington, DC: DoD, January 2012), http://www.defense.gov/news/defense_strategic_guidance.pdf; and U.S. Department of the Navy, *A Cooperative Strategy for 21st Century Seapower* (Washington, DC: Department of the Navy, October 2007), http://www.navy.mil/maritime/maritimestrategy.pdf.

Africa (MENA).[67] Those who hold this view point to an array of indicators that include decreased U.S. reliance on foreign energy supplies, but also the U.S. departure from Iraq and drawdown in Afghanistan, as well as the U.S. "pivot" to Asia. The U.S. government has made repeated assurances to the contrary, though the disbelief persists. The question of U.S. commitment to Middle Eastern stability in particular is also occasionally paired with speculations about whether others might seek to fill a perceived security void should the United States in fact become less involved. China and Russia are the two states most frequently raised in this context, though it is widely acknowledged that no other nation has the capability or capacity to play an equivalent security role.[68] Given the region's continued centrality to the world's energy and economic health, governments and executives around the globe are acutely interested in U.S. posture, policy, and ultimately, action, in the Middle East and North Africa.

Reality

The shale gas and tight oil revolution has done little to relieve pressures on traditional allies and partners in Europe and Asia.

If shale gas and tight oil have had relatively little impact on U.S. national security interests but have changed views about how those interests might be protected, the story varies a bit for America's traditional allies and partners. Europe, the home of America's broadest security alliance, (the North Atlantic Treaty Organization, NATO), continues to struggle with economic competitiveness. Economic troubles (to which energy insecurity contributes) have led to falling force levels among some of the United States' most reliable and consistent international partners. Some have suggested that the American "rebalance" toward Asia reflects an implicit expectation that Europe will take a greater role in responding to security crises in its own neighborhood, specifically in the southern Mediterranean and Africa. But diminished European capacity, which may shrink further, means that any military operation of scale, reach, or duration would necessitate significant augmentation from the United States. Further, Europe's relationship with Russia has remained one of many factors in Washington's multifaceted and complex calculations about how best to manage relations with Moscow. If better-supplied markets fed by shale gas and tight oil increase European willingness to challenge Russia in a way that ultimately led to armed conflict, U.S. forces would likely be involved for both political and practical reasons.

The impact of shale gas and tight oil on the security environment in Asia has been relatively limited thus far. Better-supplied energy markets could alleviate some of the immediacy of (and change the cost calculations for) developing resources in the South China Sea, though

67. For example, Middle East analyst Daniel Pipes blogged that the United States' improved energy position means "Washington will be largely freed from having to kow-tow to the oil and gas pashas" in the region. Daniel Pipes, "Symposium: The Geopolitics of U.S. Energy Independence," *International Economy* (Summer 2012), http://www.danielpipes.org/13380/symposium-the-geopolitics-of-us-energy.

68. "Is Russia Taking Over the U.S. Role in the Middle East?," *EuroNews*, November 14, 2013, http://euronews.com/2013/11/14/is-russia-taking-over-the-us-role-in-the-middle-east/; Robert Lawrence Kuhn and Florence Eid-Oakden, "China Carving a Role in Middle Eastern Affairs," *South China Morning Post*, December 2013, http://www.scmp.com/comment/insight-opinion/article/1386790/china-carving-role-middle-eastern-affairs. Most analysts conclude, however, that both nations also share the U.S. interest in regional stability.

they are unlikely to diffuse the many other, and more dominant, sources of tension that underlie the issue. The shifting energy and trade routes spurred, at least partially, by North America's changing demands, have increased the importance of the Indian Ocean to Pacific nations, and to China, India, and Australia in particular. Evidence of this shift is apparent both in Chinese and Indian naval strategy and investment. This too plays a role in the U.S. rebalancing strategy, which includes an effort to increase U.S. military access and relationships in South East Asia in particular.

On net, therefore, the national security impact of the shale gas and tight oil revolution on the United States' main allies and partners has not been disruptive, but it has done little to modify preexisting trends. Given the close ties, both political and practical, between the United States and its friends in both Europe and Asia, stability in energy-supplying regions going forward will likely continue to be a major factor in American national security calculations.

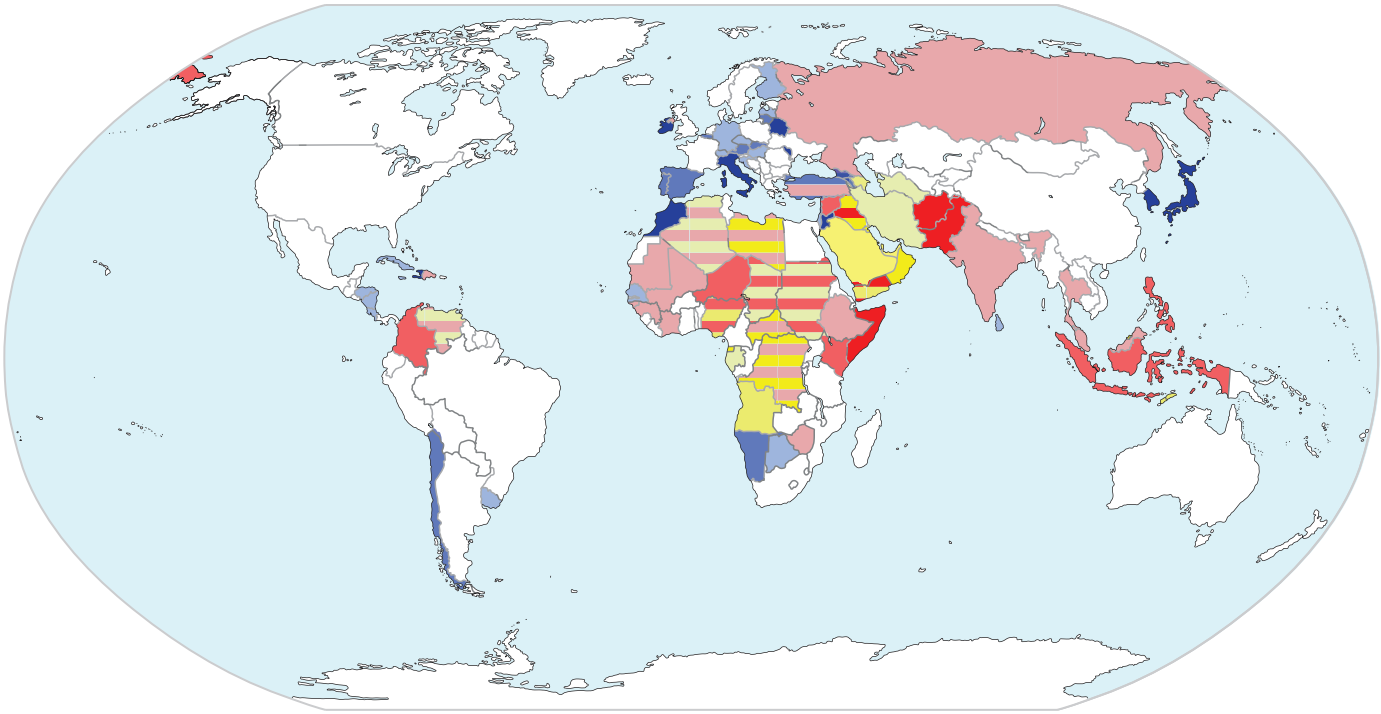
The shale gas and tight oil revolution has increased the potential for market instability, strained governance, and unrest for energy import and export-dependent states.

As with any major market shift, the shale gas and tight oil revolution and its broader effect on energy markets have created disruptions. How these disruptions are accommodated could have implications for U.S. interests in preserving stability and enhancing good governance. The United States' interests in state stability can be direct (e.g., if allies, partners, or nations where significant numbers of American citizens live are threatened) or indirect. Indirect concerns include the possibility of a single state's conflict spreading to its neighbors and causing broader regional conflagrations (large-scale ethnic or sectarian clashes, major refugee flows that strain regional capacity, etc.), or an inability for a state to control its own territory, thus allowing it to be exploited by terrorist organizations.

Figure 4 offers a broad overview of the current nexus between energy security and instability, derived from a combination of various indices. It shows countries heavily reliant on energy imports, those with a large dependence on oil and gas revenues, and those that rank highly in one or more indicators of instability (terrorist safe havens, locations of terrorist attacks, and high ratings on the Fund for Peace's "failed states index").[69] While overly simplified, the figure offers a basic sense of which countries are currently plagued by both instability and energy insecurity (which are often closely interrelated).

69. For import dependence, darker shades of blue indicate a higher percentage of net energy imports as a percentage of energy use. For energy exporters, darker shades of yellow indicate higher percentages of natural resources as a percentage of the overall economy. For instability, darker shades of red mean a higher number of appearances on lists of the top 20 most incidents of terrorism in 2011, the top 18 terrorist safe havens in 2012, and the top 20 highest ranking on the Failed States Index.

Figure 4: Energy Security and Instability



Blue = Net energy imports as percent of energy use (2011)
Yellow = Resource revenue as a percent of total fiscal revenue (2006-10)
Red = one or more negative factors: Top 20 highest incidents of terrorism (2011), Top 18 terrorist havens (2012), and Top 20 highest failed states index (2013)

Darker blue indicates greater foreign energy dependence. Darker yellow indicates greater dependence on energy revenue Darker red indicates greater numbers of factors.

Note: All data is for most recent available yeartv

Source: Map is based on data from: Office of the Coordinator for Counterterrorism, *Country Reports on Terrorism 2012: Chapter 5: Terrorist Safe Havens* (Washington, DC: U.S. Department of State, May 2013), http://www.state.gov/j/ct/rls/crt/2012/209987.htm; Failed States Index 2013, *The Fund for Peace* http://ffp.statesindex.org/rankings-2013-sortable; START Dataset, National Consortium for the Study of Terrorism and Responses to Terrorism, University of Maryland, http://www.start.umd.edu/data-and-tools/start-datasets; World Bank, "The Data Catalog: Energy imports, net (% of energy use)," http://data.worldbank.org/indicator/EG.IMP.CONS.ZS; International Monetary Fund, "Macroeconomic Policy Frameworks for Resource-Rich Developing Countries," August 24, 2012, http://www.imf.org/external/np/pp/eng/2012/082412.pdf.

The shale gas and tight oil revolution exacerbates the gap between U.S. national and popular interests.

By and large, it appears that the perceived impact of shale gas and tight oil is driving the global interpretation of U.S. national security interests and the steps the United States might take, thereby complicating international relationships and placing greater demands on U.S. leaders and resources. Questions have been raised in the eyes of others around the world about the degree to which U.S. political leaders can actually deliver on national security commitments or act in accordance with stated interests. This particular difficulty is salient because of the scope and potential scale of the disruption to energy markets that shale gas and tight oil portend and, more importantly, because of the uncertainty about the direction unconventionals might take.

Current U.S. Energy Strategy

The previous sections looked at the effect of the shale gas and tight oil energy phenomenon, in a broader energy context, on various players in the international community and on the U.S. national security environment. Some of those effects have come directly from the new realities that shale gas and tight oil production has created, while others have resulted from the Obama administration's policy responses. The shale gas and tight oil revolution is just one factor complicating the development of an updated U.S. energy policy that was already in flux due to a series of shifts in the global energy landscape and the debate over whether to pursue a low-carbon pathway to deal with climate change.

A U.S. strategy for how best to deal with shale gas and tight oil development is still evolving. The pace and magnitude of production keep changing, as does the industry's understanding of the resource base (technology, pricing, players, rules, infrastructure, impacts on other resources and the environment, etc.). Keeping pace has proven a challenge, as evidenced by growing perceptions of a gap between stated U.S. policies and what happens in practice.

U.S. Energy Policy: What We Have Said

Because of these shifting dynamics and the uncertainty surrounding the United States' role in global energy markets, U.S. energy policy pronouncements and associated actions have come under increased scrutiny.

The most comprehensive articulation of the Obama administration's view of how new energy realities affect U.S. national security, and thus its policies, was offered by then-National Security Adviser Tom Donilon in a speech delivered in April 2013.[70] His speech outlined five key impacts the new energy reality had on the United States, and four resulting policy responses. Donilon argued that the United States' new energy posture (1) directly strengthens the domestic economy; (2) allows the United States to engage from a position of greater strength; (3) raises supply in global gas markets, to the benefit of the United States and its allies; (4) does *not* indicate the United States can or should disengage from the Middle East or the rest of the world; and (5) does not materially affect the fact that climate change represents a national security challenge. Given those effects, Donilon continued, the administration's policy would be to (1) lead global energy and climate policy through domestic steps

70. White House, "Remarks by Tom Donilon, National Security Advisor to the President at the Launch of Columbia University's Center on Global Energy Policy," April 24, 2013, http://www.whitehouse.gov/the-press-office/2013/04/24/remarks-tom-donilon-national-security-advisor-president-launch-columbia-.

(investments in alternative energy sources, emissions limitations, etc.); (2) work to manage potential sources of energy-related conflict; (3) help other countries to increase energy supply, build capacity, and strengthen institutions that enable international cooperation; and (4) work with other nations to reduce greenhouse gas emissions, prepare for climate impacts, and facilitate alternative energy source adoption.

The speech was widely seen as striking a balance between recognizing advantages that the new energy posture affords the United States, its commitment to the rest of the world, and the need to aggressively pursue global climate change action. It was also seen as the first clear expression of the administration's position on the national security consequences of the new U.S. energy posture. Since the speech, a variety of administration officials amplified and reinforced its themes. The most notable comments have generally fallen into one of three categories: the importance of pursuing solutions to the climate change challenge, staying engaged in global affairs, or relative strength.

The administration is but one voice in the debate, however. Members of Congress, industry leaders, energy analysts and journalists are active participants in a deep, publicly held exploration of what this new energy production means for the United States and the rest of the world. While governments and energy market participants take note of policy statements, they pay much closer attention to how well those pronouncements align with actions, and, many energy watches feel that thus far, there is a disconnect between U.S. rhetoric and actions. Some of the most frequently cited instances of rhetoric outpacing actions relate to how the United States intends to treat exports of both liquid natural gas (LNG) and crude oil.

Contours of U.S. Shale Gas and Tight Oil Export Policies Remain Unclear

To be clear, the Obama administration does a great deal of work through its domestic and international activities to promote some of the core goals and outcomes expressed by top policymakers. These include encouragement of open investment frameworks and more access to production abroad, promoting unconventional oil and natural gas best practices and "tutorials" around the world, and seeking to advance common aims among countries through countless international forums.

However, one of the most anxiety-producing conversations to date is the ongoing processes for approving exports of natural gas and crude oil to world markets. Thus far, despite a stated policy aim of enhancing the energy security of others around the world, the export policies for shale gas and tight oil of the Obama administration remain opaque. The administration has yet to take a formal position on whether crude oil exports are desirable, over the short or longer term, or even of the specific conditions under which they should be considered. Coupled with the slow process of approving natural gas exports to countries with which we do not have a free-trade agreement, market watchers at home and abroad are left wondering exactly how the Obama administration's broad statements on energy policy are intended to play out in practice. International reactions have been mixed. On the natural gas

side, potential consumers have barraged the United States with interest and inquiries into its gas export policy. International pressure to revisit the U.S. ban on crude oil exports has been much less pronounced to date.

Every national government faces scrutiny over how clear a line can be drawn from its public pronouncements to its specific policies, and the U.S. government, given its openness and role as global leader, may be among the most carefully studied in this regard. That basic condition is heightened in the case of shale gas and tight oil, both because of the scale and pace of development and because of the geographic concentration of production thus far. The Obama administration's policy statements have tried to articulate to the world how it intends to manage its resource abundance, but its pronouncements have created expectations and raised uncertainty about the details in ways that leave many unclear about future actions. While not limited to future decisions about exports, how the United States decides to proceed on this issue is a key bellwether for industry and governments alike.

Potential Strategic Pathways for the United States

As noted above, the evolution of shale gas and tight oil production has occurred so fast that U.S. policymakers have been challenged to respond with a largely unexpected new energy posture for the United States. The difficulty of setting a clear path is compounded by the uncertainty around the future of unconventional oil and gas development. Will it remain essentially a U.S. phenomenon, or will other countries begin to realize their own production potential? How long might production continue to rise, how long would it take to decline? Therefore, as policymakers craft an energy strategy moving forward, it behooves them to evaluate a range of potential futures in regards to global unconventional oil and gas production pathways, because the best U.S. strategy for one set of production scenarios might be ill suited for another.

In its broadest formulation, the shale gas and tight oil revolution has essentially meant that the *means* available to U.S. leaders to apply toward strategic ends have increased. Those *ends*, however—broadly framed as fostering a stable, prosperous country and world—remain the same. Thus the key question is about *ways*—that is, how best to utilize the new means (shale gas and tight oil) to achieve the ends of stability and prosperity. Most observers have argued for one version or another of two general pathways, one of "energy stability" and the other of "energy leverage."

This first pathway, "energy stability," argues that the United States' shale gas and tight oil advantage should be used to enhance energy security around the world, on the theory that more stable energy markets will foster strong economies and enhance geopolitical stability. This pathway is challenging, precisely because stability in energy markets is so difficult to achieve. Supply and demand changes, combined with often-mismatched investment, infrastructure, and political timetables that require rapid supply responses have long made stable energy systems elusive. The premise of this approach is at once about balancing supply and demand, but also rests on the view that domestic energy economies seek strength, resilience, and stability through reliable connections to well-supplied global markets. From an unconventional oil and gas perspective, an "energy stability" pathway has several fundamental components: 1) the encouragement of unconventional production worldwide; 2) the protection and promotion of free trade; and 3) actions to address global climate change.

This approach is consistent with the international regimes governing energy and trade that the United States has helped to create. Several international institutions and

agreements enshrine U.S. longstanding commitment to these core principles. This notion of stable supply, free markets, diversity, efficiency, and flexibility are also at the heart of the last 40 years of U.S. international energy policy, supported by a long series of efforts to increase supplies and promote trade in all energy sectors in all regions of the world.

The second approach—"energy leverage"—views the energy advantages presented by the U.S. shale gas and tight oil production as tools that can be employed in the service of broader geopolitical or economic objectives. Here, the United States would seek to maximize its own shale gas and tight oil production, and use the resulting energy supplies and economic benefits to strengthen its global leadership position. While it is unlikely that the United States would overtly stop promoting development of resources abroad, a less intentional manifestation of this approach could come from the United States being less concerned about adequacy of global supply (due both to its own supply situation and to the desire to sell its oil- and gas-derived products elsewhere.) Other options consistent with a "leverage" approach include either limiting gas exports, with the aim of capturing as much domestic economic benefit from global price differentials as possible (and for as long as lower prices don't stymie domestic production), or directing exports to allies and friends—a popular suggestion from several voices in the U.S. Congress. Another way to exercise leverage is to use relative energy adequacy as the context for sanctioning countries dependent on energy exports or imports for their livelihood.

Rhetorically, the administration's statements on its energy strategy contain elements of both "energy stability" and "energy leverage." Its actions are similarly mixed. When U.S. actions and words fail to align or comments from disparate groups within the U.S. system reveal opposing viewpoints, other countries start to debate the United States' strategic intentions.

To some degree, perceptions of policy inconsistencies are impossible to avoid. At the same time, aligning policy pronouncements and actions as closely as possible makes policies more effective and reduces frictions—economic, political, and diplomatic—that can be time consuming and costly. Earlier chapters have offered numerous examples of such friction, and the number of key energy policy issues still to be determined offer ample opportunity for much more. The question for U.S. policymakers, therefore, is whether a consensus can be built around a broader energy strategy—energy stability, energy leverage, or a conscious and more explicit blending of the two—to minimize those frictions in the months or years ahead. Building that consensus requires a deliberate examination of how each policy approach holds up against a range of possible unconventional futures, as described below.

Future Unconventional Energy Scenarios

To inform this exploration, the study team examined four potential futures out to 2025,[71] a timeframe chosen as the midpoint for assessment as it provides a reasonable future range through which to assess potential outcomes. To extend that analysis, it was augmented by a high-level projection of how each scenario might play out to 2040. The scenarios are illustrative and not meant to encompass the full range or complexity of possible energy futures. Their basic features are as follows:

Baseline Scenario: This scenario assumes that unconventional oil and natural gas production is basically and predominantly a U.S. (in the case of oil) and North American (in the case of natural gas) story.

Breakthrough Scenario: This scenario assumes that the U.S. experience continues apace, but also that the vast stores of unconventional oil and gas around the world are unlocked as other nations successfully overcome the cost, technological, and environmental barriers inhibiting current production.

Failure Scenario: In this scenario, unconventional oil and gas around the world remain undeveloped, and the success experienced in the United States begins to reverse itself toward the end of this decade. By 2025, the United States is back to an oil and gas production profile that looks similar to what was expected before the current boom took off (i.e., the strategic outlook of 2005–08).

Gas Breakthrough Scenario: This scenario assumes that unconventional gas production increases globally, but that tight oil maintains a minimal share of global oil production.

Each of these scenarios could arise from a variety of factors and trends, and could be significantly altered by factors that include national policies, political instability, economic shifts (either global or regional), and technological advances.

71. For the purposes of this analysis, the study team, in cooperation with the original authors, used modified versions of scenarios by Energy Research Institute of the Russian Academy of Sciences (ERI RAS), *Global and Russian Energy Outlook up to 2040* (Moscow: ERI RAS, 2013), http://www.eriras.ru/files/Global_and_Russian_energy_outlook_up_to_2040.pdf; and IEA, *World Energy Outlook 2011: Are We Entering a Golden Age of Gas?* (Paris: IEA, 2011), http://www.worldenergyoutlook.org/goldenageofgas/.

Scenarios' Implications

The four scenarios collectively portray a wide range of potential outcomes for unconventional production, with different implications and potential winners and losers. On the whole, however, a series of insights emerge.

- ***A natural gas breakthrough could be transformative.*** A world in which gas captures greater market share from oil and is used more widely in the economy could be a subtle but significant trend with geopolitical implications. Natural gas is a versatile and clean fuel (low carbon dioxide and particulate emissions) that could not only penetrate further into electricity, electric power, residential or commercial heating, and transportation sectors, but also as a feedstock for a wide variety of petrochemical products. Under the right circumstances, natural gas provides a unifying role for economies oriented to climate change action pre-2030. As markets shift in such significant ways, market players will undoubtedly try to secure the best possible vantage point within the new markets. This could lead to stiff competition and, in some cases, geopolitical tension.

- ***The variation in unconventional oil outlooks is not that significant.*** In the four scenarios posited here, unconventional oil production plays a role in two, the Baseline and the Breakthrough. In both cases, the timelines for production are sufficiently long that the eventual volume does not represent a huge portion of the market nor does it have a large impact on prices. In either case, OPEC could lose or gain market share, but given the huge variability from other producers, the range of potential demand, and other variables, this is not likely to be a huge factor that could lead toward reshaping global oil market dynamics. The country that is likely to be most significantly affected by the future of unconventional oil is the United States, as it is the only major country for which a success or failure could swing its status as either a net importer or net exporter over the forecast period.

- ***The shift toward markets in the East is the defining feature of every possible future.*** Every scenario examined here results in a perpetuation of the shift east in energy demand. For the United States, this reality becomes problematic in a Shale Failure environment, as U.S. production would decline at some point in the 2020s, after market relationships will have firmly solidified their eastern orientation. Asia, and China in particular, drives demand growth across all four scenarios, giving its overall economic health an outsized impact on the global energy system. A collapse or significant slowdown in Asia's growth projections, however, would throw a serious wrench into the global investment and marketing plans of some of the world's largest companies.

- ***A Failure scenario is most likely to create additional impetus for conflict or tension.*** Though energy resources are not the only factor at play in current areas of international contention (the South and East China Seas and the Arctic, for example), their resource potential becomes more valuable as markets tighten, as they would in a Failure (and, for oil, a Global Gas) scenario.

- ***Climate goals must be more actively pursued no matter how the future unfolds.*** The scenarios illustrate that policy choices related to environmental goals, pollution reduction, or climate change could have a major impact on fuel and technology choices but that no unconventional oil and gas production scenarios leads to emissions reductions anywhere close to those advocated for by the international climate community. The emergence of stricter standards on greenhouse gas pollution or a price on carbon could reconfigure fuel choices and thus the overall market. Depending on the policy choices, natural gas, being a more climate-friendly fossil fuel than its counterparts, could lead to greater fuel switching. In the absence of a global climate agreement, individual countries or regions could take on their own policies. Pollution levels in China could force the hand of the leadership to aggressively reduce emissions and pursue cleaner sources more aggressively than they are doing today. The United States, if it turns back toward climate-oriented policies, could also drastically reorient its fuel choice. The emergence of a global climate agreement at the UN climate talks could also impact the trajectory of unconventional oil and gas and have an impact on of the energy sector writ large, with oil and coal being the primary losers, and natural gas following suit.

PRODUCERS

- ***The U.S. is most sensitive to alternative futures.*** What happens in terms of U.S. shale gas and tight oil production will have a major impact on trade flows, as it will determine the U.S. role as either an importer or exporter. On the gas side, in all but a Shale Failure future, the United States is an exporter, prompting the rerouting of natural gas trade flows and providing greater flexibility of supply to all consumers while contributing direct benefits to the U.S. economy. With respect to oil, in either a Baseline or Breakthrough future the United States would continue to import some amount of oil, but to a much lesser extent than in the Failure or Global Gas scenarios. While the global energy situation will change depending on what happens in the United States, because production to date has been largest in the United States, its economic and geopolitical future is most closely tied to how shale trends play out. Canada and Mexico, the two largest energy trade partners for the United States, will also face significant impacts depending upon U.S. production.[72]

- ***The next decade will prove critical for Russia.*** Russia and its market share are disadvantaged in both the Baseline and Breakthrough scenarios due to unconventionals. However, the Global Gas scenario is a mixed bag, as higher oil prices (and the limited production of unconventional oil) would enable increased conventional production. Russia's ability to turn to new markets (in the East) will be important for it to retain market share; this goal is most helped by a Shale Failure future, but much more dependent on internal reforms in all others. This reality suggests that Russia has a relatively narrow window over the next decade to undertake those reforms if it wishes to best position itself against uncertainty. The direct link between revenues and energy

72. Canada shares in robust shale gas development in the Breakthrough scenario.

production makes Russia highly price sensitive, a vulnerability that is most problematic in either a Baseline or Breakthrough future.

- ***Implications for OPEC countries vary.*** Low prices and greater supply of unconventionals from the Breakthrough scenario negatively impact OPEC, though it fares better in other cases (and to be fair, much of the impact is from factors beyond just existence of unconventional oil and gas). In the Failure/Breakthrough scenario, OPEC is able to increase market share for oil, and as its own domestic energy demand increases is able to meet the demand with gas, exporting the surplus. In the medium term, the biggest questions are the status and impact of Iraq and Iran, and when or if their production comes back online and what that does to other members of OPEC and the sensitive balance between Saudi Arabia, Iran, and Iraq—and, if countries begin to pursue domestic reforms, the pace and scope of these reforms.

REENTRANTS, NEW ENTRANTS, AND RESOURCE DEPENDENTS

- ***Shale Failure is preferable for certain producers if unconventionals don't exist at home.*** For this group of countries, less-well-supplied markets are generally better from a revenue standpoint; for those importing products from abroad (e.g., Mexico), this would be more of a mixed bag. Countries like Mexico or Algeria might benefit from a Breakthrough-like future on the margins, but probably not to a sufficient degree that it would bring about a shift in preferences (i.e., may prefer shale failure to guarantee the greatest likelihood of oil price stability, all things being equal).

- ***New Africa production will face near-term challenges but is likely to work out in the long run.*** Most of the pressure for new entrants from Africa in each of the scenarios takes place in the midterm, when markets are well supplied and the need to bring on new investment is less intense. Over all longer-range forecasts, both oil and gas resources will be needed. The impact of unconventionals is merely to delay those projects, though this may slightly perpetuate the period of potential instability on the continent.

CONSUMERS

- ***All major consumers benefit from greater abundance.*** From a consumer perspective, the better-supplied gas markets that result in all but the Failure scenario offer more diverse import options and prices lower than would otherwise be the case (though regional differences persist in each of the hypothesized futures). Oil importers benefit most from the Breakthrough and Baseline scenarios, but would face higher prices and fewer supply options under a Failure or Global Gas future.

- ***Promoting unconventional oil and gas developments could reduce import dependence in some places, especially China.*** The ability for China to domestically produce its own unconventional resources as envisioned after 2020 in all but the Breakthrough scenario (though just for gas in the Global Gas scenario) would afford China greater supply diversity and security, and could alleviate its over-reliance on environmentally unfriendly coal.

- ***Resource competition in Asia could intensify and shift to the Indian Ocean over time.*** China, Japan, and Southeast Asia are now in a full-fledged competition to attract energy supplies. While the presence of unconventional oil and gas brings at once greater market stability but also more leverage over pricing and contract negotiations, no region in Asia is able to shift its own energy posture vis-à-vis domestic unconventional oil and gas production, thereby intensifying competition to lock in resources destined for the region. This competition has already begun to shift west toward emerging resource producers in Asia. The geopolitical nature of China's relationship to Africa relative to some of its neighbors (e.g., Japan, South Korea) is another source of possible tension as China and India both seek to establish a network of basing and logistical networks to establish presence in the region.
- ***Europe will continue to face challenges in every possible scenario explored.*** While Europe would accrue the benefits of greater supply mentioned above in a Baseline or Breakthrough scenario to some degree, Europe will remain import dependent overall. In a Breakthrough world of high unconventional oil and gas production, higher-cost European resources are shelved in favor of lower-price unconventionals and lower prices reduce incentives to aggressively pursue renewable alternatives. In the Failure scenario, the absence of unconventional oil and gas would decrease the EU's flexibility and cause it to face competition in the market from a greater range of consumers; on the other hand, this could prompt a more aggressive push toward renewable sources. In every scenario, Europe would continue to face competitiveness challenges, though to varying degrees, which in turn will affect the level of pressure on European environmental objectives.

Which Path to Choose? Stability vs. Leverage

The range of potential energy futures and impacts laid out above highlight the core tension over whether the United States can best enhance global prosperity and stability by focusing on energy policies that benefit broad notions of energy security more directly or by seeking to enhance its own economic and energy advantage to then bring to bear in service of those ends (i.e., an energy-stability or energy-leverage pathway). The meaning of the choice is inherently limited by the fact that the United States cannot by itself assure any amount of energy or geopolitical stability. That said, given its position both within the energy sector and more broadly, U.S. actions and perceived conduct can clearly influence the actions of others.

The question then becomes: Which possible strategic pathway is the most robust against the range of possible future scenarios?

Again, an "energy stability" approach suggests that energy's contributions to U.S. and global stability and prosperity are greatest in an environment of global market stability. Conceptually, this would mean taking steps aimed at increasing global supply, while simultaneously attempting to minimize disruptions to producers most vulnerable to price volatility or decline. In the context of the scenarios above, the desired supply increases would likely resemble those postulated in the Breakthrough scenario, although this scenario would present some risks resulting from the strains greater energy supply might induce—for example, the threat that lower energy prices could pose to Russia's economy. How this might play out within Russia is difficult to anticipate, but it would almost certainly lead to greater geopolitical instability and uncertainty. Finally, while maximizing unconventional energy supplies appears advantageous from an energy-security side, it could be problematic from the perspective of mitigating climate change. Any energy approach that fails to precipitously decrease global emissions by 2050 will be inconsistent with U.S. and globally stated goals on emissions reductions, and as such raises the risks to global security and prosperity. From a climate-change vantage point, a dramatic increase in unconventional production helps to perpetuate the existence of a fossil-based energy system. Absent the ability to find scalable replacements to the current system, however, a low-carbon pathway may have negative repercussions of its own (i.e., low-carbon solutions that do not work could place an enormous strain on a country's economy).

But how well does a strategy aimed at encouraging a Shale Breakthrough fare in the event of a Shale Failure? If unconventional oil and gas production does not prove as prolific as current thinking suggests, and the United States has pursued a pathway of stability by

encouraging free and open markets, trade in energy, and market responsiveness, the United States would likely experience a global energy market more able to adjust to sudden decline in one major supply source and capable of finding near-term and longer-term accommodations. In addition, while significant readjustments would likely be painful for both consumers and producers, the United States would presumably benefit from having acted in accordance with free-market principles.

A leverage strategy, on the other hand, rests on greater U.S. production relative to other countries, and implies a much different set of actions than might be taken under an energy-stability approach. Under a leveraging rubric, the United States would seek an outcome that roughly approximates the Baseline scenario, though absent other producers coming on line in the mid- to late 2020s. Rather than encouraging the spread of investment and know-how, the United States would seek to restrict it as much as possible, and to extract as much economic benefit as possible from rising production. The United States could either limit production once its domestic needs were met, or (more likely) maximize production and seek to target exports to friends and allies to enhance its attractive power. The United States would continue to press for free trade in other areas to grow markets from the presumed continued growth of its manufacturing sector, while claiming a national security interest in restricting energy exports.

As with the energy-stability approach, there are multiple risks associated with a leveraging strategy. As noted earlier, one of the most obvious is the vulnerability that perceived hypocrisy on trade might pose to the trade of other U.S. goods and services. (That said, the United States might be able to weather such criticism with no real consequence simply due to its relative economic power.) A bigger question might be how successful the United States could actually be in maintaining its relative advantage.

At its core, a strategy that rests on the United States picking winners and losers might serve the short-term objectives in any given situation, but it is likely to create second- and third-order effects that will not only be difficult to anticipate, but will also increase the potential for other problems to arise.

With respect to its overall robustness against other possible outcomes, a leveraging approach represents substantial risk. Again, if others are spurred to more actively pursue their own production in response (and opposition) to U.S. actions, there may be little the United States could do to stand in their way. In addition, the bedrock of a leveraging approach is that U.S. production continues to rise, a reality that could fail to materialize for any number of reasons. Thus the timeline for how long a substantial U.S. advantage might last is extremely uncertain. If a Shale Failure were to occur, the United States would need to "mea culpa" its way back into the arms of competitive market participants that may remember the U.S. unwillingness to engage during a time of increased production.

Perhaps the greatest danger of the leveraging approach is to overestimate what energy leverage really achieves in the world of broader geopolitical aims. Foreign policy is rife with examples of peace pipelines, energy weapons, and a host of other initiatives for which

geopolitical aims were hitched to energy projects that simply did not go forward or, if they did, failed to deliver the intended effect.

One of the core questions within this exercise is whether or not other major global actors would reinforce an "energy stability" approach (a necessary ingredient for the broadest success of this option) should the United States choose to more ardently pursue it. In all likelihood, most countries would temper their responses based on their own interests, but U.S. leadership would help shift things in that direction. Again, neither the "energy stability" nor the "energy leverage" pathway is likely to be followed or achieved in its entirety, but evaluating them against the range of outcomes set forth in the section above makes the risks and rewards associated with each more explicit.

Ultimately, either by design or by accident, the United States and other countries are unlikely to pursue a purely energy-stability or leverage-oriented pathway. This is because energy policy is a mix of complex domestic and international factors, and geopolitics is even more complicated by the larger universe of energy and nonenergy-related elements that influence the relationships among countries. Rather than all this uncertainty leading to stasis, however, it is precisely the unknown nature of energy developments, geopolitical forces, and national security interests that argues for steering as much as possible towards an energy-stability pathway.

Recommendations

U.S. policymakers should take the following actions to implement this approach:

1. ***Promote greater production and more efficient energy use at home and abroad.*** The United States has a well-established track record of promoting common energy principles, albeit with mixed success. Countries like Colombia, Brazil, and Azerbaijan have opened up their oil and gas sectors to outside investment. Many other countries have not followed this path, however, and govern their energy resources under a different framework. Saudi Arabia, for example, does not pursue a policy of open investment and maximizing production. For them, managing their resource base for the long-term economic benefit of the country is a guiding principle. As the global swing supplier, they play a different and important role in the market of being able to quickly and ably respond to oil-supply disruptions or demand downturns by taking oil on and off the market. In many instances, the recommendation points to direct U.S. support for energy reform among the big producer, reentrant, and revenue-dependent countries outlined in this report (and others).

2. ***Beyond current activities, further encourage production of unconventional oil and gas abroad.*** Indeed, the United States has already been active in this area of diplomatic and technical engagement since the early days of shale gas development. These efforts are most effective when they involve companies that are on the front line of developing these new resources.

3. ***Encourage trade in energy resources to promote flexible, adaptable, and efficient markets.*** Ideally this would include an expansion of natural gas exports, as well as the initiation of exports of crude oil, at the very least it requires a more flexible and expeditious approach to exports and a more direct explanation of the country's longer-term policy on the export of these commodities.

4. ***Maintain continued and clear U.S. commitment to protect sea lanes of communication.*** In the near term, it is important to instill confidence in both the willingness and the capability of the United States to maintain its role as lead provider of this global common good while working toward more collective approaches to the greatest possible extent. Over the longer term, however, the United States might consider a policy of more broadly sharing responsibility for this mission as global markets continue to shift and concern morphs from one of U.S. sustained protection

to one of U.S. shared protection and absence of conflict or tension over this role.[73] It is equally as important to be clear about the potential for this eventual shift and explicit about steps being taken toward those ends.

5. ***Scale back domestic rhetoric on the "independence" afforded by new energy posture.*** U.S. leaders are responsible both for providing for the safety and security of the citizenry and for reflecting that citizenry's priorities. That said, public appreciation for the United States' continued reliance, both direct and indirect, on global energy markets is critical if efforts to deter threats to regional stability, or to respond to instability if necessary, are to be successful. U.S. leaders must be candid about the risks that unconventionals pose to the rest of the world, and modest about the potential benefits they offer, in order to mitigate the growing gap between public and national interests.

6. ***Bolster commitment to culture of innovation—especially vis-à-vis climate challenge.*** The U.S. should continue to support investment in and application of new technologies that made this and other types of frontier energy "breakthroughs" possible. This is especially true when it comes to maintaining research and investment commitments to clean and efficient energy technologies that will be central to a long-term strategy on climate change.

7. ***Utilize the opportunity to bolster foreign policy ties or geopolitical dynamics where energy has traditionally played a central role.*** This new energy trend most fundamentally alters energy-related trade ties. To the extent that those trade shifts are disturbing or even potentially destabilizing to certain relationships or regional dynamics, seek out opportunities to shore up new areas of cooperation and ways to deepen engagement despite the shifts in commercial trade ties.

73. International efforts to combat piracy, which involve a vast number of countries from around the world, offer one potential model upon which greater cooperation might be based. However, many U.S. officials remain leery of moving too quickly down this path, noting that the level of interaction required to do truly effective burden-sharing requires exposure of key capabilities that would be relevant in any "hot" military conflict. At present, therefore, willingness to take cooperative steps too far with regard to China, for example, while the relationship continues to contain elements of both cooperation and competition, is limited.

Conclusion

Shale gas and tight oil production in the United States is an energy trend with a pace and scale of development that took observers, even seasoned ones, by surprise. The resource development has had important impacts on the global energy sector. It has changed energy trade flows, altered the investment outlook for energy projects, and reordered the climate-change debate to more squarely focus on the role of gas in meeting low-carbon goals. Most significantly it has helped to change the energy posture of the United States from one of growing import dependence and worsening balance of payments to one where the United States is importing less (and likely to start exporting) and has improved its global business competitiveness.

To date, the broader geopolitical impacts have remained limited. It is too soon to say whether the production surge will fundamentally transform global oil and gas markets. Moreover, the uncertain trajectory of U.S. production and the even more uncertain outcome of efforts to produce unconventionals abroad make anticipating the future impacts of this trend all the more treacherous.

So far, perception is leading reality when it comes to geopolitical and national security impacts. Many countries and companies will act on early interpretations of this trend. Some will be rewarded, while others may lose out (especially on the investment side). In general, shale gas and tight oil are driving the focus of markets to the east more quickly than was previously anticipated. Softer markets put pressure on most oil and gas producers (exporters) to reform or improve their domestic energy policies to ensure greater resilience. Finally, major consumers and importers are searching for ways to tap into the relative economic advantage achieved by the United States.

The lack of clarity in U.S. intentions underlying many of the geopolitical consequences to date reflects the fact that a clear U.S. position has been slow to emerge, and remains unclear to many observers. As stated earlier, this is understandable given the speed at which this new energy posture has occurred in the United States and given the degree of uncertainty about how this energy trend will continue. That said, it is possible to foresee the general range of potential outcomes. Review of those outcomes suggests that there is less risk associated with pursuing policies that hew more closely to an energy-stability, rather than an energy-leveraging, approach.

Appendix 1

Definitions of Unconventional Oil and Gas

For the purposes of this report, when we discuss unconventional oil and gas in the context of the United States, we use the terms shale gas and tight oil. According to the International Energy Agency (IEA):

> Light tight oil (LTO) is oil that has been generated from kerogen-rich shales but has either remained in the shale formation (instead of migrating to a conventional reservoir) or migrated to a nearby low-permeability rock. Because of the low permeability of the reservoir, these resources can only be produced economically with the implementation of special techniques such as hydraulic fracturing in horizontal wells.[1]

> Shale gas is found in commonly occurring rock formations rich in organic matter, loosely classified as shale. While we have known about such formations for almost 200 years, the rock's low permeability made production uneconomical until recently. The combined application of horizontal drilling and hydraulic fracturing provided the breakthrough that allowed shale gas to be produced in North America.[2]

When we discuss the potential for production of unconventional resources outside of the United States, we use the term unconventionals because we recognize that oil sands, heavy oil, coal bed methane, and other types of unconventional oil and natural gas have significant potential around the world and are often included in the unconventional category. Again, according to the IEA:

> **Unconventional oil** includes extra-heavy oil, bitumen (oil sands), light tight oil, kerogen oil (oil shale), coal-to-liquids (CTL), gas-to-liquids (GTL), and additives.
>
> > Extra-heavy oil and bitumen includes mostly the oil sands in Canada (800 billion barrels in recoverable reserves) and extra-heavy oil from Venezuela's Orinoco belt (500 billion barrels in recoverable reserves). These resources are also present in other countries, but outside of Venezuela and Canada, IEA's projections to 2035 include some production only in Russia and China, where projects either already exist or are at an advanced planning stage.[3]

1. International Energy Agency (IEA), *World Energy Outlook 2013* (Paris: IEA, 2013), 447, http://www.worldenergyoutlook.org/publications/weo-2013/.
2. IEA, *World Energy Outlook 2011: Are We Entering a Golden Age of Gas?* (Paris: IEA, 2011), 50, http://www.worldenergyoutlook.org/media/weowebsite/2011/WEO2011_GoldenAgeofGasReport.pdf.
3. IEA, *World Energy Outlook 2013*, 446.

Kerogen oil (oil shale) is produced from kerogen, the solid organic matter contained in shales that is the source of oil and gas. When heated under the right conditions, over geological time, kerogen is transformed into liquid or gaseous hydrocarbons. This geological process can be mimicked by heating kerogen-containing shale at a controlled rate, transforming it into liquid hydrocarbon. While deep shale deposits can be exploited through in-situ heating, most of the activity occurs in near-surface deposits, which are accessible with mining techniques.[4]

Coal-to-liquids (CTL) is the transformation of coal into liquid hydrocarbons. This can be done through either coal gasification into syngas (a mixture of hydrogen and carbon monoxide), combined using the Fischer-Tropsch or methanol-to-gasoline synthesis process to produce liquid fuels, or through the less developed direct-coal liquefaction technologies, in which coal is directly reacted with hydrogen.[5]

Gas-to-liquids (GTL) is the process in which methane reacts with oxygen or steam to produce syngas followed by synthesis of liquid products from the syngas using Fischer-Tropsch catalytic synthesis.[6]

Unconventional natural gas resources include tight gas, shale gas, coalbed methane (CBM), and methane hydrates. While different techniques are applied, depending on the type of gas being extracted, one common method is known as hydraulic fracturing: large volumes of water (mixed with sand and chemicals) are injected underground to create cracks in the rock. This frees the trapped gas, which can then flow into the well bore created by the drill and be collected. Another key technology is horizontal drilling, which enables the exposure of significantly more surface to the well.[7]

Tight gas formations have low permeability, making it difficult for gas to flow through the rock. Gas has been produced from tight sand formations in North America for over 40 years, with new technologies being constantly developed to improve productivity.[8]

Coalbed methane (CBM) is natural gas contained in coal seams that is trapped in the fractures and on the surface of coal. While the extraction of CBM was initially undertaken to make coal mines safer, commercial production has been in place since the late 1980s.[9]

Methane hydrates are deposits of natural gas trapped together with water in a crystalline structure that forms at low temperatures and moderate pressures. They can be found either on the sea floor, in shallow sediments beneath

4. Ibid., 449.
5. Ibid., 661.
6. Ibid.
7. IEA, "Glossary of Terms," http://www.iea.org/aboutus/glossary/u/.
8. IEA, *World Energy Outlook 2011*, 50, http://www.worldenergyoutlook.org/publications/weo-2011/.
9. Ibid., 50.

the sea floor, or underneath arctic permafrost. While estimates for the size of this resource show that it is vastly abundant, producing gas from methane hydrates poses huge technological challenges. The extraction technology is still in its infancy, and existing production projects are small and experimental.[10]

Comparatively, conventional oil includes crude, natural gas liquids (NGLs), and condensates. According to the IEA:

> **Crude** makes up the bulk of oil produced today; it is a mixture of hydrocarbons that exist in liquids phase under normal surface conditions. It includes condensates that are mixed in with commercial crude oil streams.
>
> **Natural gas liquids (NGLs)** are the liquid or liquefied hydrocarbons produced in the manufacture, purification, and stabilization of natural gas. NGLs are recovered as liquids in separators, field facilities, or gas-processing plants. NGLs include but are not limited to ethane, propane, butane, pentane, natural gasoline, and condensates.[11]
>
> **Condensates** are liquid hydrocarbons recovered from associated or nonassociated gas reservoirs. They are composed mainly of pentane (C_5) and higher carbon number hydrocarbons. They normally have an American Petroleum Institute (API) gravity of between 50^o and 85^o.[12]

10. IEA, *World Energy Outlook 2013*, 119.
11. Ibid., 662.
12. Ibid., 661.

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