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During the past 15 years, innovative new techniques involving horizontal drilling and hydraulic fracturing have unlocked a vast resource potential and resulted in the rapid growth in production of natural gas from shale. The same techniques have also matriculated into the oil sector resulting in a dramatic increase in light tight oil production. In what follows, we will address the unique set of circumstances that exist in the US that have facilitated the “era of abundance” for US oil and gas. Then, we will address the implication for energy security and how that connects to a new geopolitical reality afforded to the US, with attention given to recent changes in global oil and gas markets as evidence.

What made the successes witnessed in the US during the past 15 years possible? To begin, geology matters. The scale of the technically and economically recoverable oil and gas resources locked

up in shale is tremendous and geographically diverse (see Figure 1), and as time passes the understanding of the resource expands. But, while the right geology is a *necessary* condition, it is not *sufficient*. Shale resources assessed in locations outside the US are significant, yet shale oil and gas production on a global scale is still largely limited to the US. This follows because *sufficiency* requires a host of above-ground factors to be appropriately aligned. These include market institutions and regulatory frameworks spanning the energy value chain, such as...¹

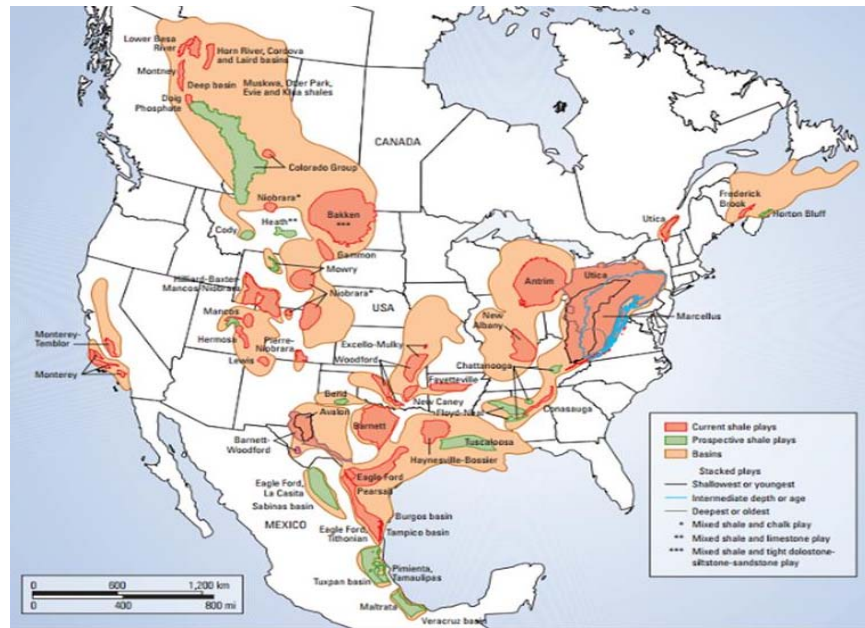
- a regulatory and legal apparatus in which upstream firms can negotiate directly with landowners for access to mineral rights on privately-owned lands.
- a market in which liquid pricing locations, or hubs, are easily accessed due to liberalized transportation services that dictate pipeline *capacity* is unbundled from pipeline *ownership*.
- a well-developed pipeline network that can facilitate new production volumes as they are brought online and connect producers to end-users.
- a market in which interstate pipeline development is relatively seamless due to a well-established governing body (i.e. - the Federal Energy Regulatory Commission) and a comparatively straightforward regulatory approval process.
- a market in which demand pull is sufficient, and can materialize with minimal regulatory impediment, to provide the opportunity for new supplies to compete for market share in the energy complex.
- a market where a well-developed service sector already exists that can facilitate fast-paced drilling activity and provide rapid response to demands in the field.
- a service sector that must compete by reducing costs and improving technologies in order to gain a competitive advantage.
- a sizeable rig fleet that is capable of responding to upstream demands without constraint.
- a deep set of upstream actors that includes independent producers that can behave as the “entrepreneur” in the upstream thereby facilitating a flow of capital into the field toward smaller scale, riskier ventures than those typically engaged by vertically integrated majors.

Every one of the above bullets has some relevance to infrastructure – from permitting to access to market function to price formation to investment, etc. If any of these features is absent, an effective barrier to market development is presented, usually manifesting in the form of higher costs. Moreover, some of the above *sufficient* conditions can be co-dependent on the others, which highlights to the notion that well-designed market institutions and regulatory frameworks can be self-reinforcing. For example, a well-developed service sector relies on a deep set of entrepreneurial, independent upstream players to create large demands for its products and

¹ For more, see “The Land of Opportunity? Policy, Constraints and Energy Security in North America” by Kenneth B Medlock III, <https://www.bakerinstitute.org/research/land-opportunity-policy-constraints-and-energy-security-north-america/>.

services, just as the population of independent producers in the US upstream might not be so deep absent a well-developed service sector.

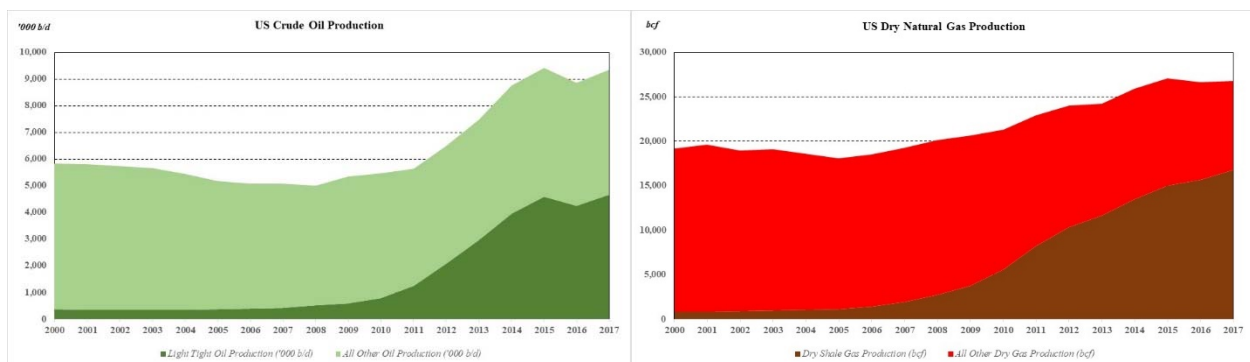
Figure 1 – Shale Resources in North America



Source: <http://alfin2300.blogspot.com/2012/03/gallery-of-world-hydrocarbon-endowment.html>

The coexistence of these factors makes the US a unique environment for upstream shale-directed investments. The result is self-evident, as US oil and gas production have each increased significantly in last decade, driven entirely by shale-directed developments (see Figure 2).

Figure 2 – US Oil and Gas Production, 2000-2017

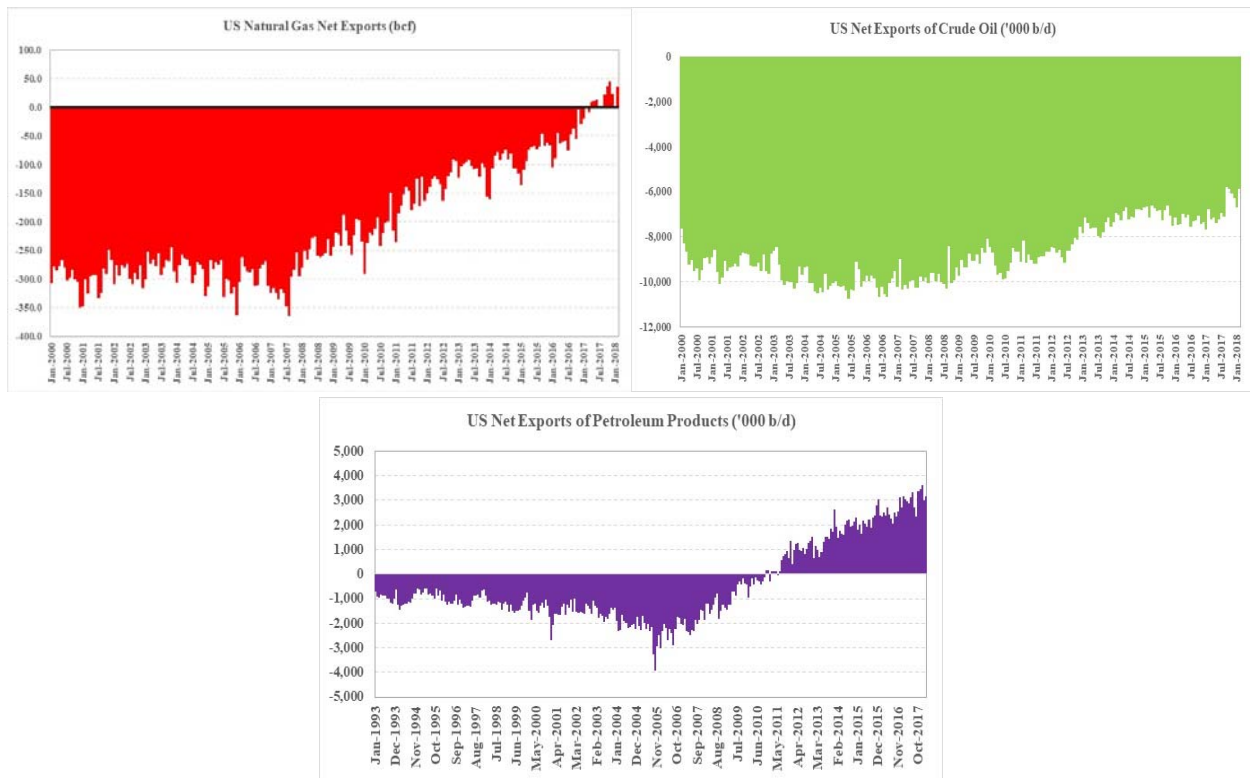


Source: US Energy Information Administration

Concomitant with the growth in US oil and gas production, we have seen significant shifts in the US balance of trade in crude oil, natural gas and petroleum products, with the US now a net

exporter of the latter two (see Figure 3). While the US is still a net importer of crude oil, US exports of light crudes have increased substantially since the lifting of the oil export ban, eclipsing 2.5 million barrels per day during the second week of May. This has, in turn, afforded a more efficient, increasingly export-oriented use of US refining infrastructure, which is better suited to handle heavier imported crudes. Weekly data from the US Energy Information Administration indicate that the combined total exports of crude oil and refined products eclipsed 8.3 million barrels per day in late April, up from just under 1.0 million barrels per day in early 2006. This translates into a significant shift in the net balance of trade for US crude oil and petroleum products. Natural gas exports (pipeline and LNG) have also ramped up as new export licenses have been granted with expanding opportunities for profitable export, and the US is now a net exporter of natural gas. Altogether, the expansion of US exports of crude oil, refined products and natural gas have transformed the US from a significant consuming nation that was beholden to policies aimed at securing supplies from foreign countries. Today, the US is a producing nation that can use its energy abundance to wield influence through foreign policy.²

Figure 3 – Net Exports of Natural Gas, Oil and Petroleum Products, Jan 2000-Feb 2018



Source: US Energy Information Administration

² “Geopolitical dimensions of US oil security,” Jim Krane and Kenneth B Medlock III, *Energy Policy* (Mar 2018)

Despite this, it is important to recognize that growth in US oil production does not render the US “independent” from other actors in the global oil market. In fact, any disruption of supply from a significant oil exporting nation would trigger an increase in global prices that could be economically and politically destabilizing for importing countries. Oil is an openly traded commodity in a globally fungible market. As such, prices are formed by supply and demand fundamentals, with short-run price movements influenced by factors such as OPEC spare production capacity, rates of global demand growth, inventory levels, geopolitical events, natural disasters and financial markets. Given the global interconnectedness of oil consumers and producers, there is no such thing as *independence* from international oil market perturbations. Even if the United States were to become a net oil exporter, US oil and petroleum product prices would remain exposed to international influences.

Nevertheless, the growth in US oil and gas production is transforming the status quo and shifting the geopolitical balance. This highlights the importance of the so-called “shale revolution” in achieving US geopolitical and foreign policy aims. The legacy of US regulatory and market institutions engenders significant global influence, and today there is much discussion about the US being an “energy superpower.” In fact, this terminology has permeated the US State Department and been a recognized facet of diplomacy carried forth by the Bureau of Energy Resources for the past several years, spanning Administrations. Currently, we can see this directly from the Bureau of Energy Resources website.

ENR promotes U.S. interests globally on critical issues such as: ensuring economic and energy security for the U.S. and our allies and partners; removing barriers to energy development and trade; and promoting U.S. best practices regarding transparency and good governance. In addition, we review applications for the construction, connection, operation, or maintenance of facilities for the exportation or importation of petroleum, petroleum products, coal, and other fuels (except for natural gas) at the borders of the United States.

The Bureau serves as the principal advisor to the Secretary of State on energy security, policy, operations, and programs. Through diplomacy and a wide range of programs, ENR works to ensure worldwide energy security by fostering diverse global energy supplies from all sources of energy.

ENR operates at the critical intersection between energy and U.S. national security, and ensures U.S. leadership on global energy issues. U.S. national security is threatened when:

- Our allies lack reliable access to affordable energy or a diversity of choices;
- Foreign energy markets shut out U.S. companies;
- Poor governance prevents market-based energy solutions;
- Competition for energy leads to conflict; or
- Terrorists and rogue regimes seek to exploit energy resources to fund violence and destabilizing activities.

To address these challenges, ENR works with leaders at the highest levels of government, business, and civil society, playing a crucial role in achieving U.S. foreign policy objectives in the energy arena. ENR foreign assistance programs are integral to the Bureau’s diplomatic engagement overseas and provide critical support for the Department’s objectives and the Administration’s global diplomacy priorities.

See: <https://www.state.gov/e/enr/>, accessed Feb 5, 2018

Increasing US oil and gas exports have facilitated the goals set forth by the US State Department. So, the energy renaissance has had direct bearing on US diplomacy. However, the US government is neither the owner nor the producer of mineral wealth in the US, as is the case with government ownership of mineral wealth in many other nations. Thus, the soft power afforded to the US government is facilitated by the unique regulatory and market institutions established in the US that allows the private sector's commercial development of oil and gas.

In general, legal institutions that place mineral rights in the hands of landowners and allow intellectual and physical property to be monetized have led to a regulatory framework in the US that is highly conducive to innovation and entrepreneurial activity across the energy sector. In the oil and gas space, incentives for domestic development derive from transparent, market-driven prices and a low cost to lift and move supplies. Hence, domestic production is very sensitive to the availability of capital and infrastructure. If anything disrupts the availability of either capital or infrastructure, production can grind to a halt in the affected region. This complicates the calculus around policy formation at the federal level, particularly when compared to the local level.³ In short, domestic policy must continue to support domestic production if foreign policy goals that are facilitated by domestic oil and gas production are to be realized.

As the US increases its exports of crude oil, petroleum products and natural gas, its influence expands into those nations that increasingly rely on imports to satisfy their energy appetites associated with economic growth. In general, expanded US production renders global supply to be more price responsive, and, as a result, carries an energy security benefit to consumers at home and abroad. As argued in previous Baker Institute research, this also benefits US foreign policy endeavors in dealing with potentially hostile oil-producing nations, and provides a stabilizing effect on the global oil market.⁴

Geopolitics, Energy Security, and Oil and Gas Trade

There are multiple definitions of the term “geopolitics”, but it generally refers to the impact of geography on the balance of power in international affairs. Such geographical elements include things such as access to open seas, topography of countries/regions, and local climate because they each convey information about potential for force projection, national defense capability, and economic prowess. Hence, for the last roughly 100 years, the term has been used to discuss how things such as the industrial revolution as well as technological innovations in transportation and communications would reshape the international political landscape. Over the last few decades, the term has become increasingly used when referring to discussions centered on access to adequate energy supplies and how various international actors could shape international energy

³ See “The Market Impact of New Natural Gas-Directed Policies in the United States” (Feb 2015) by Kenneth Medlock and Peter Hartley, available online at <https://www.bakerinstitute.org/research/north-american-energy/>.

⁴ See “To Lift or Not to Lift? The US Crude Oil Export Ban: Implications for Price and Energy Security” (March 2015) by Kenneth Medlock, available online at <https://www.bakerinstitute.org/research/north-american-energy/>

trade for political gain. Hence, the concept of energy security has been embroiled in broader discourse concerning geopolitics.

The concept of energy security gained prominence in public policy discourse following the oil price shocks of the 1970s as a negative correlation between oil price and macroeconomic performance in oil-importing countries became increasingly recognized. In this context, “energy security” generally refers to the concept of ensuring an adequate supply of energy at a stable and reasonable price to avoid economic malaise. So, energy security can be captured by three basic concepts: (1) adequacy of supply, (2) stability of price, and (3) relatively low price. First, adequacy of supply follows from the fact that energy is required for virtually all modern economic activity. Second, price stability is important because irregular price volatility can be a source of uncertainty, which (if it negatively impacts investment) carries a negative macroeconomic impact. Third, price level matters because it has a direct impact on household disposable income and industrial/commercial operating budgets; quite simply, if more financial resources are diverted to energy purchases, less is available for other activities. Hence, the concepts of energy security and economic security are intimately linked, as the former, if achieved, facilitates elements of the latter.

Each of these has relevance to the role of the US in the broader geopolitical context, and, of course, domestic energy security and economic well-being. Diversification of the overall energy supply portfolio is one means of ensuring stability in supply at a reasonable price. The ability to access a variety of supply sources is a crucial component in most energy security arguments. For example, the negative impacts of any temporary disruption in supply can be more easily overcome if there is an easily accessible alternative source of supply for the same fuel. It follows, therefore, that diversification of supply is generally viewed to be beneficial for energy security. Europe, for example, has become all too familiar with this over the past decade, as tensions revolving around natural gas payments from Ukraine to Russia have resulted in multiple temporary pressure reductions on pipelines providing supply to Europe from Russia traversing Ukraine.⁵ In fact, these disruptions have sparked significant effort to diversify sources of supply across the European Union away from Russia.

This is where the US has an important and growing role to play. In particular, as domestic oil and gas production increases, the US will have a greater impact on global market balance, both by direct export and by displacement. This, in turn, raises an important point about market fungibility. Energy security is facilitated by increasing both spatial and intertemporal trading opportunity in energy commodity markets. In this regard, the US has a distinct economic and geopolitical advantage. As expounded in previous testimony given before the Senate Energy and Natural Resources (SENR) Committee, the existence of infrastructure that allows trade to occur enhances market function thereby providing elements of reliability and security of supply for consumers,

⁵ “Could trade help achieve energy security?” by Kenneth B Medlock III, World Economic Forum (Mar 3, 2016).

and the regulatory and legal frameworks in the US have historically been conducive to infrastructure investment, especially when compared to other regions around the world⁶

Physical infrastructure enhances market fungibility by connecting markets spatially (via regional trade) and through time (via storage). As a case in point, constraints on the ability to meet the unexpected demand shock in the wake of the disaster at Fukushima in early 2011 resulted in the spot price of Asian LNG rising to unprecedented levels. If LNG export capacity had existed in the US at that time, price increases in Asia would not have been so extreme. This point was not lost on LNG developers as they rushed to acquire permits to export US natural gas as LNG in the years that followed, and the enduring increase in natural gas produced from shale continues to provide ample commercial opportunity to profitably export LNG from the US.

As US LNG exports rise, the global market will become physically linked to North America, the most liquid natural gas market on the world. This should, in turn, facilitate more trade and alter the liquidity paradigm that has characterized the global LNG market heretofore. This emerging reality has triggered enormous interest by consumers in Asia, Europe and Latin America as US-sourced LNG exports are understood to be market-driven and, thus, relatively secure. On the geopolitical front, this means US LNG serves as a “credible threat” to the status quo enjoyed by incumbent regional suppliers – for instance, Russia into Europe or Bolivia into Brazil. Moreover, as the introduction of US LNG enhances market liquidity, it will fundamentally alter the nature of natural gas pricing everywhere.

We have already seen evidence of US LNG as a paradigm altering credible threat in the Baltic region. Upon the opening of the LNG import facility in Lithuania, Russia renegotiated the price on its gas sales to the region in order to maintain its market position. This, of course, means the region still imports Russian natural gas. But, the cost of doing so is now lower and there exists capability to at least partially switch suppliers should Russia use natural gas to exercise any hegemonic intent. Hence, the credible threat of US LNG supply has fundamentally altered the status quo in the Baltic region.⁷

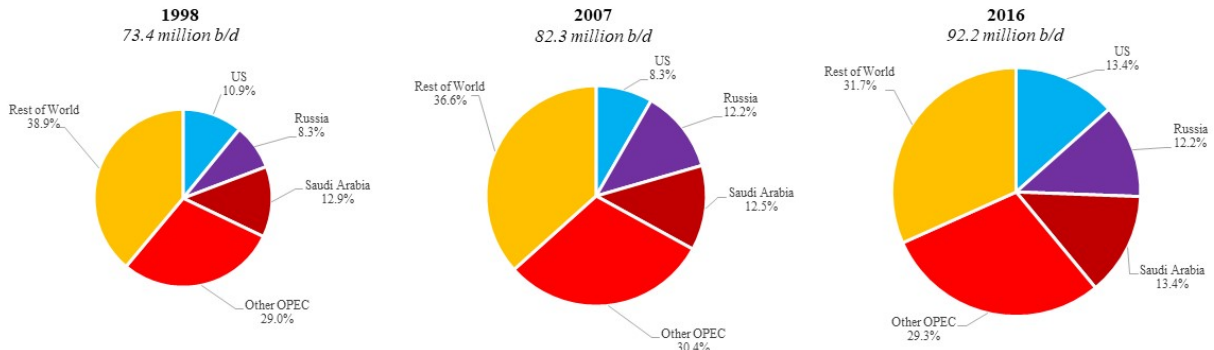
Oil markets are also being fundamentally altered by significant growth in US oil production. As indicated in Figure 4, global oil production has increased by over 18.7 million barrels per day since 1998, and OPEC’s market share has held relatively steady over that same period at around 42%. Since 2007, despite OPEC’s ability to hold market share, the global oil market has undergone a significant shift as strong growth in US oil production – rising by over 5.4 million barrels per day – has seen the US share of global output rise from 8.3% to 13.4%, representing growth in volume

⁶ See testimony at SENR full committee hearing on energy infrastructure (Feb 8, 2018). Oral and written testimony as well as questions for the record are available at <https://www.energy.senate.gov/public/index.cfm/2018/2/full-committee-hearing-on-energy-infrastructure>.

⁷ See, “A ‘Credible Threat’ Approach to Long Run Deterrence of Russian-European Hegemony” by Kenneth B Medlock III available at <http://www.forbes.com/sites/thebakersinstitute/2014/03/10/a-credible-threat-approach-to-long-run-deterrence-of-russian-european-hegemony/>.

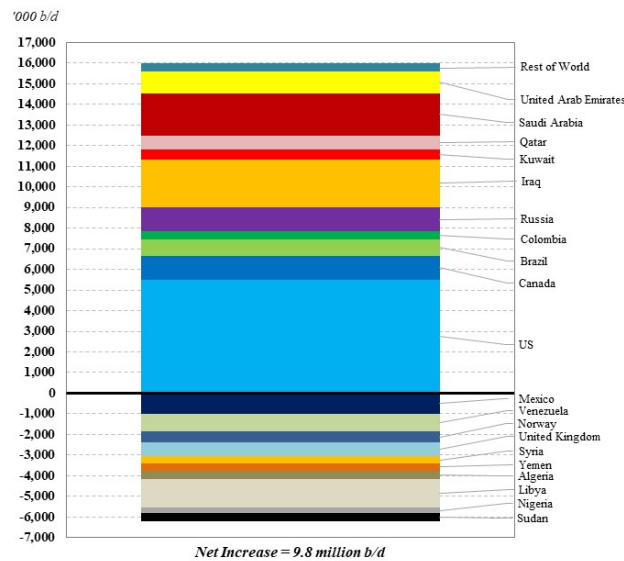
and market share not seen since Saudi Arabian oil production increased by 6.4 million barrels per day over the decade of the 1970s. Notably, the growth in US production has largely offset declines witnessed in other non-OPEC regions, except Russia where output share has also remained stable since 2007.

Figure 4 – Shares of Global Oil Production by Select Region, Select Years



Source: BP Statistical Review

Figure 5 – Change in Global Oil Production by Country/Region, 2007-2016

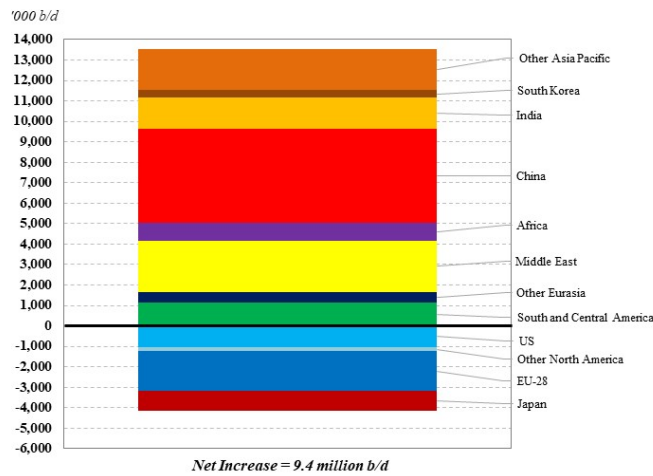


Source: BP Statistical Review

Digging a little deeper in the trends witnessed since 2007 highlights how important US oil production has been for global market balance. As seen in Figure 5, production increased in several countries – such as Saudi Arabia, Iraq, Russia, Brazil, Canada and the US, to name a few – while it decreased in others – such as Mexico, Venezuela, the United Kingdom, and Libya, among others. Among the countries depicted in Figure 4 where production decreased from 2007 through 2016,

Mexico, Venezuela, Syria, Yemen, Algeria, Libya, Nigeria and Sudan all were negatively impacted by various above-ground issues, such as sector mismanagement and domestic civil strife. In sum, this amounted to a decrease of about 5 million barrels per day of supply. The production increase from the US during this same period was about 5.5 million barrels per day, meaning US light tight oil production (shale) accounted for an important source of supply to offset production declines driven by above-ground factors. Moreover, given the declines in the UK and Norway (about 1.2 million barrels per day) and the rapid demand growth seen in developing, non-OECD countries (see Figure 6), US production has provided an incredibly important incremental source of supply.

Figure 6 – Change in Global Oil Consumption by Country/Region, 2007-2016



Source: BP Statistical Review

Given the dramatic *net* growth in demand of almost 10 million barrels per day since 2007, driven entirely by the developing world, additional sources of oil supply have been paramount for market balance and broader energy security. Given that US oil production is commercially motivated (rather than dictated by government or national oil company policy), the incremental supplies of US oil to the global market are arguably more secure than supply from virtually anywhere else in the world. As argued in previous research, distinct energy security benefits accrue as more stable and secure sources of crude oil enter the growing global market. Greater stability, in turn, lessens international market oil price volatility, which matriculates through to petroleum product prices. As noted above, it is well-documented that higher prices and greater price volatility are associated with macroeconomic malaise. So, the US has a distinct opportunity to lead an oil industry transformation that could see lines of global oil trade redrawn as North American production captures a larger portion of the growing international market. This will, if fully realized, have tremendous implications for US foreign policy endeavors in its dealings with countries such as Iran, Venezuela and Russia. For example, to the extent that US oil production is price responsive, the US government can act with greater impunity in using targeted sanctions to dissuade

hegemonic behavior. In addition, US oil supply will lend greater stability to the global crude oil market thereby conveying benefits to the US and its allies.

Concluding remarks

Energy is critical to modern economic activity. This is, in fact, why energy security concerns – either discussed in the context of domestic reliability or international access – are such an important component of energy policy discourse. Just 15 years ago, the consensus view was that US oil and gas production would be in inexorable decline, and the US would be a growing *importer* of both fuels. However, upstream innovations have shifted the competitive landscape in global oil and natural gas markets, to the point where now the US is a growing *supplier* of oil and gas to global markets. This has been propelled by a robust, technically and commercially recoverable resource endowment in the US and the unique set of regulatory and market institutions that have promoted commercial development of infrastructure; each has conveyed significant benefit in the energy security domain and will carry a significant 21st century competitive advantage to US interests. This becomes even more salient when one considers the anticipated growth of emerging markets in developing Asia over the next 20 to 30 years. The sheer collective size of these markets – over 3 billion people in economies projected to grow in excess of 5% per year – will put steady pressure on supply lines for all fuels, meaning the US with its relative abundance of oil and gas is well-positioned to play an important role in shaping energy geopolitics for the next few decades.