The New American Oil Boom

IMPLICATIONS FOR ENERGY SECURITY

ENERGY SECURITY
LEADERSHIP
COUNCIL

a project of

Securing America's
Future Energy

Disclaimer: Although the authors and endorsers of this report have used their best efforts in its preparation, they assume no responsibility for any errors or omissions, nor any liability for damages resulting from the use of or reliance on information contained herein. The authors have sought to obtain permission from all image, data, and chart owners and apologize to any who could not be properly traced for permission and acknowledgement.

Energy Security Leadership Council

COUNCIL CO-CHAIRS

General P.X. Kelley, U.S. Marine Corps (Ret.)
28th Commandant, U.S. Marine Corp

Frederick W. Smith
Chairman, President and CEO, FedEx Corporation

MEMBERS

Admiral Dennis C. Blair, U.S. Navy (Ret.)
Former Director of National Intelligence and Commander in Chief, U.S. Pacific Command

General Bryan "Doug" Brown, U.S. Army (Ret.)
Former Commander, U.S. Special Operations Command

Steve Cahillane
President & CEO, Coca-Cola Refreshments (CCR), The Coca-Cola Company

Admiral Vern Clark, U.S. Navy (Ret.)
Former Chief of Naval Operations

General Richard A. Cody, U.S. Army (Ret.)
Former Vice Chairman, U.S. Army

General James Conway, U.S. Marine Corps (Ret.)
34th Commandant, United States Marine Corps

Sam Gilliland
Chairman & CEO, Sabre Holdings

Adam M. Goldstein
President & CEO, Royal Caribbean International

General John A. Gordon, U.S. Air Force (Ret.)
Former Homeland Security Advisor to the President

Maurice R. Greenberg
Chairman & CEO, C.V. Starr & Co., Inc

General John W. Handy, U.S. Air Force (Ret.)
Former Commander, U.S. Transportation and Air Mobility Command

Admiral Gregory G. Johnson, U.S. Navy (Ret.)
Former Commander, U.S. Naval Forces, Europe

General John M. Keane, U.S. Army (Ret.)
Former Vice Chief of Staff of the U.S. Army

Admiral Timothy J. Keating, U.S. Navy (Ret.)
Former Commander, U.S. Pacific Command

Herbert D. Kelleher
Founder & Chairman Emeritus, Southwest Airlines Co.

John F. Lehman
Former Secretary to the U.S. Navy

General Michael E. Ryan, U.S. Air Force (Ret.)
16th Chief of Staff, U.S. Air Force

Eric S. Schwartz
Former Co-CEO, Goldman Sachs Asset Management

Michael R. Splinter
President & CEO, Applied Materials, Inc.

Jeffrey C. Sprecher
Chairman & CEO, Intercontinental Exchange

David P. Steiner
CEO, Waste Management, Inc.

Michael T. Strianese
President, CEO & Director, L-3 Communications

General Charles F. Wald, U.S. Air Force (Ret.)
Former Deputy Commander, United States European Command

Josh S. Weston
Honorary Chairman, Automatic Data Processing, Inc.

Executive Summary

In 2011, net U.S. imports of crude oil and refined petroleum products declined for the sixth consecutive year, reversing a decades-long trend of rising reliance on foreign suppliers. A number of factors played a role, including reduced demand for petroleum fuels as a result of the recession and rising levels of efficiency in the nation's automotive fleet. Recently, however, increased domestic production of liquid fuels has accounted for a substantial portion of the shift, rising by 1.4 million barrels per day (mbd) between 2008 and 2011 while net imports declined by 2.7 mbd. Based on current U.S. dynamics, both trends—rising production and falling imports—appear to be sustainable for the next decade and possibly longer.

Numerous observers have suggested that this outlook is transformative for U.S. energy security. They argue that the nation is on the cusp of an era of energy independence through self-sufficiency in supply—an era characterized by greater economic stability and national security as the result of reduced reliance on Middle East oil supplies. The nature and meaning of energy independence, however, is widely misunderstood. Although increased domestic oil production will have clear positive effects on the U.S. economy, it alone will not insulate America from the risks of oil dependence. This can only be accomplished by reducing the role of oil in our economy.

PART ONE: THE NEW AMERICAN OIL BOOM

Between 2009 and 2011, the United States experienced three consecutive years of crude oil production growth for the first time since 1983-1985.[1] A number of regions contributed to rising output, including the upper Midwest, the Gulf Coast, the Rocky Mountain West, and the federal Gulf of Mexico. Perhaps more importantly, the recent increases have been substantial in volume. Compared to annual crude production in 2008, output in 2011 was 709,000 barrels per day higher—growth of more than 14 percent.[2] The last comparable growth period in U.S. crude oil production occurred in the late 1960s.[3]

Without question, the United States is experiencing a renaissance in domestic liquid fuel production. In fact, growth in crude oil production is being augmented by rising output of natural gas liquids and liquids derived from biomass. Taken together, output of domestic liquid fuels reached 8.8 million barrels per day in 2011, its highest level in two decades.[4] Moreover, a number of recent government and industry estimates suggest that the current expansion in liquid fuel production is sustainable for the next decade or more. In its recently released *Annual Energy Outlook 2012,* the Department of Energy forecast U.S. traditional liquids output to reach 10.7 mbd in 2020 and 10.8 mbd in 2030.[5]

I. ORIGINS

While a number of factors surely played a role in the changing U.S. outlook, a handful of major developments stand out. In fact, the combination of trends and developments that truly catalyzed the rapid expansion of U.S. oil production over the past several years represents a kind of 'perfect storm' of price, technology, and opportunity.

Oil Prices: High and rising oil prices sustained over a period of several years sent a clear investment signal to the U.S. oil industry, which tends to be among the most price-sensitive in the world. No doubt, there have been periods of immense volatility, and prices have occasionally retreated as they did at the height of the global financial meltdown in late 2008. But taken as a whole, the majority of the past decade has been characterized by a steady upward march in oil prices.

Technology: On its own, a strong price signal would not necessarily have translated directly into meaningful increases in U.S. oil production. Higher prices needed to be complemented by an increase in producible resources—either through new discoveries, new recovery methods, or better drilling technology. In fact, a combination of all of these things came together beginning in the mid-2000s, most impressively in the onshore region of the lower-48 United States as the natural gas industry deployed hydraulic fracturing and horizontal drilling to exploit vast reserves of gas trapped in low-permeability shale formations.

Opportunity: As U.S. natural gas prices collapsed in 2009, companies that had been active in unconventional gas production began to shift capital and drilling programs toward liquids. Compared to persistently low natural gas prices, high and rising oil prices provided an attractive target. Some of the most significant unconventional gas plays were known to contain sizeable liquid-bearing formations, and a number of other unconventional resource plays throughout the United States were known to be primarily liquids-rich. The investments in drilling technology and

1 U.S. Department of Energy (DOE), Energy Information Administration (EIA), online statistics, at http://www.eia.gov/petroleum/data.cfm

2 Id.

3 Id.

4 Id. Figure is crude oil and NGLs plus biofuels. Does not include refinery processing gain.

5 DOE, EIA, *Annual Energy Outlook 2012,* (AEO) Table A.11; includes crude oil, NGLs, and conventional biofuels

equipment that had been so central to the expansion in shale gas production—namely horizontal drilling and multi-stage hydraulic fracturing—were directly applicable to producing liquids from numerous unconventional oil formations.

II. TRENDS AND OUTLOOK

Oil prices, technology, and opportunity are driving the most significant expansion in U.S. onshore crude oil production in two decades. Mature regions like the Permian basin in Texas have been an important part of the picture, but large quantities of light sweet crude oil held in unconventional deposits in North Dakota, Colorado, and elsewhere are being successfully developed as well. Though important economic and regulatory uncertainties surely exist, the lower-48 onshore United States appears to be positioned for a sustained period of growth. Combined with the return to normal operations in the federal Gulf of Mexico, onshore production will drive total U.S. crude output 23 percent higher in 2020 compared to 2010 levels. Net U.S. liquids imports will fall by 21 percent over the same period.[6]

PART TWO: DEFINING ENERGY SECURITY

While rising domestic oil production will have important benefits for the U.S. economy, it is important to understand the limits of its effects on energy security. Energy security is almost entirely a function of the importance of oil consumption in the domestic economy and is not related to the original source of that oil. In other words, a nation cannot achieve energy security so long as it is economically beholden to oil, which is priced in a global market.

I. THE MYTH OF ENERGY INDEPENDENCE

For decades, long-term energy security has routinely been defined in American political discourse as the attainment of self-sufficiency in energy supply, or energy independence. That is, energy security is often equated with the ability to become *independent* from foreign oil suppliers. Pursuit of this so-called independence has typically been most intense during periods of high and volatile oil prices, particularly when such periods have overlapped with high levels of U.S. imports. Unfortunately, the concept of energy security through self-sufficiency in supply alone ignores America's true vulnerability as an oil consumer, driving policymakers toward a goal that is fundamentally misguided.

II. THE NATURE OF OIL DEPENDENCE

In order to craft an enduring strategy to achieve real and lasting energy security, it is important to understand the nature of the problem. There are four factors that characterize U.S. oil dependence: the importance of oil in the economy, the lack of available alternatives, the fact that prices are set in a global market, and the volatility of oil prices.

Oil plays an important role in the U.S. economy: Oil derives its strategic significance from its role in the overall U.S. economy and the transportation sector in particular. In 2010, petroleum fuels accounted for 37 percent of U.S. primary energy demand, more than any other single fuel.[7] While this figure represents a significant decline from 1977, when oil represented 47 percent of primary U.S. energy demand, oil is clearly still a key input to the economy. The transportation sector currently accounts for more than 70 percent of total U.S. oil demand.[8]

6 DOE, EIA, *AEO 2012,* (AEO) Table A.11
7 BP, plc., *Statistical Review*, at 41
8 DOE, EIA, *Annual Energy Review 2010,* (AER) Tables 5.1b and 5.13c

The volume of oil that we consume might not be important in its own right except that oil is relatively expensive. The total value of oil consumed by the United States represents a significant portion of all economic activity in the nation. Even when oil prices are low, the value of our total consumption remains large. The value of petroleum fuels consumed in the United States has ranged from $47 billion to $895 billion over the past four decades, representing between 2.6 and 8.5 percent of GDP.[9] During the past five years specifically, spending by U.S. households and businesses on petroleum fuels has averaged $755 billion annually, or more than 5 percent of GDP.[10]

There are currently no alternatives in transport: The transportation sector remains highly dependent on costly petroleum fuels that affect consumer spending in real time. In 2010, the U.S. transportation sector relied on petroleum-based fuels for 93.2 percent of delivered energy.[11] Even this figure understates the problem, as liquid fuels derived from biomass provided approximately four percent of delivered energy. These fuels, which are substitutes for petroleum, are priced on the same curve. Taken together, liquid fuels provide 97 percent of the energy that moves our cars, trucks, ships, and aircraft.[12]

As a result of this utter reliance, American consumers and businesses, and the economy by extension, are fully exposed to oil prices with practically no means to choose less costly alternatives in the short term. In other words, oil demand is highly price inelastic. As oil prices increase during crises such as those that occurred in 1973-1974, 1979-1981, 1999-2000, 2007-2008, and 2011-2012—or during the course of normal market fluctuations associated with the business cycle—consumers have no choice but to pay more for their fuel. This increased spending in the short term must come at the expense of other spending on goods and services, the negative effects of which reverberate throughout the economy.

Oil prices are determined in a global market: Because it is fungible and relatively easy to ship by tanker overseas and through pipelines, rail, and trucks onshore, there is essentially a single global market for oil. Oil prices are set in open commodity markets, and oil is traded globally, which means that prices are affected by events in oil-producing and oil-consuming countries around the world. In fact, in some cases, oil prices can be significantly impacted by events in countries that are neither large oil consumers nor large producers—for example, by countries that host important shipping channels or infrastructure. The key consequence of this dynamic is that changes in oil supply or demand *anywhere* tend to affect prices *everywhere.* The impact on the United States—or any other consuming country—is a function of the amount of oil consumed and is not related to the amount of oil imported.

Oil prices are volatile: In an era of rapidly rising demand, high levels of geopolitical volatility, and tight spare capacity, the price of crude oil is becoming increasingly high and volatile. For the U.S. economy, which is highly dependent on petroleum for mobility, this volatility represents a dangerous vulnerability. Volatility creates uncertainty and economic dislocation and affects planning and budgetary decisions, resulting in less efficient resource allocations and ultimately preventing the U.S. economy from maximizing its potential.

The volatility of petroleum fuels is the single most damaging consequence of U.S. oil dependence. In 2001, the average U.S. household spent approximately $1,756 dollars on gasoline, equivalent to 4.2

9 SAFE analysis based on data from: DOE, EIA, *AER 2010,* Table 3.5; and BEA, "Current Dollar and Real GDP"
10 Id.
11 DOE, EIA, *AER 2010,* Table 2.1e
12 Id.

percent of the median household income of $42,228.[13] Over the following six years, as oil prices marched steadily upward, household spending on gasoline increased as well, reaching $3,764 in 2008—or about 7.5 percent of the median household income of $50,303.[14] This increase of more than $2,000 per household essentially functioned as a kind of tax, providing no additional consumer value of any kind relative to 2001.

After averaging $2.35/gal in 2009, U.S. gasoline prices rose to $2.79 in 2010 and a record $3.52 in 2011.[15] Average household spending on gasoline, which had fallen sharply back to $2,662 in 2009, reached a record $4,060 in 2011, equal to 8.2 percent of the median household income of $49,446. The increase in gasoline prices between 2010 and 2011 nearly derailed the U.S. economic recovery. From a policy perspective, increased gasoline spending acted as a significant headwind against efforts to stimulate consumer spending, nearly offsetting any benefits of the 2011 payroll tax cut for households.

III. EVALUATING THE BENEFITS OF THE BOOM

Given the nature of U.S. oil dependence, it is important for policymakers to understand the benefits and limitations of the new American oil boom. Rising U.S. oil production will have important benefits for the domestic economy on a number of fronts. However, as long as the United States remains a large consumer of oil, no level of domestic fuel production can meaningfully improve energy security.

Rising oil production will improve the trade deficit: All things being equal, rising domestic oil production will have a beneficial impact on the U.S. trade deficit. This shift in dynamics cannot have come soon enough, as the role of oil imports in the U.S. trade deficit has been rapidly expanding in recent years. Progressively higher oil prices have meant that, even as oil imports have declined in volume, they have remained high in cost.

The oil industry will be an important source of employment growth: As the number of rigs drilling for oil and gas in the United States has increased dramatically in recent years, the number of workers directly employed in oil and gas extraction has also increased. In fact, more people were employed in oil and gas extraction in March 2012 than at any time since November 1988.[16] At a time when the unemployment rate remains above eight percent in the United States, the job growth potential of the new American oil boom cannot be overlooked.

Rising domestic oil production will not achieve a long-term domestic price advantage in oil: In recent months, a number of political commentators have suggested that, as the United States produces more oil domestically, it will achieve sharply lower prices in much the same way that natural gas prices have fallen during the surge in U.S. shale gas production. This simply is not credible. While the United States does have a large degree of autonomy in natural gas pricing, this is because the oil and natural gas markets are vastly different: there is no global market for gas.

Self-sufficiency in supply will not shield U.S. consumers from price volatility: Both Canada and Norway were net oil exporters for the entire period of the 2003-2008 increase in global oil prices, and both nations remained net exporters through the subsequent price spike in 2011.[17] In

13 SAFE analysis based on data from: DEO, EIA; and U.S. Bureau of Economic Analysis
14 Id.
15 DOE, EIA, *Monthly Energy Review,* February 2012, Table 9.4
16 Bureau of Labor Statistics, Industries at a Glance, "Oil and Gas Extraction," at http://www.bls.gov/iag/tgs/iag211.htm
17 SAFE Analysis based on data from: IEA, *Oil Information 2011,* Part IV, Table 3; and *Monthly Oil Market Report*, February 2012, Tables 2 and 3

the case of both Norway and Canada, however, domestic retail fuel prices tracked global oil prices almost perfectly throughout the entire period from 2003 through 2011.[18] Indeed, adjusted in a common currency and not including taxes, retail fuel prices in Canada and Norway moved in lockstep not just with global crude benchmarks, but also with retail fuel prices in the United States over the same period.[19]

Rising oil production will not mitigate the foreign and military challenges of U.S. oil dependence: As U.S. oil imports continue to decline, and other countries—China in particular—grow to become larger net oil importers, many are asking whether the United States may soon face reduced foreign and military policy burdens in regions such as the Middle East. This is unlikely to be the case, as the U.S. commitment to stability in oil-producing regions is largely a function of the importance of oil consumption in the global and domestic economies. In this context, rising U.S. production of oil is unlikely to lessen our military commitment to stability in the Middle East or provide added flexibility in dealing with difficult foreign policy challenges in major oil-producing countries.

PART THREE: IMPLICATIONS FOR POLICYMAKERS

As lawmakers develop policies to improve U.S. energy security, it is important to work within a framework that addresses the true nature of the problem: the economy's heavy reliance on petroleum, particularly in the transportation sector. A set of implications for policymakers emerges from this framework and from the analysis laid out in this report. These implications prioritize energy security, recognizing that the best policies are those that reduce the economy's exposure to oil price volatility. They also support growth in domestic production, recognizing that the new American oil boom is poised to benefit the economy in numerous ways. The primary implications are as follows:

1. **Vehicle fuel-economy standards are the most important energy security accomplishment in decades. They must be supported and continuously improved.**
   In 2010, the National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) finalized light-duty fuel-economy rules for the period 2012-2016. In 2011, EPA and NHTSA finalized the nation's first-ever medium- and heavy-duty truck rules and proposed an additional rule for light-duty vehicles for the period 2017-2025. Taken together, the rules finalized and being considered by NHTSA and EPA will reduce U.S. demand for gasoline and diesel by 3.7 mbd in 2030 compared to baseline projections. This level of reduction in oil intensity will meaningfully enhance American energy security.

2. **Fuel efficiency is not enough on its own. The long-term goal of energy security policy must be to break the petroleum's stranglehold on the transportation sector.**
   Over the long term, the United States can achieve meaningful energy security by transitioning away from liquid fuels in the transportation sector. Vehicles that derive motive power from grid-generated electricity stored in onboard batteries are entering the market today and over time could represent a key pillar in a more secure transportation sector and economy. Plug-in electric vehicles are particularly promising in light-duty applications, which account for roughly 40 percent of U.S. oil demand.[20]

18 SAFE analysis based on data from: IEA, *Energy Prices and Taxes: Quarterly Statistics*, Fourth Quarter 2011
19 Id.
20 ORNL, *Transportation Energy Data Book*, Table 1.13

Also promising is the potential of natural gas in the heavy-duty segment of the U.S. transportation fleet. Heavy-duty tractor trailers account for more than 10 percent of U.S. oil demand.[21] These high-mileage, low-efficiency vehicles are an ideal target for natural gas fuel, specifically liquefied natural gas (LNG). At a time when the United States is essentially capable of producing more natural gas than the economy can consume, there could be real advantages to deploying gas in heavy-duty applications, particularly if the nation is able to maintain its strategic pricing advantage in gas.

3. **Policy can and should support increased domestic production of oil.**
   The oil and gas industry should have access to produce the most cost-effective resources that can be developed in an environmentally safe manner. Without question, federal environmental regulations should hold the industry to the highest performance standards attainable. However, with such standards in place, promising tracts of federal territory—both onshore and offshore—should be offered to industry for development. This approach has the potential to further increase domestic production levels while generating significant revenues for the federal treasury.

21 Id., Tables 1.12 and 5,2

Table of Contents

Introduction

For the first time in several decades, the American oil industry is in the midst of a sustained and substantial growth phase. After three consecutive years of production increases, domestic crude oil output reached an eight-year high in 2011, and most analysts expect the upward trend to continue well into the current decade. Rapidly rising output from onshore unconventional resources and the return to normal operations in the deepwater Gulf of Mexico are now expected to drive U.S. crude production 23 percent higher by 2020 compared to 2010 levels.[1] This marks a sharp reversal from expectations as recently as just four years ago, when conventional wisdom suggested that U.S. crude oil production was in a decades-long state of inexorable decline that began in the 1970s.

If this were not impressive enough, the increase in crude production tells only part of the story. If rising output of natural gas liquids (NGLs) and biofuels is taken into account, U.S. domestic production of liquid fuels reached its highest level in 20 years in 2011. When combined with an increasingly efficient vehicle fleet, expanded domestic fuel output has driven a tectonic shift in the outlook for U.S. oil imports. By 2020, the United States may well be importing less than 40 percent of its liquid fuel needs. In 2005, it imported 60 percent.[2] As if to provide a signal of greater things yet to come, the United States was actually a net exporter of refined petroleum products in 2011 for the first time since 1949.[3]

This shift in outlook is likely to have far-reaching implications for the domestic economy, perhaps none more substantial than its impact on the trade deficit. However, the most profound impact of the new American oil boom may ultimately be its effect on the nation's political dialogue regarding energy security. For the first time in decades, the prospect of self-sufficiency in liquid fuel supplies is a subject of serious discussion. This self-sufficiency, commonly referred to as energy independence, has been a political aspiration as far back as the Nixon Administration. In recent months, leading national policymakers of both political parties, as well as analysts from a variety of market and policy analysis organizations, have suggested that energy independence is achievable and that it has implications for the U.S. economy, foreign policy, energy security, and energy policy more broadly.

In this context, it is important to understand the nature and characteristics of oil markets, energy security, and energy independence. Specifically, how should energy independence be defined, and does achieving it have any meaningful benefits? What is the relationship between energy independence and energy security, and how should these concepts guide U.S. policymakers as they chart a strategic course for the coming decades?

Americans first became acutely aware of the consequences of energy *insecurity* during the oil price shocks of 1973-1974 and 1979-1981. Both shocks were associated with immense economic dislocation, sharp recessions, and high unemployment as the economy struggled to adjust to rapidly rising costs for a key input—oil accounted for 46 percent of U.S. primary energy demand in 1973.[4] Notably, both 1970s oil shocks were the result of temporary supply disruptions that occurred in the global market and were ultimately resolved (the Arab Oil Embargo in 1973 and the Iranian Revolution in 1979). Perhaps more critically, the 1973 shock highlighted to the public the dangers of relying on an energy source subject to price spikes induced by nations with which the United States was likely to disagree on foreign policy.

1 U.S. Department of Energy (DOE), Energy Information Administration (EIA), *Annual Energy Outlook 2012* (*AEO*), Table A.11
2 DOE, EIA, *Annual Energy Review 2010* (*AER*), Table 5.1b
3 DOE, EIA, *Short Term Energy Outlook* (*STEO*), March 2012
4 BP, plc., Statistical Review of World Energy 2011 (Statistical Review)

In the decades that followed the oil shocks, national policymakers implemented a series of reforms that reduced America's vulnerability in important ways. Petroleum fuels were phased out of the electric power sector, vehicles became more efficient, and many homes transitioned to natural gas for space heating. At the same time, conditions in the global oil market improved, resulting in generally low prices throughout most of the mid- to late-1980s, 1990s, and early 2000s. Throughout this period, however, rising levels of oil consumption combined with falling domestic production had served to make the United States highly import-dependent by the turn of the century.

By the mid-2000s, oil prices began a sustained upward march that reignited the political discussion about energy security and the national debate about how best to achieve it. This time, the key driver of oil price volatility was not a specific physical disruption in supplies, though outages in Iraq and Venezuela in 2003 certainly helped catalyze the initial run-up. Rather, it was a far more structural and fundamental issue: that of rapidly rising oil demand in emerging market economies. When oil prices surged to their all-time dollar-denominated record of $147 per barrel (bbl) in July of 2008, it was on the heels of the most expansive five-year growth period in global oil demand since the 1970s.[5] This growth stressed the global supply system to its maximum capacity. The resulting price volatility played an important role in sending the U.S. economy into its deepest recession since the Great Depression.[6]

For the first time in several decades, the American oil industry is in the midst of a sustained and substantial growth phase. After three consecutive years of production increases, domestic crude oil output reached an eight-year high in 2011.

The 2007-2009 recession provided a brief reprieve in terms of both oil prices and oil demand growth. Global demand actually fell by 2 percent during the contraction, and prices generally stabilized in much of 2009 and 2010. But demand growth roared back in 2010 as the global economy—emerging markets in particular—returned to expansion. In fact, global oil demand in 2010 exceeded pre-crisis levels by 1.1 percent.[7] As a result, oil suppliers were already well into the process of unwinding surplus inventories and reactivating spare production capacity as the world economy entered 2011. In such a tight market, the Arab Spring, most notably the Libyan Civil War, sent oil prices surging to levels not seen since 2008. Global benchmark crude streams averaged $111/bbl in 2011, the highest annual average in history.[8]

Oil prices have yet to retreat in any meaningful way through the first quarter of 2012, despite evidence that high prices are driving reduced demand in the United States and Western Europe. Supply-side factors have clearly played a role. A transit dispute between Sudan and South Sudan removed nearly 350,000 barrels per day (b/d) from the market as of March 2012.[9] Political instability in Syria, Yemen, and Columbia—along with weather and mechanical outages in Canada and the North Sea—drove total unplanned outages to 750,000 b/d in the first quarter of 2012.[10] Against this backdrop, rising tension over Iran's nuclear program and increasingly stringent Western sanctions targeting the Iranian oil industry have surely loomed large. Nonetheless, robust demand growth in emerging market economies remains

5 SAFE Analysis based on data from: BP, plc. *Statistical Review of World Energy June 2011*, Statistical Supplement
6 U.S. Bureau of Economic Analysis (BEA), National Accounts, "Current Dollar and Real GDP"
7 BP, plc., *Statistical Review*, at 9
8 DOE, EIA, online statistics, "Spot Prices," at http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm
9 International Energy Agency (IEA), *Monthly Oil Market Report*, March 2012
10 Id.

among the most credible explanations for high and rising oil prices. The International Energy Agency (IEA) recently forecast global demand to reach a record 91.1 million barrels per day (mbd) in the fourth quarter of 2012, up 1.4 percent year-over-year from 2011.[11] The entire increase is expected to come from emerging market economies.

In light of current oil price levels, the new American oil boom is taking on increased significance in the political and policy discussion regarding energy security. But America's policymakers must be clear about the benefits and limitations of rising domestic oil production. Notions of so-called energy independence are irrelevant as long as America remains a significant consumer of oil, which is priced in a global market based on developments in dozens of countries. In this sense, true energy security comes not from reduced imports, but from reduced dependence on oil as a key input to the economy.

America's policymakers must be clear about the benefits and limitations of rising domestic oil production. Notions of so-called energy independence are irrelevant as long as America remains a significant consumer of oil, which is priced in a global market based on developments in dozens of countries.

This has important implications for American policymakers as they consider the relationship between rising domestic oil production and U.S. energy security. Our policy goals must prioritize consistent reductions in the oil intensity of the U.S. economy over time. To the extent that an added degree of self-sufficiency in oil supply is achieved, this will clearly benefit the broader economy in a number of ways. However, self-sufficiency does not equal energy security, and it must not distract from the long-term strategies set out by numerous congresses and administrations, including improving motor vehicle efficiency and investing in advanced vehicle technologies to dramatically reduce our dependence on oil.

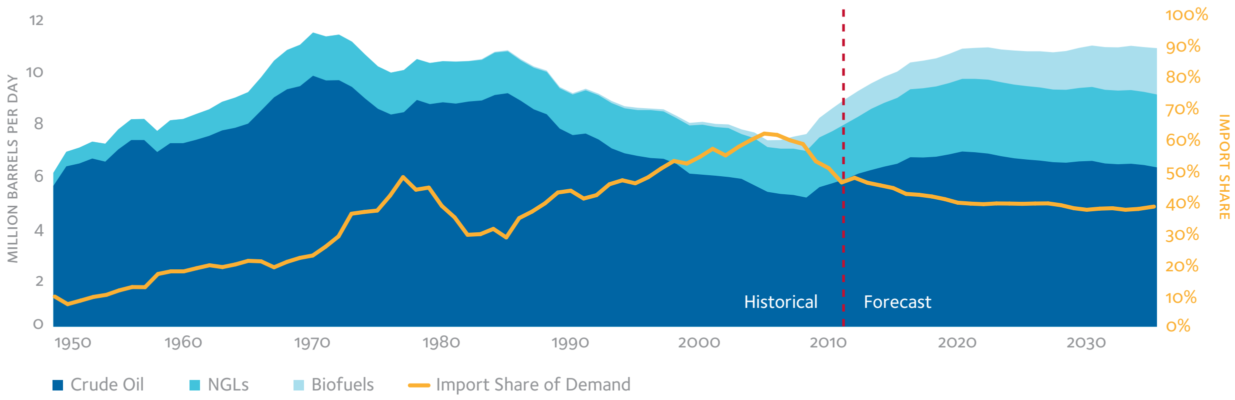
11 IEA, *Monthly Oil Market Report*, March 2012

The New American Oil Boom

Between 2009 and 2011, the United States experienced three consecutive years of crude oil production growth for the first time since 1983-1985.[12] A number of regions contributed to rising output, including the upper Midwest, the Gulf Coast, the Rocky Mountain West, and the federal Gulf of Mexico. Perhaps more importantly, the recent increases have been substantial in volume. Compared to annual crude production in 2008, output in 2011 was 709,000 barrels per day higher—growth of more than 14 percent.[13] The last comparable growth period in U.S. crude oil production occurred in the late 1960s.[14]

Without question, the United States is experiencing a renaissance in domestic liquid fuel production. In fact, growth in crude oil production is being augmented by rising output of natural gas liquids and liquids derived from biomass. Taken together, output of domestic liquid fuels reached 8.8 million barrels per day in 2011, its highest level in two decades.[15] Moreover, a number of recent government and industry estimates suggest that the current expansion in liquid fuel production is sustainable for the next decade or more. In its recently released *Annual Energy Outlook 2012*, the Department of Energy forecast U.S. traditional liquids output to reach 10.7 mbd in 2020 and 10.8 mbd in 2030.[16]

U.S. PRODUCTION OF CRUDE OIL, NGLS, AND CONVENTIONAL BIOFUELS



Note: Does not include advanced biofuels, liquids from coal, some blending components, certain ethers, or refinery gains. Biofuels not adjusted for energy content. Source: DOE, EIA

Combined with an increasingly efficient vehicle fleet, rising domestic output is expected to contribute to major reductions in U.S. oil imports (compared to both current levels and to forecasts from as recent as four years ago). In fact, the transition is already well underway. In 2005, net U.S. imports of crude oil and petroleum products accounted for 60 percent of final consumption.[17] In 2011, that figure fell to 44.7 percent, and by 2025 it could be as low as 37.9 percent.[18] To understand the importance of these developments and implications for long-term policy planning, it is first necessary to identify the factors that are contributing to rapidly rising U.S. oil output.

12 SAFE Analysis based on data from: DOE, IEA, *AER 2010*, Table 5.1b; and DOE, EIA, Petroleum Supply Monthly, February 2012
13 Id.
14 Id.
15 Id. Figure is crude oil and NGLs plus biofuels. Does not include refinery processing gain.
16 DOE, EIA, *AEO 2012*, Table A.11; includes crude oil, NGLs, and conventional biofuels
17 DOE, EIA, *AER 2010*, Table 5.1b
18 DOE, EIA, *AEO 2012*, Table A.11

I. ORIGINS

U.S. field production of crude oil reached its historical peak of 9.6 mbd in 1970. That same year, average well productivity also reached its apex of 18.1 barrels per day.[19] Over the following decades, domestic crude production entered a state of gradual and seemingly inexorable decline, falling in 29 of 38 years between 1970 and 2008.[20] There were of course important—but temporary—periods of growth along the way. The discovery of oil in Alaska's Prudhoe Bay led to rising output and a U.S. production plateau in the late 1970s and early 1980s. Nonetheless, declines elsewhere eventually overtook the effects of Prudhoe, which itself peaked at 1.6 mbd in 1988 and then entered a state of natural decline.[21] When domestic crude production reached a low point of 4.95 mbd in 2008, average well productivity had fallen by nearly 50 percent from its 1970 peak to just 9.4 barrels per day.[22]

The consistency with which oil production trended downward for essentially four decades provides a useful backdrop to highlight the stunning nature of the current turnaround. Unlike the discovery of Prudhoe Bay, for example, current expectations of rising output are not based on a single discovery in a remote frontier basin. There is tremendous diversity in the range of resources contributing to growth. It is also not the case that rising output simply reflects a massive expansion in drilling programs. U.S. average well productivity has increased along with production, from its 2008 low of 9.4 barrels per day to 10.6 barrels per day in 2011.[23]

While a number of factors surely played a role in the changing U.S. outlook, a handful of major developments stand out. In fact, the combination of trends and developments that truly catalyzed rapid expansion of U.S. oil production over the past several years represents a kind of 'perfect storm' of price, technology, and opportunity.

Oil Prices: High and rising oil prices sustained over a period of several years sent a clear investment signal to the U.S. oil industry, which tends to be among the most price-sensitive in the world. No doubt, there have been periods of immense volatility, and prices have occasionally retreated as they did at the height of the global financial meltdown in late 2008. But taken as a whole, the majority of the past decade has been characterized by a steady upward march in oil prices, which averaged less than $30/bbl in 2003, doubled to more than $60/bbl by 2006, surpassed $90/bbl in 2008, and averaged a record $111.26/bbl in 2011.[24] This progressive increase in prices—which, critically, has been viewed by most industry participants as predominantly driven by long-term global economic fundamentals—created a strong incentive to invest in upstream oil exploration and development.

There are number of reasons why oil production in the United States tends to be price sensitive. A stable and transparent regulatory environment and generally low barriers to entry relative to other oil-producing regions facilitate a high level of capital mobility. More important, however, is the relatively high marginal cost of incremental U.S. production. A 2010 analysis from Sanford Bernstein concluded that the U.S. marginal production cost for oil was between $83/bbl and $86/bbl, including operating costs, production taxes, and depreciation.[25] More specifically, IEA recently estimated the breakeven cost

19 DOE, EIA, *AER 2010*, Table 5.2
20 Id. Table 5.7
21 Alaska Department of Revenue, Tax Division, Fall 2011 Revenue Source Book, Table C-2a
22 DOE, EIA, *AER 2010*, Table 5.2.
23 SAFE Analysis based on data from: DOE, EIA, AER 2010, Table 5.2; and World Oil Online, "U.S. Well Counts Rise in All Regions," Volume 233 No.2, February 2012
24 DOE, EIA, online statistics, "Spot Prices," at http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm
25 Sanford Bernstein, "Bernstein Energy: 2010 U.S. Marginal Cost Curve – Oil Floor and Gaspiration?" May 27, 2011

(including royalties) for U.S. tight oil resources at $50/bbl.[26] For the U.S. offshore, the Department of Energy reports total upstream costs (finding and lifting) averaged $74.20/bbl between 2006 and 2008.[27] This figure retreated to $51.60/bbl between 2007 and 2009, in large part due to sharply reduced capital and operating costs in the wake of the financial crisis. Given current dynamics in global upstream costs, the 2006-2008 figure is likely a closer representation of current U.S. offshore costs.

It is important to place these costs in a production context. Currently, approximately one-fifth of U.S. crude oil production originates from extremely price sensitive marginal wells that produce less than 15 barrels per day.[28] An additional 22 percent of production originates from higher flowing, but also expensive, projects in the deep and ultra deepwater federal Gulf of Mexico.[29] Tight oil production currently accounts for approximately 11 percent of U.S. supplies.[30] In other words, more than half of U.S. crude supplies are identifiable as high marginal cost resources that require oil prices of at least $50/bbl just to break even. Clearly, a high level of confidence in supportive oil prices is needed to develop U.S. resources, and that is exactly what the market has provided since at least 2003.

Technology: On its own, a strong price signal would not necessarily have translated directly into meaningful increases in U.S. oil production. Higher prices needed to be complemented by an increase in producible resources—either through new discoveries, new recovery methods, or better drilling technology. In fact, a combination of all of these things came together beginning in the mid-2000s, most impressively in the onshore region of the lower-48 United States.

The story begins not with oil, but with the massive increase in development of unconventional natural gas. For decades, industry geologists were aware of the existence of natural gas resources deep in underground shale formations.[31] However, the resource was viewed as technologically difficult to access and economically unattractive. In essence, shale and other tight reservoirs are defined by reduced porosity vis-à-vis conventional reservoirs.[32] This reduced porosity made it difficult to collect commercial quantities of natural gas without expending tremendous capital.

Throughout the 1990s, the public and private sectors each invested significantly in research and development efforts designed to improve existing drilling technologies in order to profitably unlock shale gas.[33] A 1999 report from the Office of Fossil Energy noted that the DOE-led Natural Gas and Oil Technology Partnership promoted a number of advances in hydraulic fracturing.[34] The report also cites advances made by the DOE-funded Gas Research Institute during the 1990s, including better diagnostics and greater ultimate recovery. Beginning in 2003, surging natural gas prices added a final incentive for the industry to focus on achieving commercial production of natural gas from unconventional reservoirs. After averaging $3.96 per million Btu (MMBtu) in 2001 and $3.36/MMBtu in 2002, prices rose to average $5.47 and $5.89/MMBtu in 2003 and 2004 respectively.[35] Between 2005 and 2007, the annual spot price for natural gas in the United States never fell below $6.73/MMBtu.

26 IEA, *World Energy Outlook 2011,* at 128

27 DOE, EIA, *Financial Performance of Major Energy Producers 2009,* Table 11

28 DOE, EIA, "Distribution of Wells by Production Rate Bracket," at http://www.eia.gov/pub/oil_gas/petrosystem/petrosysog.html

29 DOE, EIA, *AEO 2012,* Table 132

30 SAFE Analysis based on data from: IEA, *Monthly Oil Market Report,* December 2011, at 25

31 DOE, Office of Fossil Energy and National Energy Technology Laboratory, *Modern Shale Gas Development in the United States: A Primer,* at 13 (April 2009)

32 Id. at 14

33 See, e.g., Massachusetts Institute of Technology, *The Future of Natural Gas,* at 73-75 (2010) and Jesse Bogan, "The Father of Shale Gas: Interview with George Mitchell," Forbes, July 16, 2009

34 DOE, "Environmental Benefits of Advanced Oil and Gas Exploration and Production Technology," Drilling and Completion Technology Fact Sheet, at 7 and 8, (1999)

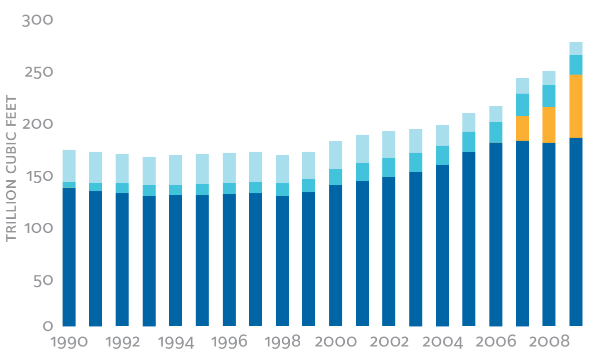
35 DOE, EIA, online statistics, "Natural Gas Spot and Futures Prices (NYMEX)," at http://www.eia.gov/dnav/ng/ng_pri_fut_s1_d.htm

By 2008, rising prices and better application of drilling technology resulted in a virtual revolution in the natural gas industry. Proved reserves increased by 54 percent between 2000 and 2009—from 177 trillion cubic feet (tcf) to 273 tcf.[36] Moreover, proved reserves present only part of the picture. The Colorado School of Mines Potential Gas Committee estimates that potential U.S. gas resources could be closer to 2,000 tcf, resulting in a theoretical reserves-to-production ratio of nearly 100 years at today's consumption levels.[37]

The recovery technology that the industry used to unlock shale resources is known as hydraulic fracturing. Although fracturing existed in the industry for decades, its combination with new drilling techniques and other process improvements proved revolutionary. In order to extract natural gas from deep shale reservoirs, hydraulic fracturing over-pressurizes the source rock, creating multiple fractures in which gas supplies can accumulate. The fracturing process is typically achieved using fluids (like water under high pressure) along with viscosity-enhancing chemical agents (surfactants). In addition, producers typically inject a proppant, or propping agent, into the well to keep the fractures from closing when pressure is reduced.[38] Instead of using traditional vertical wells, hydraulic fracturing and recovery take place via horizontal wells, which increase exposure of the well bore to the gas-producing zone.

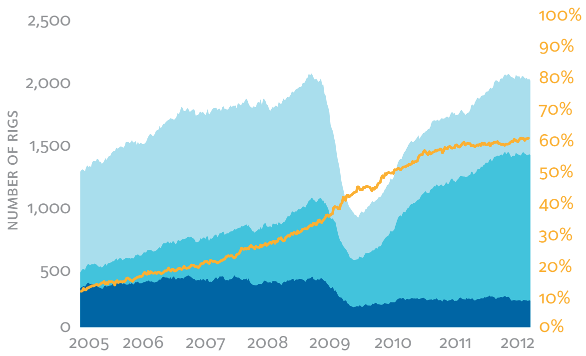
The growing attractiveness of horizontal drilling is reflected in the U.S. well count beginning in 2005, when the number of horizontal and directional wells drilled began expanding slowly. In the first week of January 2005, 127 horizontal wells were drilled. For the same period in 2006, the number was more than 320. By 2008, high and rising natural gas prices drove an influx of investment in natural gas production, and the horizontal well count surged. In the week ending December 5, 2008, 625 horizontal wells were drilled in the United States.[39]

U.S. PROVED RESERVES, NATURAL GAS



Source: DOE, EIA

NORTH AMERICAN RIG COUNT BY TYPE



Source: Baker Hughes

Opportunity: Beginning in 2009, a number of factors combined to suppress natural gas prices for an extended period. Initially, natural gas prices were most significantly impacted by reduced demand during the recession. Between 2007 and 2009, annual U.S. natural gas demand fell by 0.8 percent.[40]

36 DOE, EIA, *AER 2010*, Table 4.2
37 Potential Gas Committee, "Potential Supply of Natural Gas in the United States," December 31, 2010
38 DOE, *Modern Shale Gas Development*, at 56
39 Baker Hughes, "North American Rotary Rig Count," at http://investor.shareholder.com/bhi/rig_counts/rc_index.cfm
40 DOE, EIA, *AER 2010*, Table 6.5

Industrial demand fell particularly sharply, declining by 7.3 percent, or 488 billion cubic feet.[41] The decline in demand sent prices sharply downward, from an annual average of $8.86/MMBtu in 2008 to just $3.94/MMBtu in 2009.[42]

However, even as the U.S. economy recovered and natural gas demand returned to pre-crisis levels, prices did not return to the very high levels witnessed between 2005 and 2008. Total U.S. natural gas demand in 2010 exceeded pre-recession levels by 2.9 percent, and year-over-year demand increased by an additional 2.5 percent in 2011.[43] Yet natural gas prices averaged just $4.37/MMBtu in 2010 and fell to $4.00/MMBtu in 2011.[44] The trend has only intensified during the first half of 2012, with prices testing 10-year lows below $2.00/MMBtu.[45]

The recent drop can be partially explained by demand-side factors, including an unusually warm 2011-2012 winter season, which suppressed consumption of natural gas for space heating. More fundamentally, however, the natural gas industry in the United States has been a victim of its own success, essentially supplying more gas than the U.S. market can currently consume. A number of end-use sectors are evolving to incorporate low-cost natural gas as a fuel, but the speed of the transition has been limited in all cases by a combination of issues, including infrastructure, capital, and competition.

For many traditional commodities, these dynamics—excess domestic supply of a low-cost resource that is in high demand globally—would naturally lead to exportation. However, the physical properties of natural gas historically made it difficult to ship overseas and, therefore, prevented the development of a global market. In recent decades, technology to liquefy and store gas as liquefied natural gas (LNG) has emerged, and LNG plays a significant role in the energy economies of a number of countries, particularly in East Asia. Currently, the United States has extremely limited LNG export capacity—a single facility in Alaska. As a testament to the transformative nature of the shale gas revolution, however, the Department of Energy has received at least 10 applications to construct LNG export terminals, including a number of LNG import facilities (gasification terminals) seeking approval to convert to export facilities (liquefaction plants).[46]

Over the long term, increased domestic demand for natural gas in the electric power, industrial, and transportation sectors could create a structural price adjustment. Approval of several LNG terminals may also ultimately serve as an outlet to allow U.S. gas supplies to serve markets in Europe and Asia. However, domestic prices are likely to remain under downward pressure in the interim, the immediate consequence of which has been a notable reduction in spending on dry natural gas drilling.[47]

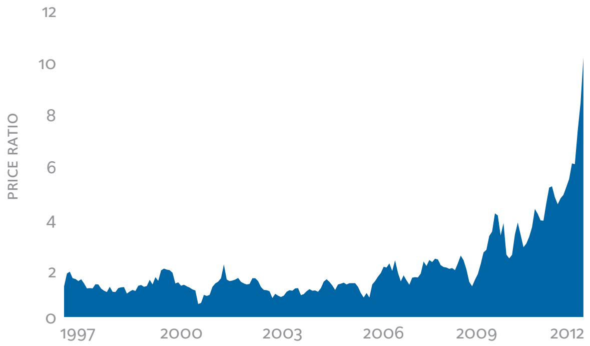
U.S. natural gas dynamics since 2009 stand in marked contrast to dynamics in the petroleum industry, where prices are directly determined by the net effect of changes in supply and demand in every country around the world. The global nature of the oil industry facilitated a rapid recovery in oil prices after the 2008-2009 financial crisis. Even during 2009, much of which was characterized by high unemployment and weak economic growth in the United States, oil prices bounced back to average between $60 and $80/bbl throughout much of the year.[48] A fast return to high rates of demand growth in emerging markets and other global market fundamentals trumped a slow recovery in the developed world in terms of oil price impact.

41 DOE, EIA, *AER 2010,* Table 6.5
42 DOE, EIA, online statistics, "Natural Gas Spot and Futures Prices (NYMEX)," at http://www.eia.gov/dnav/ng/ng_pri_fut_s1_d.htm
43 DOE, EIA, online statistics, "Natural Gas Consumption by End Use," at http://www.eia.gov/dnav/ng/ng_cons_sum_dcu_nus_m.htm
44 DOE, EIA, online statistics, "Natural Gas Spot and Futures Prices (NYMEX)," at http://www.eia.gov/dnav/ng/ng_pri_fut_s1_d.htm
45 Id.
46 DOE, Office of Fossil Energy, "Applications Received by DOE/FE to Export Domestically Produced LNG from the Lower-48 States," February 28, 2012, at http://fossil.energy.gov/programs/gasregulation/LNG__Summary_Table_03_15_12.pdf
47 See, e.g., Marilyn Radler, Oil, Liquids-rich shales dominate capital spending budgets for 2012," Oil and Gas Journal, March 5, 2012
48 DOE, EIA, Petroleum Statistics online, "Spot Prices," at http://www.eia.gov/dnav/pet/pet_pri_spt_s1_d.htm

By the end of 2009, companies that had been active in unconventional gas production began to shift capital and drilling programs toward liquids production. Compared to persistently low natural gas prices, high and rising oil prices provided an attractive target. In a phenomenon largely unique to the United States, the ratio of oil prices to gas prices began to expand dramatically. Between 2005 and 2007, a barrel of oil was on average worth about 1.5 times an equivalent amount of natural gas. By the fourth quarter of 2009, the oil-to-gas price ratio in the United States had expanded to 3.1.[49] It would average 3.2 in 2010 and 4.9 in 2011. In March 2012, a barrel of oil was worth an astounding 10 times the equivalent volume of natural gas.

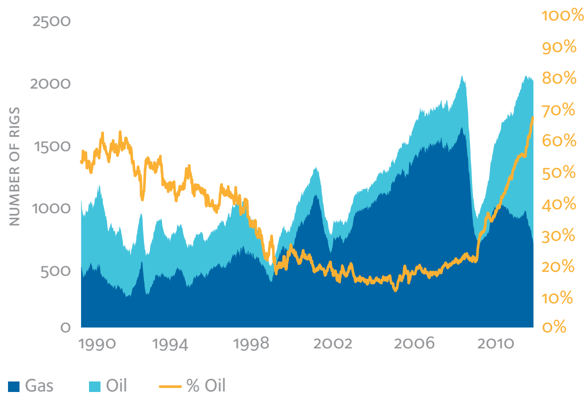
Fortunately, some of the most significant unconventional gas plays were known to contain sizeable liquid-bearing formations, and a number of other unconventional resource plays throughout the United States were known to be primarily liquids-rich. The investments in drilling technology and equipment that had been so central to the expansion in shale gas production—namely horizontal drilling and multi-stage hydraulic fracturing—were directly applicable to producing liquids from numerous unconventional oil formations. To take advantage of attractive oil economics, companies began rapidly shifting readily-available capital and labor assets out of gas and into liquids.

OIL TO GAS PRICE RATIO (BTU EQUIVALENT)



Source: DOE, EIA

U.S. RIG COUNT: OIL AND GAS SPLIT



Source: Baker Hughes

This trend is also clearly reflected in the U.S. rig count. During the height of the shale gas boom between 2005 and 2008, the U.S. oil rig count had fallen below 500, and oil rigs accounted for less than 15 percent of the total U.S. rig count. An expanding spread between oil and natural gas prices led to a surge in oil drilling that rapidly changed this dynamic. In April 2011, the number of rigs drilling for oil in the United States surpassed the number drilling for gas for the first time since 1995, and the oil rig count has only continued to grow.[50] By early 2012, there were more rigs drilling for oil in the United States—approximately 1,296— than at any time since Baker Hughes began reporting the count in 1987.[51]

II. CURRENT TRENDS AND OUTLOOK

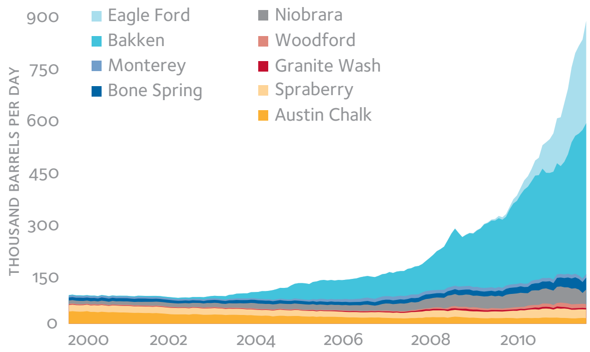
Oil prices, technology, and opportunity have combined to create a modern boom in oil drilling in the United States. The result has been the most significant expansion in onshore crude oil production in two decades. Mature oil-producing regions like the Permian basin in Texas have been an important part of the

49 SAFE analysis based on data from: DOE, EIA, online statistics, "Natural Gas Spot and Future Prices (NYMEX)" and "Oil Spot Prices"
50 Baker Hughes, "North American Rotary Rig Count—U.S. Oil and Gas Split"
51 Id.

picture, but large quantities of light sweet crude oil held in unconventional deposits in North Dakota, Colorado, and elsewhere are being developed using the same techniques. As a whole, the lower-48 onshore United States appears to be positioned for a sustained period of growth based largely on development of these resources, collectively referred to as light, tight oil (LTO). The return to normal operations in the federal Gulf of Mexico will supplement this growth over the next decade, with important implications for U.S. imports and exports, particularly of refined petroleum products.

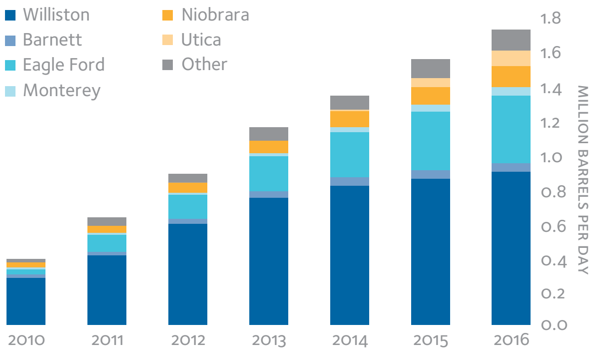
Evaluating Onshore Growth: Some recent estimates place liquids output from the Bakken shale in North Dakota as high as 1.0 mbd by 2020.[52] Output from the Eagle Ford in Texas, which surged to 300,000 b/d at year-end 2011 from just 30,000 b/d in 2010, is on a similar trajectory.[53] Proved oil reserves in both Texas and North Dakota experienced notable increases between 2008 and 2009, largely as a result of LTO resources. In North Dakota, oil reserves increased by 481 million barrels to 1.1 billion barrels.[54] Oil reserves in Texas increased by 529 million barrels, reaching a total of 5.5 billion barrels.[55]

MONTHLY PRODUCTION FROM SELECTED TIGHT OIL PLAYS



Source: U.S. Energy Information Administration; 2011 is through November

PROJECTED U.S. PRODUCTION OF TIGHT OIL



Source: IEA, December 2011 Monthly Oil Market Report

In a 2011 report, the Department of Energy estimated U.S. technically recoverable shale oil resources for year-end 2009 to be 24 billion barrels across just four basins—the Eagle Ford in Texas, Bakken in North Dakota, Monterey in California, and Avalon and Bone Springs in Texas and New Mexico.[56] By comparison, total U.S. proved reserves of oil were 30.9 billion barrels at year-end 2010.[57] In fact, the DOE estimates are arguably conservative, as they do not include numerous basins that have been added to the list of potential oil resource plays since 2009, such as the Utica shale in Ohio and the Niobrara shale in Colorado. Further, the range of onshore unconventional LTO resources that can be developed using horizontal drilling and multi-stage hydraulic fracturing extends beyond shales to include tight sands, low-permeability carbonates, chalks, and more. A forthcoming study from IHS CERA will review more than 10 mature and 15 emerging LTO plays in the United States and Canada.[58]

As development of unconventional oil resources has increased, producers are also gaining insights into field characteristics, best practices, and efficient application of technology, leading many to believe recoverable

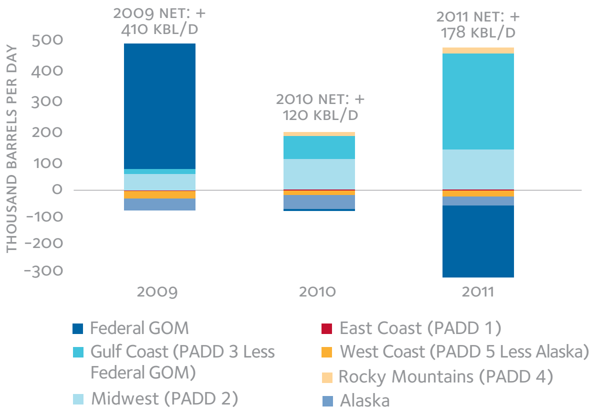
52 Clifford Kraus, "Shale Boom in Texas could increase U.S. Oil Output," New York Times, May 27, 2011
53 DOE, EIA, This Week in Petroleum, "EIA tracks U.S. tight oil production as volumes soar," March 14, 2012
54 DOE, EIA, "Summary: U.S. Crude Oil, Natural Gas, and Natural Gas Liquids Proved Reserves," Table 6
55 Id.
56 DOE, EIA, *Review of Emerging Resources: U.S. Shale Gas and Shale Oil Plays*, at x
57 BP, plc., *Statistical Review 2011*, at 6
58 SAFE discussions at IHS CERAWeek 2012

resources may be greater than expected. For example, while DOE estimates Bakken recoverable oil resources to be 3.6 billion barrels, Continental Resources—the largest and most experienced holder of acreage in the play—believes the Bakken alone will ultimately yield more than 20 billion barrels of oil.[59] The United States Geological Survey is in the process of completing a revised estimate for the Bakken.

Companies with experience in unconventional gas development are clearly positioning themselves for long-term exposure to oil. In 2011 and 2012, as the oil-to-gas price ratio has continued to increasingly favor oil due to a range of structural factors, a number of companies previously active in gas drilling are shifting short- and medium-term capital investment programs to focus largely on liquids. For example, Devon Energy, the fourth largest U.S. gas producer, reportedly spent more than 90 percent of its 2011 exploration and development capital budget (a total of $6.1 billion) on oil and liquids-rich projects.[60] Similarly, Chesapeake Energy, the second largest producer of natural gas in the United States, will direct 85 percent of its drilling capital expenditures toward liquids in 2012, up from just 10 percent in 2009.[61] More generally, field services group Baker Hughes estimates that industry-wide capital spending in U.S. onshore LTO plays rose by a factor of five between 2008 and 2011, from $5 billion to $25 billion.[62]

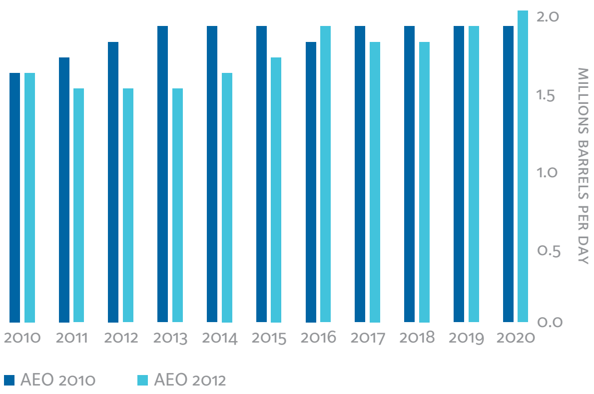
Federal Gulf of Mexico: It is important to note that the offshore federal Gulf of Mexico is expected to play in important role in supplementing onshore growth in the lower-48. In fact, initial U.S. production gains in 2009 were largely the result of surging output from the Gulf. In 2009, rising GOM output accounted for 86 percent of the 410 kbl/d total increase in U.S. crude output.[63] In April 2010, the *Deepwater Horizon* incident led to a moratorium on exploration and development drilling in the Gulf, which negatively affected output in that year and 2011 as well. However, the return to normal operations in the Gulf has opened the door for future growth, and current DOE forecasts suggest the Gulf will achieve pre-incident levels of crude production by 2014.[64] Going forward, output from the Gulf is expected to once again be a key pillar in overall U.S. production growth.

CHANGE IN CRUDE PRODUCTION BY REGION (2009–2011)



Source: DOE, EIA

GULF OF MEXICO CRUDE PRODUCTION



Source: DOE, EIA

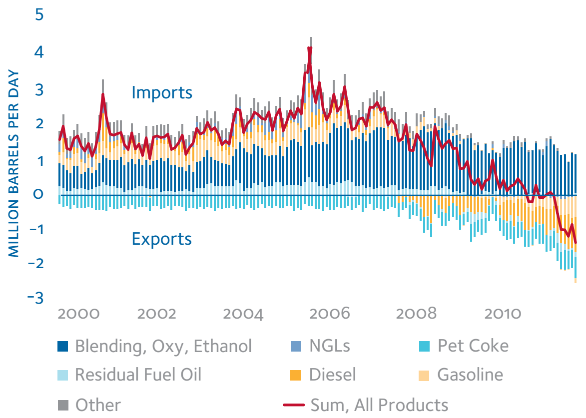
59 Christopher Helman, "Tycoon says North Dakota oilfield will yield 24 billion barrels of oil, among world's biggest," Forbes Magazine, June 27, 2011
60 Devon presentation to Credit Suisse Energy Summit, February 8, 2012
61 Chesapeake investor relations presentation, March 2012
62 Derek Mathieson, "North America Gas: The Technology Transformation," Baker Hughes, Presentation at IHS CERAWeek 2012
63 DOE, EIA, Petroleum Statistics online, "Crude Oil Production"
64 DOE, EIA, *AEO 2012*, Table 132

Oil Trade: In 2011, the United States was a net exporter of refined petroleum products for the first time since 1949.[65] While a number of factors played a role in this shift, increased crude oil production has been a key driver. Notably, the surge in crude oil production has been particularly concentrated in the U.S. mid-continent, extending from North Dakota down to Texas and the Gulf of Mexico—Petroleum Administration for Defense Districts (PADD) 2 and 3. Rising production of Canadian crude from the Alberta oil sands has contributed additional volumes to the midcontinent, with 1.1 mbd entering the U.S. in 2010 through a network of pipelines that largely extend into the Midwest (PADD 2), with limited volumes to the Gulf Coast (PADD 3). The proposed Keystone XL pipeline would add 700,000 b/d of capacity from Alberta to PADD 3 refineries on the Texas Gulf Coast.

Domestic demand factors have also played a role. At the same time the mid-continent was experiencing a glut of new supplies, U.S. gasoline demand was struggling to return to pre-recession levels. A slow economic recovery and increasingly-efficient vehicle fleet have each played a role. After averaging 9.3 mbd in 2007, finished motor gasoline demand averaged 8.9 mbd in 2009.[66] While demand held steady in 2010, it declined again to 8.7 mbd in 2011. Through the first several months of 2012, the picture is increasingly bearish, with gasoline demand in the U.S. averaging just 8.4 mbd.[67]

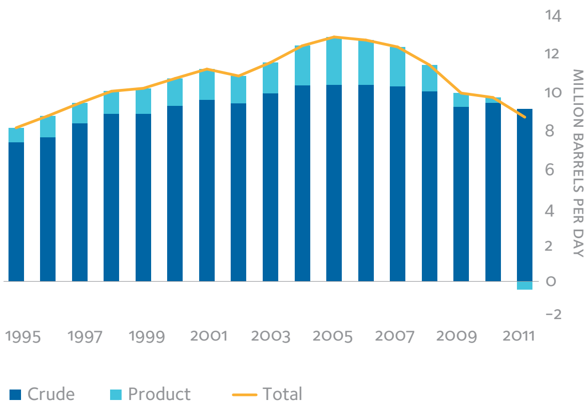
The decline in domestic demand for gasoline has had two important effects on trade. First, it has reduced the need for imported gasoline in many regions of the United States. Gross imports of finished gasoline were down to just 105,000 b/d in 2011, from prerecession levels above 400,000 b/d.[68] In addition to freeing up some gasoline supplies for export, this shift gave U.S. refiners the flexibility to increase yields of middle distillates, such as diesel fuel, which are highly valued in Latin America, Europe and Asia. The net effect of these trends—increased domestic crude and reduced domestic fuel demand—has been a rising level of both gasoline and diesel exports from the United States. In 2011, the U.S. was a net exporter of both products: 374,000 b/d of finished gasoline and 677,000 b/d of diesel.[69]

U.S. NET PETROLEUM PRODUCT TRADE



Source: DOE, EIA

U.S. NET IMPORTS OF CRUDE AND PRODUCTS



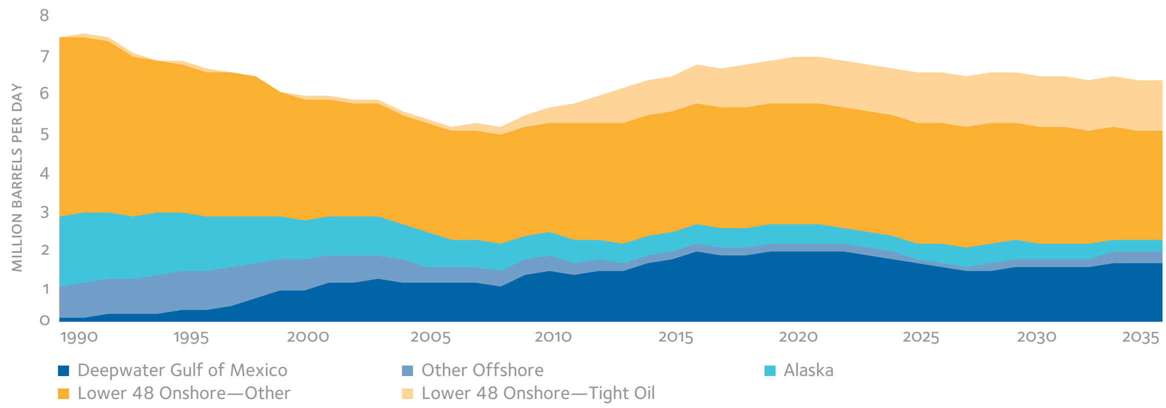
Source: DOE, EIA

65 DOE, EIA, "Petroleum Supply Monthly," February 2012, Table 4
66 DOE, EIA, *AER 2010,* Table 5.11
67 DOE, EIA, Weekly Petroleum Status Report, April 18, 2012, Table 1
68 DOE, EIA, "Petroleum Supply Monthly," February 2012, Table 4
69 Id.

As impressive as this turnaround may be, it is important to maintain an overall perspective. Despite a positive story in refined products, the United States is still the world's largest net importer of crude oil, outpacing China by some 3.5 mbd in 2011.[70] U.S. crude imports totaled 8.9 mbd last year, down substantially from their record high of 10.1 mbd reached in 2004, 2005, and 2006.[71] Still, the current figure represents a large import burden considering that total crude fed into U.S. refineries in 2011 was 15.3 mbd.[72] In other words, the United States continues to import roughly 60 percent of its crude supplies. Imports from Canada accounted for 24 percent of the total last year, but OPEC still provided 47 percent.[73]

Long Term Outlook: The long-term outlook for U.S. domestic liquids production appears to be extremely favorable. Current DOE projections reflect rising output from both onshore tight oil resources in the lower-48 as well as surging deepwater Gulf of Mexico output post-*Deepwater Horizon*. In its *Annual Energy Outlook 2012*, DOE estimates that onshore tight oil production will triple between 2010 and 2020, from 0.4 mbd to 1.2 mbd, and then plateau through 2030 at 1.3 mbd.[74] Deepwater Gulf crude output reaches 1.8 mbd in 2020, up from 1.3 mbd today, before falling back to 1.4 mbd in 2030.

U.S. CRUDE PRODUCTION (HISTORICAL AND FORECAST)



Source: DOE, EIA, *AEO 2012*

Numerous data points support the DOE assessment and other similar estimates. As discussed above, a range of geological, economic, and technological factors have combined to create what appears to be a broad base of sustainable growth for at least a decade and possibly more. If nothing else, the fundamental case for buoyant oil prices in the coming years is extremely strong based on projected demand growth in China, India, the Middle East, and other emerging markets. This price support should continue to incentivize aggressive exploration and development programs in the United States.

However, there are also reasons to be cautious. In the case of tight oil, the industry is in the very early stages of developing the resource, and there is not yet a good deal of data on most North American tight oil plays. This uncertainty creates a window of possible outcomes that includes considerable upside potential, but also some significant downside risk. In particular, the issue of decline rates and their impact on requisite investment levels is important to consider.

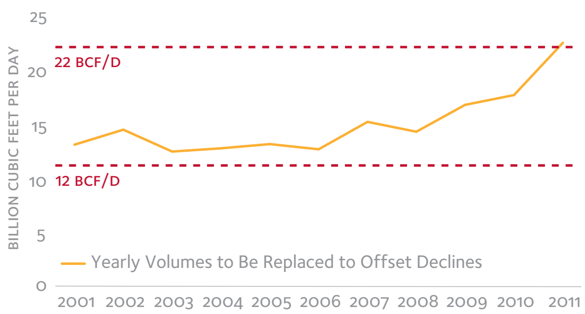
70 SAFE analysis based on data from: DOE EIA, online statistics, "Petroleum Imports by Area of Entry," and IEA, *MOMR*, February 2012
71 DOE, EIA, "Petroleum Supply Monthly," February 2012, Table 4
72 DOE EIA, online statistics, "Refinery Utilization and Capacity," at http://www.eia.gov/dnav/pet/pet_pnp_unc_dcu_nus_m.htm
73 DOE, EIA, online statistics, "U.S. Net Imports by Country," at http://www.eia.gov/dnav/pet/pet_move_neti_a_EP00_IMN_mbblpd_m.htm
74 DOE, EIA, "Tight oil, Gulf of Mexico deepwater drive projected increases in U.S. crude oil production," February 8, 2012

This issue has been discussed in great detail with regard to North American shale gas. According to published company reports, the first-year decline rate for a typical natural gas well in the Haynesville shale is 81 percent; the second-year rate is 34 percent and the third-year rate is 22 percent.[75] These rapid decline rates mean that steady production requires ongoing capital investment in stimulating existing wells and—more importantly—drilling new wells.

Recent trends illustrate the importance of decline rates in overall investment. In 2001, prior to the advent of significant shale gas production in the United States, the U.S. industry's aggregate decline rate was approximately 23 percent annually.[76] For 2001 dry gas production of 19.6 trillion cubic feet, this meant that the industry needed to replace 4.5 tcf year-over-year in lost production.[77] Beginning in 2006, significant shale gas volumes began to enter the U.S. production picture. By 2010, shale gas accounted for 20 percent of U.S. dry natural gas production of 21.6 tcf, driving the U.S. decline rate up to more than 32 percent.[78] At today's natural gas production level of approximately 23 tcf annually, this means the U.S industry now has to replace more than 7.5 tcf of lost gas production year-over-year.

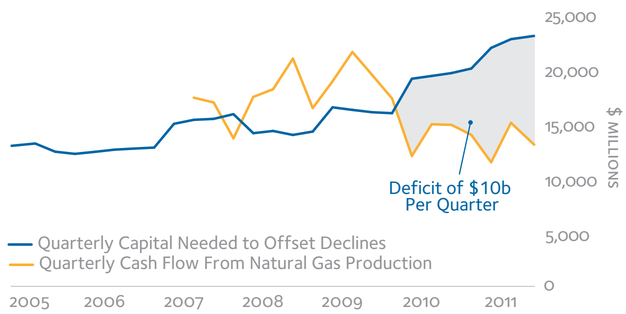
In many ways, the challenge posed by this dynamic is financial as opposed to geological. Based on publicly available data, the upfront capital required to find and develop natural gas using hydraulic fracturing and horizontal drilling is three to four times higher than that needed for traditional gas supplies.[79] In other words, just as the quantity of incremental gas the U.S. industry needs to find and produce to offset annual declines is increasing substantially (by a factor of nearly 2x between the mid-2000s and 2011), capital cost is increasing even faster. According to one recent analysis, the U.S. natural gas industry currently requires roughly $22 billion in quarterly investment just to maintain production levels.[80] In an environment of low natural gas prices, this "investment treadmill" is getting harder and harder to sustain, resulting in a capital investment deficit of as much as $10 billion in the fourth quarter of 2011. Clearly, the U.S. natural gas industry is headed for an adjustment in price, supply, or a combination of both.

TOTAL U.S. NATURAL GAS PRODUCTION (YEARLY VOLUMES TO BE REPLACED TO OFFSET DECLINES)



Source: HPDI, ARC Financial Research

TOTAL U.S. NATURAL GAS PRODUCTION (MAINTENANCE CAPITAL AND CASH FLOW GENERATION)



Source: HPDI, Company Reports, ARC Financial Research

The issue of decline rates and the investment level needed to sustain production will likely be relevant for tight oil. At a fundamental level, the geology and recovery methods are analogous: low permeability

75 See e.g. Chesapeake Energy, 2008 Investor and Analyst Meeting, presentation entitled, "Haynesville Shale Overview," slide 19
76 ARC Financial, "Running Hard on the Natural Gas Treadmill," December 12, 2011
77 Id.
78 Id.
79 ARC Financial, "Running Hard on the Natural Gas Treadmill," December 12, 2011
80 Id.

reservoirs are being over-pressurized through hydraulic fracturing to recover commercial quantities of hydrocarbons. However, the initial production rates vary by resource type and geology, and there is likely to be a wide range of results for tight oil. Averaged over the first month, typical Bakken wells produce between 300 and 1,000 b/d. But within five years, the vast majority of wells are producing less than 100 b/d.[81] In this context, a continuous drilling program is required to maintain steady levels of production.

Similar to unconventional gas, tight oil resources also carry higher drilling costs than traditional wells. Typical U.S. onshore drilling and completion costs were roughly $400,000 per well at the end of the 1990s.[82] By 2003, the average U.S. oil well cost slightly more than $1 million to drill and complete.[83] In comparison, according to recent reports, operators in the Eagle Ford shale in Texas spent between $5.5 and $9.5 million per well in 2011.[84] Costs in North Dakota's Bakken shale average between $7.5 and $10 million per well.

Attracting the necessary investment to maintain resource flows from tight oil plays should be considerably easier in an environment where oil prices exceed $100/bbl. For the foreseeable future, the oil industry is unlikely to face the challenges being confronted by natural gas producers in an environment of sub-$3 natural gas. Still, for an industry that is used to dealing with post-peak oilfield decline rates that typically average between four and nine percent annually, light, tight oil produced at scale will present some new challenges, not the least of which may be increasing pressure on upstream capital and operating costs as drilling continues to expand.[85]

No doubt, additional challenges exist. Prospective LTO plays could ultimately prove to be less prolific than the Bakken and Eagle Ford shales, and resource estimates could fail to meet today's expectations. A host of regulatory issues have yet to be resolved as well. In particular, federal policy on hydraulic fracturing is still largely uncertain, with current responsibility resting almost entirely with the states (though the Obama administration has recently signaled its intention to regulate the practice on federal lands).[86] Still, viewed as a whole, the risks to the bullish U.S. oil outlook—geological, financial, and regulatory—seem manageable.

III. CONCLUSION

For the first time in several decades, the United States is poised to benefit from expansive growth in the domestic production of liquid fuels. The resulting economic benefits, including an improved trade deficit and increased domestic capital investment, will no doubt be supplemented by important employment gains and fiscal benefits at both the state and federal level. The question that remains to be answered is the precise impact that rising self-sufficiency in oil supplies will have on U.S. energy security.

Numerous analysts and pundits have focused on the effect that domestic supply growth will have on import levels, using the positive outlook to suggest that the new American oil boom will be transformative for energy security. They suggest the nation is on the cusp of an era of energy independence through self-sufficiency in supply—an era characterized by greater economic stability and national security as the result of reduced reliance on Middle East oil suppliers. The nature and meaning of energy independence, however, is widely misunderstood. Although increased domestic production will have real positive effects on the U.S. economy, even attaining self-sufficiency will not make the United States energy secure. For policymakers seeking to develop sound energy policy, greater clarity regarding the relationship of increased domestic liquids production and improved energy security is required.

81 IEA, *WEO 2011*, at 128

82 DOE, Office of Fossil Energy, *Environmental Benefits of Advanced Oil and Gas Exploration and Production Technology: Drilling and Completion*, (1998), at 34

83 DOE, EIA, *AER 2010*, Table 4.8

84 Trey Cowan, "Costs for Drilling the Eagle Ford," Rigzone, June 20, 2011

85 For an analysis of typical oilfield decline rates, see: IEA, *WEO 2008*, Chapter 10

86 Ben Geman, "White House begins gas 'fracking' rule review," The Hill, February 16, 2012

Defining Energy Security

For decades, long-term energy security has routinely been defined in American political discourse as the attainment of self-sufficiency in energy supply, or energy independence. That is, energy security is often equated with the ability to become *independent* from foreign oil suppliers. Pursuit of this so-called independence has typically been most intense during periods of high and volatile oil prices, particularly when such periods have overlapped with high levels of U.S. imports. Unfortunately, the concept of energy security through self-sufficiency in supply alone ignores America's true vulnerability as an oil consumer, driving policymakers toward a goal that is fundamentally misguided.

In order to craft an enduring strategy to achieve real and lasting energy security, it is important to understand the nature of the problem. The goal of self-sufficiency in energy supplies misdiagnoses the problem as one characterized largely by import levels. In fact, energy security is almost entirely a function of the importance of oil consumption in the domestic economy—oil dependence—and is not related to the original source of that oil. A nation cannot achieve energy security so long as it is economically beholden to oil, which is priced in a global market.

This is decidedly not a new problem. The goal of self-sufficiency has a long history in U.S. politics dating back to at least the early 1970s. Yet, from a policy perspective, the dangers of the energy independence mirage have perhaps never been as concerning as they are today. The new American oil boom is steadily chipping away at U.S. import levels, and the outlook suggests continued declines in import levels through the end of the decade. Policymakers from both parties, along with a host of market and political analysts, are again suggesting that achieving self-sufficiency in oil supplies will guarantee enduring American energy security and, therefore, should play a major role in determining U.S. energy policy. This is a fatally flawed approach. Avoiding the temptation to prioritize independence as a matter of policy in an era of rising oil production will be a difficult—but necessary—political challenge.

I. THE MYTH OF ENERGY INDEPENDENCE

The economic significance of secure energy supplies first became tangible for most Americans in the final months of 1973. Oil prices had been under some inflationary price pressure for several years in the wake of the 1971 collapse of the Bretton Woods monetary system, but had yet to post any meaningful increases. In real terms, the U.S. average crude import price was $17.36/bbl in 1970 and $17.52/bbl in 1972.[87] However, in response to American and European commitments to Israel during the Yom Kippur War, the Arab members of OPEC implemented a limited export embargo effective October 17, 1973. Over the next several months, as OPEC members continued to tighten the embargo, global oil prices rose sharply. After averaging $20.90/bbl in 1973, imported U.S. crude prices averaged $57.77/bbl in 1974, an increase of 176 percent.[88]

At the time of the crisis, the U.S. economy was particularly vulnerable to an oil price spike. The industrial and manufacturing sectors were larger components of the real economy. Vehicles were highly inefficient from a fuel consumption standpoint, and petroleum-fueled power plants generated 18 percent of U.S. electricity, as opposed to approximately one percent today.[89] Taken as a whole, the U.S. economy was

87 DOE, EIA, *Short-Term Energy Outlook*, "Real Prices Viewer," at http://www.eia.gov/forecasts/steo/realprices/
88 Id.
89 DOE, EIA, *AER 2010*, Table 8.2a

extremely 'oil intense.' That is, the amount of oil consumed for every dollar of economic output was relatively high—about 1.3 barrels per $1,000 of GDP compared to 0.5 barrels in 2011.[90] As a result, the consequences of the oil shock were severe. The U.S. economy contracted in three out of four quarters in 1974 and the unemployment rate hit nine percent in mid-1975.[91]

It is critical to note that, at the precise moment the 1973-1974 crisis was unfolding, the United States was experiencing rising levels of net oil imports for the first time in its history. In fact, net imports had grown to meet 34.8 percent of demand in 1973, up from just 19.8 percent in 1965.[92] In volume terms, net U.S. oil imports totaled six million barrels per day in 1973, supplying more than one-third of the nation's 16.5 mbd of oil demand. Imports from OPEC countries accounted for slightly less than half of total imports.[93] In today's dollars, net U.S. oil imports were valued at $13 billion in 1970. In 1974, as a result of higher import volumes and the price spike, the cost of importing oil surged to $117.1 billion.[94]

The experience of 1973-1974 helped to define the issue of energy security for many Americans as an issue of imports, particularly from the Middle East. Indeed, the political rhetoric of the time substantially contributed to this narrative. In November of 1973, President Nixon laid out his goal of American energy policy in a nationally televised address, stating, "In the last third of this century, [America's] independence will depend on maintaining and achieving self-sufficiency in energy."[95] In early 1974, with the nation suffering the initial economic effects of the crisis, President Nixon declared, "Let this be our national goal: At the end of this decade, in the year 1980, the United States will not be dependent on any other country for the energy we need to provide our jobs, to heat our homes, and to keep our transportation moving."[96]

Over the decades that followed, American energy security issues would become increasingly viewed through the lens of imports. Certainly, the fact that the nation was becoming a large net importer of oil played a role in elevating the issue. By the time of the second major energy crisis of the 1970s, the 1979 Iranian Revolution, the United States was importing 8 mbd of crude and product, and OPEC's share of imports had actually risen to 70 percent of the U.S. total.[97] In the peak year of the crisis—which was a direct result of the Iranian Revolution and associated loss of more than 8 percent of the world's oil supply—the U.S. import bill surged to an inflation-adjusted $198.2 billion.[98]

Here again, the political discourse served to reinforce the notion that energy security was in large part an issue stemming from imports. In a well-known April 1977 televised address, President Jimmy Carter noted that U.S. imports had doubled over the previous five years and concluded that U.S. "independence of economic and political action is becoming increasingly constrained."[99] Though Carter's initial speech devoted

90 SAFE Analysis based on data from: DOE, EIA, AER 2010, table 5.1b; and U.S. Bureau of Economic Analysis (BEA), National Economic Accounts, "Current and Real-Dollar GDP"

91 BEA, "Current and Real Dollard GDP;" and Bureau of Labor Statistics (BLS), "Labor Force Statistics from the Current Population Survey"

92 DOE, EIA, *AER 2010,* Table 5.1b

93 Id.

94 SAFE Analysis based on data from: DOE, EIA, *AER 2010,* Table 3.9; and BLS, "Consumer Price Index – All Urban Consumers," March 2012

95 President Richard M. Nixon, "Address to the Nation About National Energy Policy," November 25, 1973, available at http://www.presidency.ucsb.edu/richard_nixon.php

96 President Richard M. Nixon, "Address on the State of the Union Delivered Before a Joint Session of Congress," January 30, 1974, available at http://www.presidency.ucsb.edu/richard_nixon.php

97 DOE, EIA, *AER 2010,* Table 5.7

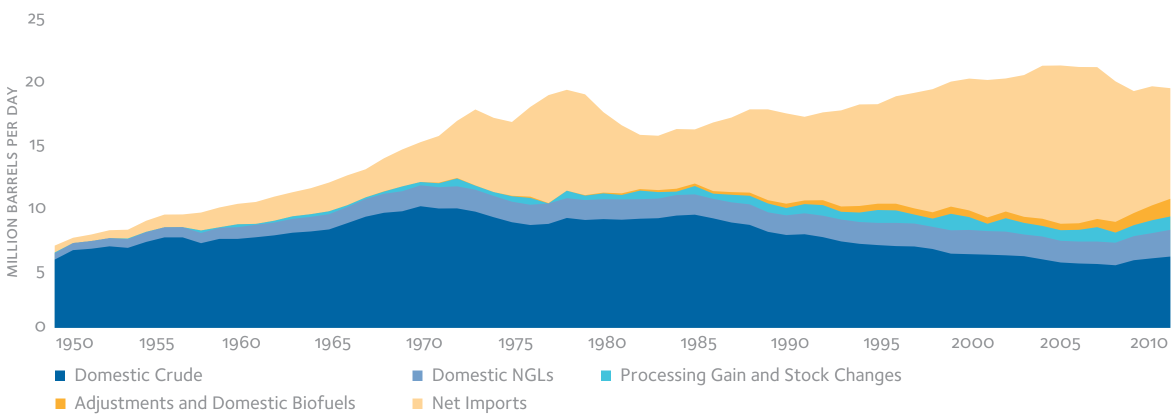
98 SAFE Analysis based on data from: DOE, EIA, *AER 2010,* Table 3.9; and BLS, "Consumer Price Index—All Urban Consumers," March 2012

99 President Jimmy Carter, "Address to the Nation on Energy," April 18, 1977, available at: http://www.presidency.ucsb.edu/jimmy_carter.php

equal time to issues of general resource scarcity, he reinforced the importance of imports in July 1979, declaring: "Beginning this moment, this nation will never use more foreign oil than we did in 1977—never."[100]

This was, of course, not to be the case over the long term. In the near term, however, import levels did decline by meaningful quantities in the aftermath of the 1979-1981 energy crisis. In fact, by 1985, the United States was importing just 4.3 mbd of crude and product, and imports accounted for only 27 percent of total consumption, a level not seen since 1972.[101] In part, the change was driven by surging production in Alaska, where output reached 1.8 mbd in 1985, up from just 191,000 b/d in 1975.[102] More central to the story, however, were a series of structural changes on the demand side that made the United States less reliant on oil in a number of sectors, particularly transportation and electricity generation.

U.S. PETROLEUM SOURCE BY ORIGIN



Source: DOE, EIA

Specifically, the federal government reacted to the events of 1973-1974 with a series of policy initiatives. Most notably, on December 22, 1975, President Gerald Ford signed the Energy Policy and Conservation Act (EPCA).[103] The legislation established a regulatory system for improving passenger automotive efficiency in the United States known as corporate average fuel economy standards (CAFE). The first CAFE standards required the miles per gallon (mpg) efficiency of new passenger automobiles sold in the United States to increase from 18 mpg in 1978 to 27.5 mpg in 1985.[104] CAFE was successful in achieving its purpose: on-road fuel efficiency of U.S. motor vehicles improved sharply beginning in the mid-1970s and continuing throughout the 1980s. In fact, between 1975 and 1990, the efficiency of all U.S. passenger cars improved by 44 percent while light-duty truck efficiency improved by 53 percent.[105]

EPCA also extended a ban on burning petroleum fuels in power plants that were capable of burning coal. This essentially began a process that would largely phase oil consumption out of the power sector—consumption for power generation had surpassed 1.5 mbd in 1973—and greatly increase the use of coal and nuclear power in the United States. The Power Plant and Industrial Fuel Use Act of 1978

100 President Jimmy Carter, "Address to the Nation on Energy and National Goals, available at July 15, 1979 http://www.presidency.ucsb.edu/jimmy_carter.php

101 DOE, EIA, *AER 2010*, Table 5.7

102 Id., Table 5.1b

103 Energy Policy and Conservation Act, P.L. 94-163, 89 Stat. 871 (EPCA) at 301, codified at 15 U.S.C. §§ 2001-12

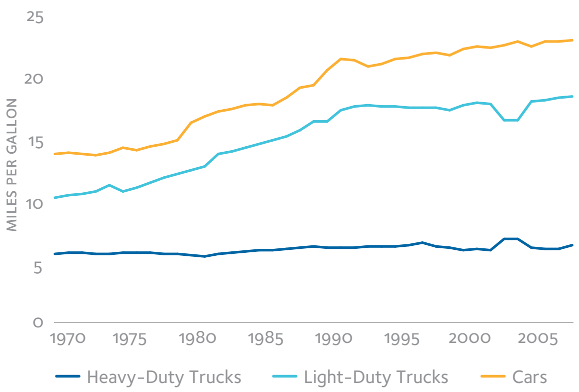
104 U.S. Department of Transportation, National Highway Traffic Safety Administration (NHTSA), "CAFE Background," available at http://www.nhtsa.gov/cars/rules/rulings/cafe/alternativefuels/background.htm

105 SAFE Analysis based on data from: DOE, EIA, *AER 2010, Table 2.8*

restricted the construction of new power plants capable of burning natural gas and petroleum fuels for electricity generation. Though it would be repealed in 1987, the Fuel Use Act precipitated a sharp decline in oil consumption for power generation—from 1.7 mbd in 1978 to 478,000 b/d in 1985.[106]

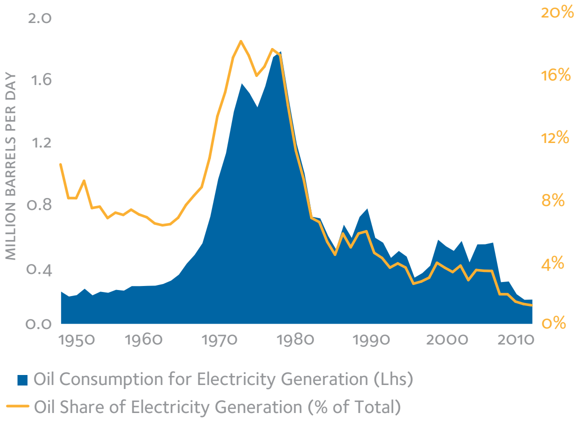
All told, the oil intensity of the U.S. economy fell by 33 percent between 1977 and 1985 due to the combined effects of fuel-economy standards and the substitution of coal and nuclear power for oil in electricity generation. As impressive as this shift was, it is arguably the case that additional gains could have been made. However, an oil price collapse in 1986 took a great deal of pressure off of policy makers, and energy security largely became a secondary issue for much of following two decades.

U.S. MOTOR VEHICLE FUEL ECONOMY



Source: DOE, EIA. Data is observed fuel efficiency for the full fleet based on miles traveled and fuel consumed.

U.S. OIL CONSUMPTION IN THE POWER SECTOR



Source: DOE, EIA

Though the U.S. confronted modest oil price spikes during the 1990-91 Gulf War and again in the late 1990s, it took the attacks of September 11, 2001, to bring energy security back to the center of the American political arena. At the time, U.S. oil imports were again soaring, reaching 10.9 mbd in 2001.[107] However, the very nature of the attacks helped to cast energy security as an issue of independence from foreign suppliers. The fact that the majority of the September 11 hijackers were Saudi nationals—and that Saudi Arabia at the time served as the second largest supplier of oil to the United States—gave rise to the narrative that U.S. expenditures on oil imports were "funding both sides of the war on terror."[108] Taking an even broader view, numerous pundits suggested that the attacks were a consequence of the decades-old U.S. military presence in the Persian Gulf, itself necessitated by American dependence on Middle East oil.[109]

In his 2003 State of the Union Address, President George W. Bush declared his commitment to "promote energy independence for our country."[110] Two years later, in 2005, in the midst of what would become one of the most significant and sustained run-ups in the history of oil prices, the United States imported

106 DOE, EIA, *AER 2010, Table 5.13d*
107 DOE, EIA, *AER 2010, Table 5.7*
108 See e.g.: Neela Banerjee, "The High, Hidden Cost of Saudi Arabian Oil," New York Times, October 21, 2002; and New York Times Editorial Board, "Ending the Oil Addiction," New York Times, February 18, 2002
109 See e.g., Shilbey Telhami, "Shrinking Our Presence in Saudi Arabia," New York Times, January 29, 2002
110 President George W. Bush, "Address Before a Joint Session of Congress on the State of the Union," January 28, 2003, available at http://www.presidency.ucsb.edu/george_w_bush.php

a record 12.6 mbd of crude oil and petroleum products.[111] It was a milestone that helped to define the direction of the U.S. energy security debate going forward. Import reduction from this historic high was widely regarded as a key metric for measuring success in energy policy.

Today, the United States can claim success in breaking away from a path of steadily rising imports, partly as a result of sharply rising domestic oil production. Yet even as the new American oil boom has fundamentally altered the picture for imports, it has not altered the energy security outlook confronting the United States. Oil dependence has never been a more pressing threat to the economy, as the United States and other oil-consuming nations have observed throughout 2011 and 2012.

II. THE NATURE OF OIL DEPENDENCE

The notion of energy independence is based on a simple idea: that the United States can regain control of its economy and its national security—at least in part—by ending its reliance on foreign oil. As discussed above, this idea has its roots in decades of American political dialogue generated during times of crisis in the global oil market. Unfortunately, this idea is fundamentally misguided and misleading. In fact, the United States has no means by which it can become independent from the global oil market or foreign countries as long as it is a large consumer of oil.

Oil prices are set in open markets and are the result of a series of individual interpretations of supply and demand, as well as expectations about the future balance of supply and demand. Myriad factors play into these assessments, including oil consumption and production levels in dozens of countries, currency values, national and international economic policies, geopolitical events, improvements in technology, and even the weather. Oil prices impact Americans as consumers, both directly and indirectly. Directly, Americans consume petroleum fuels in daily transportation activities—in passenger cars and trucks as well as in other modes, such as air travel. Indirectly, Americans are exposed to petroleum prices through their impact on the final price of shipped goods—such as food—and manufactured goods that include petro-chemicals, such as plastics, fertilizers, and pharmaceuticals.

In other words, as long as Americans are large oil consumers, they cannot be independent of oil markets or oil prices—at least not in any meaningful way. Americans are dependent on oil, not on foreign oil. There are four factors that characterize this dangerous dependence: the importance of oil in the economy, the lack of available alternatives, the fact that prices are set in a global market, and the volatility of oil prices.

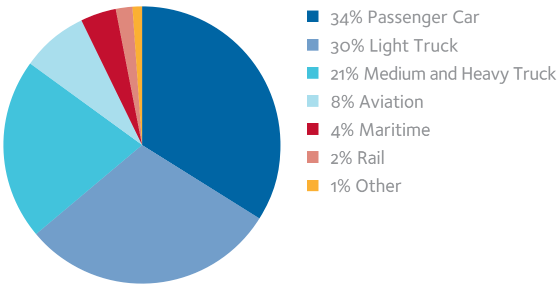
Oil plays an important role in the U.S. economy: Oil derives its strategic significance from its role in the overall U.S. economy. In 2010, petroleum fuels accounted for 37 percent of U.S. primary energy demand, more than any other single fuel.[112] While this figure represents a significant decline from 1977, when oil represented 47 percent of primary U.S. energy demand, oil is clearly still a key input to the overall economy. The volume of oil that we consume might not be important in its own right except that oil is relatively expensive. The total value of oil consumed by the United States represents a significant portion of all economic activity in the nation. Even when oil prices are low, the value of our total consumption remains large. The value of petroleum fuels consumed in the United States has ranged from $47 billion to $895 billion over the past four decades, representing between 2.6 and 8.5 percent of the GDP.[113] During the past five years specifically, spending by U.S. households and businesses on petroleum fuels has averaged $755 billion annually, or more than 5 percent of GDP.[114]

111 DOE, EIA, *AER 2010*, Table 5.1a
112 BP, plc., *Statistical Review*, at 41
113 SAFE analysis based on data from: DOE, EIA, *AER 2010*, Table 3.5; and BEA, "Current Dollar and Real GDP"
114 Id.

More generally, the United States is by far the world's largest oil consumer. Between 2007 and 2011, U.S. oil demand averaged 19.4 mbd, about 22 percent of the world total.[115] Demand in the next closest consuming country, China, averaged 8.6 mbd over the same period.[116] While industrial demand is still substantial at approximately 4.4 mbd, or about 23 percent of U.S. oil demand, the transportation sector ultimately gives oil much of its importance in the United States. In fact, today, the U.S. transportation sector alone consumes more oil than any national economy in the world. At 13.5 mbd, transportation currently accounts for approximately 71 percent of total U.S. oil demand.[117] The largest share is attributable to passenger vehicles—cars and light-duty trucks—which currently consume nearly nine mbd.[118] Heavy-duty trucks consume an additional three mbd.

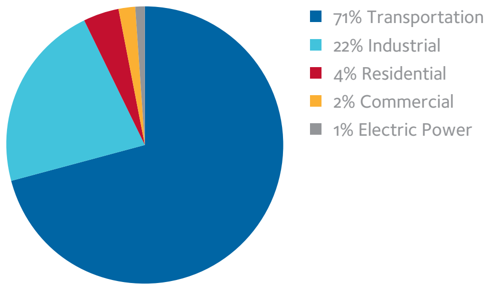
There are currently no alternatives in transport: The prominence of transportation demand gives oil the majority of its economic significance in the United States. This is because it is the sector in which it has proven the most difficult to deploy substitutes at scale. As discussed above, substitutes were most easily deployed in the electric power sector, where petroleum was virtually eliminated as a feedstock in the wake of the 1970s energy crises. Residential oil demand for space heating also proved relatively easy to displace, declining from 1.4 mbd in 1970 to 700,000 b/d in 2010 (a period during which the number of U.S. households grew by 54.1 million).[119] A similar reduction occurred in commercial demand, which fell from 764,000 b/d to 372,000 b/d over the same period. Industrial oil demand has been more difficult to displace, but a significant portion of industrial consumption occurs during the oil refining process itself. Other uses, such as road asphalt, are dependent on low-cost portions of the barrel. While some industrial processes are dependent on high cost petroleum products, the cost of oil often represents a small portion of the final good's price—in the case of pharmaceuticals, for example.[120]

U.S. TRANSPORTATION OIL DEMAND (2009)



Source: Oak Ridge National Laboratory

U.S. OIL DEMAND BY SECTOR (2010)



Source: DOE, EIA

Transportation demand, on the other hand, remains highly dependent on costly petroleum fuels that affect consumer spending levels in real time. In 2010, the U.S. transportation sector relied on petroleum-based fuels for 93.2 percent of delivered energy.[121] Even this figure understates the problem, as liquid

115 IEA, *Monthly Oil Market Report,* February 2012; and DOE, EIA, online statistics, "Product Supplied"

116 DOE, EIA, *Short Term Energy Outlook,* Custom Table Builder, March 2012, at http://www.eia.gov/forecasts/steo/query/

117 Oak Ridge National Laboratory (ORNL), *Transportation Energy Data Book,* Edition 30, Table 1.12

118 Id., Table 1.13

119 DOE, EIA, *AER 2010,* Table 5.13a

120 See., E.g., Howard Fumkin, Jeremy Hess, and Stephen Vindigni, "Energy and Public Health," The Challenge of Peak Petroleum," *Public Health Reports,* Volume 124, January-February 2009, at 10

121 DOE, EIA, *AER 2010,* Table 2.1e

fuels derived from biomass provided approximately four percent of delivered energy. These fuels, which are substitutes for petroleum, are priced on the same curve. Taken together, liquid fuels provide 97 percent of the energy that moves our cars, trucks, seaborne ships, and aircraft.

As a result of this utter reliance, American consumers and businesses—and the economy by extension—are fully exposed to oil prices with practically no means to choose less costly alternatives in the short term. In other words, oil demand is highly price inelastic. As oil prices increase during crises such as those that occurred in 1973-1974, 1979-1981, 1999-2000, 2007-2008, and 2011-2012—or during the course of normal market fluctuations associated with the business cycle—consumers have no choice but to pay more for their fuel. This increased spending in the short term must come at the expense of other spending on goods and services, the negative effects of which reverberate throughout the economy.

Oil prices are determined in a global market: Because it is fungible and relatively easy to ship by tanker overseas and through pipelines, rail, and trucks onshore, there is essentially a single global market for oil. Oil prices are set in open commodity markets, and oil is traded globally, which means that prices are affected by events in oil-producing and oil-consuming countries around the world. In fact, in some cases, oil prices can be significantly impacted by events in countries that are neither large oil consumers nor large producers—for example, by countries that host important shipping channels or infrastructure. The key consequence of this dynamic is that changes in oil supply or demand *anywhere* tend to affect prices everywhere. The impact on the United States—or any other consuming country—is a function of the amount of oil consumed and is not related to the amount of oil imported.

In the case of both 1970s oil crises, global oil price spikes were driven by supply-side events. At the height of the 1973–74 OPEC oil embargo, the disruption to global oil supplies peaked at 4.3 mbd, or 8 percent of global supplies.[122] As discussed earlier, this interruption drove a 176 percent increase in global oil prices between 1973 and 1974, a shock that affected the entire global economy. The peak disruption to global oil supplies during the 1979 Iranian Revolution was 5.6 mbd, or 8.8 percent of pre-crisis global oil production.[123] After averaging $50.80/bbl in real terms in 1978, global oil prices surged to nearly $85.49/bbl in December 1979 and hit $101.33/bbl by January 1981.[124]

More recently, demand-side events in the global oil market have dominated the oil price picture. In particular, the growth of a booming middle class in emerging market economies like China and India has ushered in an era of explosive demand growth in petroleum fuels. Between 1990 and 2010, Chinese liquid fuel demand increased by a factor of nearly four—from 2.3 mbd to 9.1 mbd.[125] The transportation sector was the key driver, with the number of passenger cars sold annually growing from less than one million in 2000 to 14.5 million in 2011.[126] In both 2010 and 2011, the number of passenger vehicles sold in China exceeded the number sold in the United States.

These figures highlight what is clearly a much larger shift in global oil demand dynamics. Throughout the history of the oil industry, the world's most developed countries have dominated the global demand picture. In 1970, the developed countries in the Organization for Economic Cooperation and Development (OECD) accounted for 75 percent of world oil demand.[127] By 2010, the OECD's 34 member countries—

122 IEA, *IEA Response System for Oil Supply Emergencies*, 2011 Update, at 11

123 Id.

124 DOE, EIA, *Short Term Energy Outlook*, "Real Prices Viewer," at http://www.eia.gov/forecasts/steo/realprices/

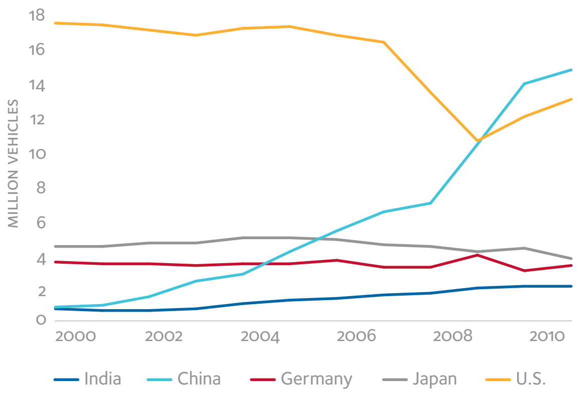
125 BP. Plc.*Statistical Review of World Energy* June 2011, Statistical Supplement

126 China Association of Automobile Manufacturers, "Automotive Statistics," at http://www.caam.org.cn/english/newslist/a101-1.html

127 BP. Plc., *Statistical Review of World Energy June 2011*, Statistical Supplement

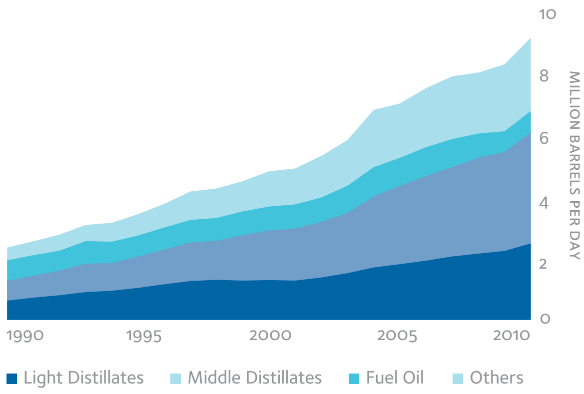
which represent less than one-fifth of global population—accounted for 53 percent of total demand, and their share is rapidly giving way to emerging markets. By 2015, emerging market economies will consume more oil than developed economies, as the number of light-, medium-, and heavy-duty vehicles on the road in Asia, the Middle East, and Latin America continues to soar.[128]

PASSENGER VEHICLE SALES 2000–2011



Sources: IEA, World Energy Outlook 2011; Ward's Automotive; China Association of Automobile Manufacturers; Japan Automobile Manufacturers Association; Verband der Automobilindustrie; Society of Indian Automobile Manufacturers

CHINESE OIL DEMAND, 1990–2010



Source: BP, plc., *Statistical Review of World Energy 2011*

As important as demand growth has been in driving oil prices for the past decade, it would be wrong to conclude that supply-side factors are unimportant in determining global oil prices. At a fundamental level, concerns about the long-term availability of global oil supplies serve to exacerbate the market's perception that rapid demand growth will be unsustainable. In large part, concerns about supply growth emanate from the fact that as much as 90 percent of conventional oil reserves are held by national oil companies (NOCs) whose investment and production decisions are far removed from the free market ideal.[129] Though many NOCs function as highly sophisticated companies at the frontier of industry technology and standards, it is often the case that they also function as branches of the central government, depositing production revenues into the treasury where they may be diverted to other purposes. This distortion leads to underinvestment in some of the world's lowest cost, most accessible oil reserves. Simply put, there is no free market for oil.

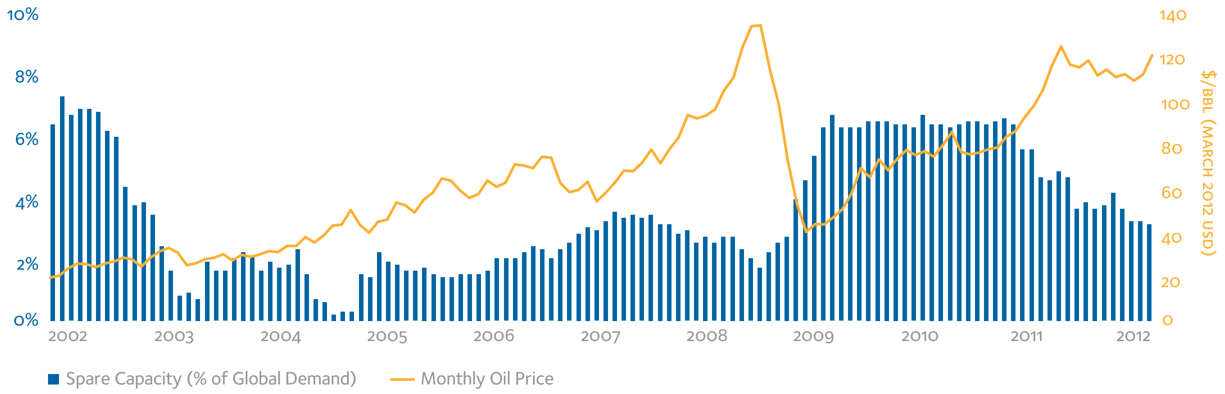
On a more short-term basis, physical supply disruptions—and the fear of additional disruptions, particularly in Iran—have played an important role in driving global oil prices to record levels in 2011 and 2012. Here again, though, the relentless nature of demand growth among the 5.8 billion people living in developing economies has only served to highlight the fragile nature of the global supply base, thinning the margin for error in a global market that has no shortage of unstable countries. In many ways, the world oil market—and thus price stability—is only as strong as its weakest link.

A simple way to gauge the supply-demand balance in the global market at any point in time is the level of spare production capacity in OPEC countries. As a cartel, OPEC maintains individual member production quotas, which vary depending on the current global economic climate and geopolitical considerations.

128 IEA, *World Energy Outlook 2011*, Table 3.2
129 IEA, *World Energy Outlook 2008*, Table 14.1

Though adherence to individual quotas is not always strong, OPEC production capacity typically exceeds the combined output of its members, with much of the surplus at any given point in time resting in Saudi Arabia. This spare capacity is a kind of market manipulation, but it also serves an incredibly useful purpose—it provides a short-term buffer for a fundamentally long-term industry in the event of unexpected supply disruptions or demand surges. The IEA defines spare capacity as that which can brought online within 30 days and maintained for 90 days.

OPEC EFFECTIVE SPARE CAPACITY: 2002–2012



Source: International Energy Agency

As a general rule of thumb, markets are typically comfortable when OPEC spare capacity is equivalent of four percent of global demand. Entering the 2000s, OPEC effective spare capacity stood at almost exactly this level, with three mbd of reserve capacity on 77 mbd of global demand.[130] Levels increased in 2001 and 2002, before tightening dramatically in 2003 as a result of a strike in Venezuela and the commencement of hostilities in Iraq. During the following 5 years, effective spare capacity in OPEC never exceeded four percent, falling below one percent in parts of 2003 and 2004—precisely the moment that oil prices began climbing to record highs.[131]

Though the 2007-2009 global economic recession and financial crisis ultimately brought reduced oil demand, lower prices, and high levels of OPEC spare capacity, the reprieve was short-lived. A strong global recovery in 2010—particularly in China, where oil demand surged by 10.4 percent—coupled with a series of supply disruptions associated with the Arab Spring brought the return of sharply higher oil prices in early 2011.[132] As a result of the Libyan Civil War, which removed 1.5 mbd of oil supplies from the global market at its peak in 2Q 2011, OPEC spare capacity averaged 3.7 percent of global demand in the second half of 2011.[133] By March 2012, it had fallen to 2.9 percent.[134]

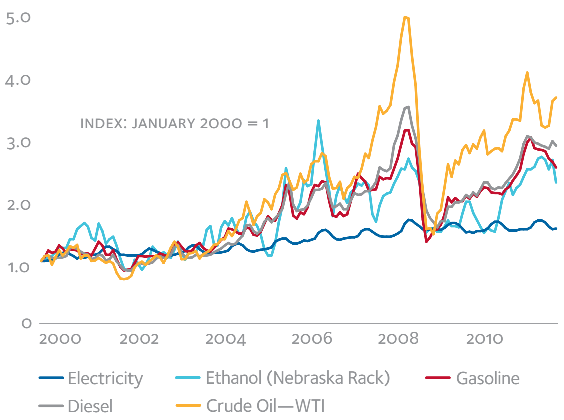
These factors—global oil supply, demand, and the market's ability to balance the two—are the key factors determining oil prices around the world. In 2011, despite three consecutive years of U.S. oil production growth and the highest total American liquids output in two decades, crude oil, gasoline, and diesel prices reached all-time annual record highs. The reason: oil prices are driven by a wide range of global factors that almost always trump steady, predictable events in one country.

130 DOE, EIA, *Short Term Energy Outlook*, March 2012, Custom Table Builder
131 SAFE analysis based on data from: IEA, *Monthly Oil Market Report*, January 2002 through February 2012
132 IEA, *Monthly Oil Market Report*, February 2012, at 55
133 SAFE analysis based on data from: IEA, *Monthly Oil Market Report*, January 2011 through February 2012
134 IEA, *Monthly Oil Market Report*, April 2012

Moreover, the various entities on the supply-side have extremely different motivations and incentives that drive their decision making. In the case of many OPEC members, there is little incentive to over-build spare capacity that sits idle the majority of the time, just as a means to keep markets calm. Admittedly, Saudi Arabia has frequently deployed its spare capacity in times of need as a means to assuage volatile oil markets—as it has repeatedly stated it would do in the event of conflict with Iran in 2012. Yet over the long term, even Saudi Arabia considers the anticipated effects of investment levels in other global regions when making decisions about its own capacity.[135] As a whole, the oil industries in OPEC members do not function as profit-maximizing firms seeking to expand market share. Instead, investment levels are determined—at least partially—as part of a strategy to achieve specified price targets, which have recently been suggested to be around $100/bbl.[136] In this context, there are real questions about the importance of the new American oil boom for the global supply-demand balance. If OPEC adheres to its historical pattern, its members will view these developments as a signal to forestall investments in new production capacity, tighten quotas, and keep the global balance tight.

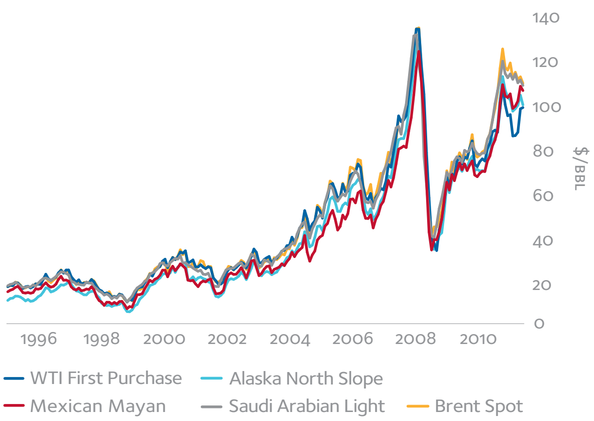
Oil prices are volatile: In an era of rapidly rising demand, high levels of geopolitical volatility, and tight spare capacity, the price of crude oil is becoming increasingly high and volatile. For the U.S. economy, which is highly dependent on petroleum for mobility, this volatility represents a dangerous vulnerability. Volatility creates uncertainty and economic dislocation and affects planning and budgetary decisions, resulting in less efficient resource allocations and ultimately preventing the U.S. economy from maximizing its potential.

CHANGE IN U.S. ENERGY PRICES (2000-PRESENT)



Source: DOE, EIA; SAFE Analysis

WORLD OIL PRICES BY CRUDE STREAM



Source: DOE, EIA

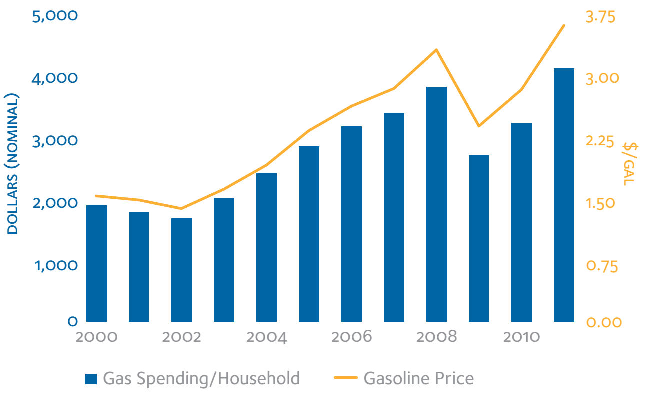
Crude price volatility extends to all crude streams, regardless of origin. To be sure, there are occasional variations in crude prices on a regional basis, particularly in cases where crude quality is an issue. For example, Canadian bitumen tends to trade at a discount to conventional crude, because it must go through a complex and costly upgrading process before it can be refined into retail petroleum products. Markets discount such streams based on expectations of future costs. Regional logistical issues can also drive price variation, as the U.S. midcontinent has proven quite well for the past two years, discounting West Texas Intermediate oil to Brent by as much as $30/bbl. But in general, all crude oil—whether it is Arabian Light, Mexican Mayan, or Alaskan North Slope—is essentially fungible, driven in price by global events, and equally volatile.

135 Summer Said, "Saudis see no reason to raise oil output capacity," Wall Street Journal, October 10, 2011
136 Javier Blas and Guy Chazan, "Saudi Arabia targets $100 crude price," Financial Times, January 18, 2012

Volatility in crude oil prices drives volatility in retail fuel prices. That is, gasoline and diesel prices in the United States have no significant variation from crude oil prices during normal market conditions. Moreover, it is important to note that this volatility affects all retail liquid fuels more or less equally, regardless of feedstock. In other words, the volatility associated with crude oil and petroleum fuels like gasoline and diesel extends directly to substitutes like ethanol.[137]

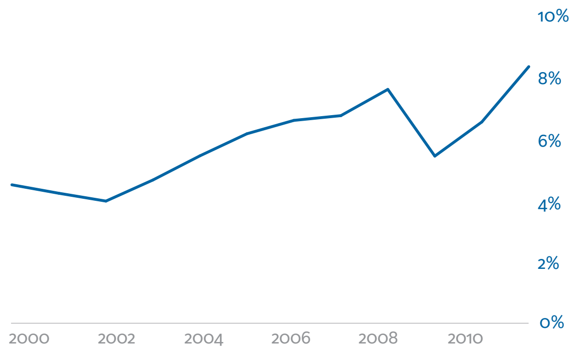
The volatility of petroleum fuels is the single most damaging consequence of U.S. oil dependence. In 2001, the average U.S. household spent approximately $1,756 dollars on gasoline, equivalent to 4.2 percent of the median household income of $42,228.[138] Over the following six years, as oil prices marched steadily upward, household spending on gasoline increased as well, reaching $3,764 in 2008—or about 7.5 percent of the median household income of $50,303.[139] This increase of more than $2,000 per household essentially functioned as a kind of tax, providing no additional consumer value of any kind relative to 2001. While the 2007-2009 recession was certainly caused by a variety of factors, it is impossible to ignore the impact of the substantial increase in gasoline spending that occurred at a time when many U.S. households were struggling to meet mortgage obligations.

GASOLINE: PRICES AND HOUSEHOLD SPENDING



Source: DOE, EIA; BLS; U.S. Census Bureau; SAFE Analysis

PERCENT OF MEDIAN HOUSEHOLD INCOME SPENT ON GASOLINE



Source: DOE, EIA; BLS; U.S. Census Bureau; SAFE Analysis

A similar cycle of rising oil prices in 2010 and 2011 led to predictable results for consumers and the U.S. economy as a whole. After averaging $2.35/gal in 2009, U.S. gasoline prices rose to $2.79 in 2010 and a record $3.52 in 2011.[140] Average household spending on gasoline, which had fallen sharply back to $2,662 in 2009, reached a record $4,060 in 2011, equal to 8.2 percent of the median household income of $49,446.[141] The increase in gasoline prices, which began in earnest late in the first quarter of 2011, nearly derailed the U.S. economic recovery. After averaging three percent in 2010, U.S. GDP growth fell to a paltry 0.4 percent in the first quarter of 2011.[142] Though growth rebounded slightly to 1.3 percent in the second quarter, consumer spending fell to its lowest level since the recession.[143]

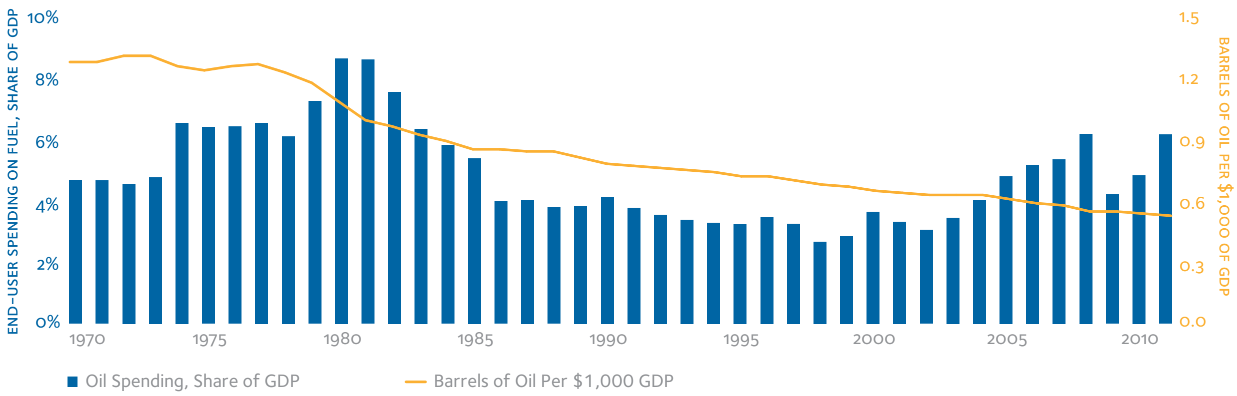
137 Salvo, Alberto and Huse, Cristian, Is Arbitrage Tying the Price of Ethanol to that of Gasoline? Evidence from the Uptake of Flexible-Fuel Technology (October 1, 2010)
138 SAFE analysis based on data from: DEO, EIA; and U.S. Bureau of Economic Analysis
139 Id.
140 DOE, EIA, *Monthly Energy Review*, February 2012, Table 9.4
141 SAFE analysis based on data from: DEO, EIA; and U.S. Bureau of Economic Analysis
142 BEA, "Gross Domestic Product: Fourth Quarter and Annual 2011," Table 1
143 Id.

From a policy perspective, the price spikes that occurred in 2008 and 2011 created real challenges. In the first case, the increase in spending on gasoline by the average household between 2001 and 2008 more than offset the effects of all income tax reductions over the same period. The tax cuts, which totaled $1,900 by 2008 for the average household, were intended to stimulate consumer spending on other goods and services and provide a boost to the economy—particularly in the aftermath of the 2001 recession.[144] Instead, the cuts simply allowed households—and the economy—to stay afloat.

The 2011 price spike created a similar policy challenge for Congress and the Obama Administration as they sought to stimulate the economy during a sluggish recovery. The payroll tax cut signed into law in 2011 provided American households with an additional $108.6 billion in take-home pay.[145] Once again, the intended effect of this policy was to stimulate consumer spending on goods and services. However, the increase in gasoline prices that occurred in 2011 cost U.S. households an additional $104.4 billion in fuel spending compared to 2010.[146] In other words, higher gasoline spending essentially completely offset the cut and negated its intended effect.

Two final issues are worth noting with respect to volatility. First, the increase in consumer spending on gasoline that occurred in 2011 came at the same time that the United States was producing more domestic liquid fuel than at any time in the past 20 years. While this increase in production has a range of economic benefits, shielding consumers from volatility is not among them. The domestic price of oil—and retail fuels by extension—are largely determined by the global balance of supply and demand, and expectations about future levels of supply in demand, in the aggregate. While the United States plays an important part in that picture, numerous other factors carry greater weight.

U.S. OIL INTENSITY AND OIL SPENDING



Source: EIA, *AER 2010*; Department of Commerce, Bureau of Economic Analysis; SAFE Calculations

Second, high oil prices are driving consumer spending on petroleum fuels to dangerous levels, even as the economy becomes less oil intense. In 2008 and again in 2011, total end-use consumer spending on petroleum fuels in the United States surpassed 6 percent of GDP.[147] In fact, 2011 was the first time this threshold was breached without triggering a recession. Today's levels of spending were last reached in

144 Tax Policy Center, Urban Institute and Brookings Institution, "Individual Income and Estate Tax Provision in the 2001-08 Tax Cuts," Table T08-0147, (2008)

145 U.S. Department of Treasury, Office of Tax Policy, "A State-by-State Look at the President's Payroll Tax Cut for Middle Class Families, " November 30, 2011

146 SAFE analysis based on data from: DOE, EIA; and U.S. Bureau of Economic Analysis

147 Id.

the early 1980s, when the economy was nearly twice as oil intense as it is today. The United States is still a long way from the record spending levels above 8 percent of GDP reached in 1980 and 1981. In today's economy, retail fuel prices would need to average 35 percent higher than 2011 levels to equal 8 percent of GDP.[148] In fact, at such levels, demand destruction would be imminent. Nonetheless, it is striking to consider that, despite a 60 percent reduction in oil intensity between the early 1970s and 2011, the United States remains economically vulnerable to volatile oil prices.

III. EVALUATING THE BENEFITS OF THE BOOM

Given the nature of U.S. oil dependence outlined above, it is important to identify what rising levels of self-sufficiency in oil supply will, and will not, accomplish for the United States. The findings below focus on the economy and national security specifically, with clear implications for energy security more broadly. They also have important implications for policymakers as they seek to craft a long-term energy security strategy for the United States.

In sum, the new American oil boom will have important benefits for the U.S. trade deficit and employment growth. It will not, however, meaningfully shield U.S. consumers from oil price volatility. Nor will rising levels of self-sufficiency in oil supply allow the United States to fundamentally alter its commitment to stability in the Middle East. This commitment, which has been explicitly articulated for decades, arises directly from the level of U.S. oil consumption in general, not the level of oil imported from the Middle East.

Rising oil production will improve the trade deficit: All things being equal, rising domestic oil production will have a beneficial impact on the U.S. trade deficit. This is likely to be the case for several reasons. From a demand perspective, domestic petroleum consumption has declined in the wake of the 2007-2009 recession, averaging 19 mbd in 2011 compared to the pre-crisis level of 20.6 mbd.[149] Further, current trends suggest that demand is unlikely to rise by any meaningful quantity in the coming decades. Recent DOE forecasts suggest transportation fuel demand will remain flat at 13.9 mbd through 2020 and rise only slightly to 14.2 mbd through 2030.[150] The combination of high petroleum prices and rising automotive efficiency across all vehicle classes has essentially put a ceiling on U.S. demand for gasoline and diesel.

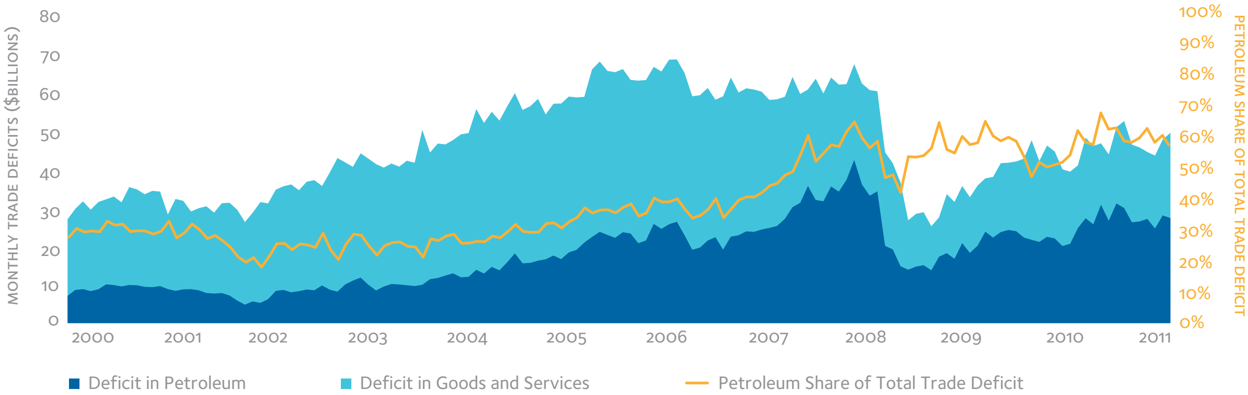
With this dynamic in place on the demand side, rising domestic oil production can be expected to displace imports on a near one-to-one basis. This has largely been the case over the past three years, and net U.S. imports have fallen by one-third from their all-time high of 12.6 mbd in 2005 to today's level of just 8.4 mbd.[151] As discussed above, the outlook going forward is equally encouraging, with rising domestic production driving imports to less than 40 percent of total supplies by 2020.[152]

This shift in dynamics cannot have come soon enough, as the role of oil imports in the U.S. trade deficit has been rapidly expanding in recent years. Progressively higher oil prices have meant that, even as oil imports have declined in volume, they have actually increased in cost. Particularly as oil prices began climbing in late 2007, petroleum's share of the U.S. trade deficit began to grow substantially. In 2008, with the cost of U.S. oil imports averaging $92.60/bbl, the United States spent a record $386 billion on

148 SAFE analysis based on data from: DEO, EIA; and U.S. Bureau of Economic Analysis
149 DOE, EIA, online statistics, "Product Supplied," at http://www.eia.gov/dnav/pet/pet_cons_psup_dc_nus_mbbl_m.htm
150 DOE, EIA, *AEO,* Table A.11
151 DOE, EIA, *AER 2010,* Table 5.7; and "Petroleum Supply Monthly," Table 4
152 DOE, EIA, *AEO 2012*, Table A.11

imports of crude oil and petroleum products.[153] The decline in demand and prices associated with the recession temporarily reduced U.S. import volumes and expenditures in 2009 and 2010, and indeed imports have never recovered to pre-crisis levels. Nonetheless, in 2011, despite the fact that the United States imported nearly one billion fewer barrels of oil than it did in 2008, the U.S. import bill surged to $326 billion as global events drove record high import prices of $102.67/bbl.[154]

SHARE OF PETROLEUM TRADE IN U.S. TRADE DEFICIT



Source: U.S. Census Bureau, Office of Foreign Trade Statistics

The quantity of capital involved in U.S. petroleum trade is significant. Taken as a whole, between 2007 and 2011, the United States ran an aggregate $1.4 trillion deficit in crude and petroleum product trade.[155] The portion of the trade deficit driven by petroleum imports now generally exceeds 50 percent and is greater than the imbalance in other goods and services with trade partners like China and NAFTA. Addressing this challenge through domestic production will generate real economic value for the American economy. In a recent research note on domestic oil production, analysts at Citi suggested that the U.S. trade deficit could be reduced to as low as 1.2 percent of GDP by 2020, down from today's level of 3 percent.[156] The article suggests, "This would also have implications for the U.S. dollar, potentially helping it appreciate by 2 percent to 5 percent in real exchange-rate terms, reversing its long-term decline and maintaining its status as the global reserve currency of choice."

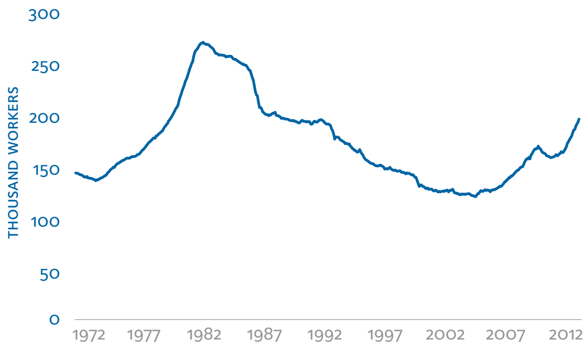
The oil industry will be an important source of employment growth: As the number of rigs drilling for oil and gas in the United States has increased dramatically in recent years, the number of workers directly employed in oil and gas extraction has also increased. In fact, more people were employed in oil and gas extraction in March 2012 than at any time since November 1988.[157] At a time when the unemployment rate remains above eight percent in the United States, the job growth potential of the new American oil boom cannot be overlooked.

Between the end of 2007 and March 2012, the oil and gas industry added 38,300 jobs just in extraction-related activities.[158] While significant, this figure substantially understates the broader employment impact of the oil and gas industry, which includes a wide range of indirect and associated positions as

153 DOE EIA, *AER 2010*, Table 3.9
154 U.S. Census Bureau, Foreign Trade Statistics, "U.S. International Trade in Goods and Services," March 2012, Table 9
155 Id.
156 Ed Morse, "Move Over OPEC—Here We Come," Wall Street Journal, March 20, 2012
157 BLS, Industries at a Glance, "Oil and Gas Extraction," at http://www.bls.gov/iag/tgs/iag211.htm
158 Id.

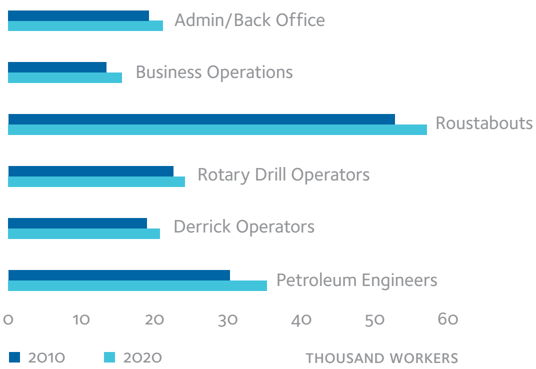
well. Indirect employment includes positions in sales and service industries nearby oil and gas production activities, including restaurant workers, retail sales employees, school teachers, firefighters, and more. In total, these indirect jobs are estimated to total in the millions in the United States.[159] The U.S. Bureau of Economic Analysis suggests that each job gained or lost in the oil and gas industry has a multiplier effect of 5 to 7 jobs economy-wide.[160] In other words, the 38,300 direct jobs created since 2007 have likely led to between 191,500 and 268,100 additional jobs throughout the economy.

TOTAL EMPLOYMENT: OIL AND GAS EXTRACTION



Source: BLS

PROJECTED GROWTH IN OIL AND GAS EMPLOYMENT



Source: BLS

Going forward, the Bureau of Labor Statistics forecasts continued direct jobs growth from oil and gas extraction activities. While the direct employment effects are expected to number in the tens of thousands, broader employment effects are likely to be more substantial. A range of forecasts from financial and consulting institutions suggest the total jobs growth picture associated with the oil and gas industry in the coming decade could total several hundred thousand.[161]

Rising domestic oil production will not achieve a long-term domestic price advantage in oil: In recent months, a number of political commentators have suggested that, as the United States produces more oil domestically, it will achieve sharply lower prices in much the same way that natural gas prices have fallen during the surge in U.S. shale gas production. This simply is not credible. While increased U.S. oil supply can free up imported barrels and help provide some amount of flexibility to the global oil market, rising levels of domestic oil production will not allow the United States to separate itself from the global market and achieve domestic pricing.

The oil and natural gas markets are vastly different. Indeed, the United States does have a large degree of autonomy in natural gas pricing. In 2011, when spot prices for natural gas averaged $4.00/MMBtu in the United States, they averaged between $8 and $10/MMBtu in much of Europe.[162] Meanwhile, Japanese LNG cargos were as low as $12 and as high as $16/MMBtu. This extreme variation in pricing is a result of the fact that—unlike the case for oil—there is no global market for natural gas. Natural gas has historically been much more difficult to ship overseas than oil, largely limiting gas trade to regional markets. As a result, rising domestic gas supplies can drive significant price reductions.

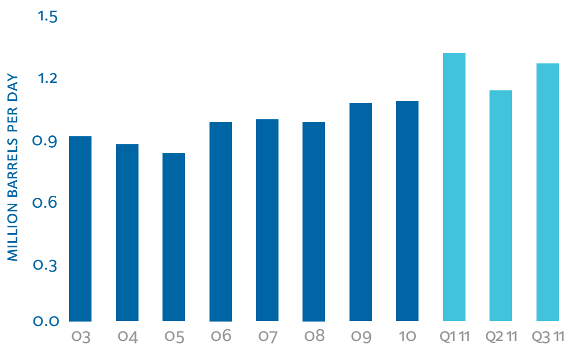
159 See e.g., Energy Tomorrow, Job Creation, available at http://energytomorrow.org/job-creation/#/type/all
160 Wood Mackenzie, "U.S. Supply Forecast and Potential Jobs and Economic Impacts (2012-2030)," at 18
161 See, e.g., Ed Morse, "Move Over OPEC—Here We Come," Wall Street Journal, March 20, 2012
162 DOE, EIA, Today in Energy, "Global natural gas prices vary considerably," September 30, 2011

In recent decades, the technology to ship gas globally via LNG tankers has changed gas dynamics slightly, but LNG trade still only accounted for 9 percent of global gas demand in 2011.[163] Today, LNG supplies feature prominently in Asia and increasingly in Europe. But the United States imported just 348 billion cubic feet of LNG in 2011—equal to less than two percent of the domestic natural gas consumed last year.[164] U.S. LNG export volumes are similarly limited for the time being to a single facility in Alaska. These dynamics may change in the coming years as pressure grows for the United States to export LNG in much larger quantities, a decision that could have an impact on the domestic pricing advantage enjoyed by U.S. consumers today.

Throughout 2011 and 2012, the glut of North American oil supplies entering the Midwest and Rocky Mountain regions has depressed crude oil and gasoline prices to a degree, but this is largely an issue of infrastructure that will be resolved as new pipeline capacity connects the mid-continent to other parts of the country. Ultimately, the oil market is global in nature, and the United States is firmly entrenched in it. As a trading nation, U.S. prices are directly tied to global prices over the long term. Most important, with notable exceptions, regional variations in crude prices do not translate into variations in refined product prices, because these products themselves are traded globally. Instead, variation in feedstock pricing benefits refiners with exposure to discounted crude streams and does not benefit consumers.

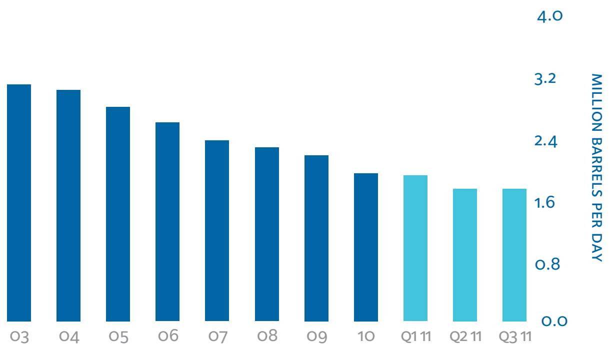
Self-sufficiency in supply will not shield U.S. consumers from price volatility: The concept of energy independence, though largely vacuous in the context of a global oil market, is often ascribed a specific meaning as discussed above. It is the concept of being self-sufficient in energy supplies, or in this case, oil supplies. By this definition, all net exporters of petroleum are energy independent. Obviously, there are numerous examples of net petroleum exporters, both past and present. But two countries stand out as relatively close proxies for the United States: Canada and Norway. Both are OECD members with industrialized, relatively wealthy societies. Both have well-developed transportation sectors, free market economies, and open political systems. In this context, it is worth asking: has self-sufficiency achieved anything significant for either country in terms of fuel price volatility?

CANADA: NET PETROLEUM EXPORTS



Source: IEA; BP,. plc.

NORWAY: NET PETROLEUM EXPORTS



Source: IEA; BP,. plc.

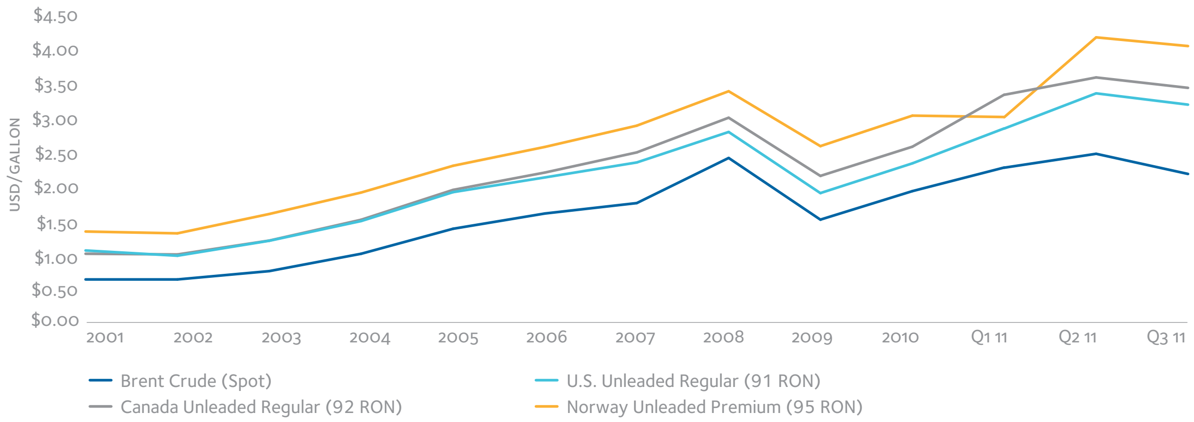
Both Canada and Norway were net oil exporters for the entire period of the 2003-2008 increase in global oil prices, and both nations remained net exporters through the subsequent price spike in 2011.[165] In the case of Canada, net exports are in a period of general growth as new oil sands production comes online.

163 IEA, *Medium-term Oil and Gas Market Report 2011*, at 183
164 DOE, EIA, online statistics, "U.S. Natural Gas Import by Country," at http://www.eia.gov/dnav/ng/ng_move_impc_s1_m.htm
165 SAFE Analysis based on data from: IEA, *Oil Information 2011*, Part IV, Table 3; and *Monthly Oil Market Report,* February 2012, Tables 2 and 3

Exports totaled less than 1.0 mbd in 2003, but had risen to 1.2 mbd in the first quarter of 2011.[166] Norway entered the period as a key global oil exporter, with net annual volumes slightly in excess of 3.0 mbd—representing approximately 90 percent of its production.[167] In recent years, as North Sea production has gone into decline, Norway's exports have steadily decreased. Nonetheless, net exports still exceeded 1.6 mbd in the third quarter of 2011.

In the case of both Norway and Canada, however, domestic retail fuel prices tracked global oil prices almost perfectly throughout the entire period from 2003 through 2011.[168] Indeed, adjusted in a common currency and not including taxes, retail fuel prices in Canada and Norway moved in lockstep not just with global crude benchmarks, but also with retail fuel prices in the United States over the same period.[169]

COMPARISON OF CRUDE OIL PRICES AND BASE GASOLINE PRICES IN U.S. AND INTERNATIONAL OIL EXPORTERS



Note: Base prices exclude all taxes.

Source: IEA

In other words, from the perspective of price volatility and its impact on consumers, being self-sufficient in oil supply neither stabilized nor lowered end-use prices in either Canada or Norway during the most recent period of instability in the global oil market. Consumers in both countries dealt with the same volatility in underlying fuel prices that American consumers faced during a period in which the United States was at times importing record volumes of crude oil and petroleum products.

To be clear, this is no way diminishes the employment or economic value of being a net oil exporter. Canada ran current account surpluses throughout much of the period between 2003 and 2008, though it slipped into deficit in 2009 and 2010.[170] Norway ran large current account surpluses between 12 and 17 percent of GDP throughout the entire period from 2003 to 2010, and export revenues have allowed the country to establish a sovereign wealth fund for the benefit of its citizens.[171] During the height of the global financial crisis in 2009, Norway's unemployment rate was just 3.2 percent.[172] Still, it must be noted with some irony that throughout the period in question, U.S. consumers actually paid the lowest base price for gasoline, despite being a large net importer.

166 Id.
167 Id.
168 SAFE analysis based on data from: IEA, *Energy Prices and Taxes: Quarterly Statistics,* Fourth Quarter 2011
169 Id.
170 World Bank, Data by Country, Canada, available at http://data.worldbank.org/country
171 World Bank, Data by Country, Norway, available at http://data.worldbank.org/country
172 Id.

Rising oil production will not mitigate the foreign and military challenges of U.S. oil dependence: Whether the result of production disruptions due to conflict in a specific country or the impediment of supply through a critical shipping route, interruptions to the flow of oil can be highly economically damaging for the U.S. and global economies, as discussed above. To mitigate this risk, U.S. armed forces expend enormous resources protecting chronically vulnerable infrastructure in hostile corners of the globe and patrolling oil transit routes. This engagement benefits all nations, but comes primarily at the expense of the American military and ultimately the American taxpayer. A 2009 study by the RAND Corporation placed the ongoing cost of this burden at between $67.5 billion and $83 billion annually, plus an additional $8 billion in military operations.[173]

As U.S. oil imports continue to decline, and other countries—China in particular—grow to become larger net oil importers, many are asking whether the United States will be relieved of its oil-security duties. The question has gained a particular relevance as U.S. imports from the Middle East have declined substantially in recent years. Persian Gulf supplies to the United States were down to 1.8 mbd in 2011 after being as high as 2.8 mbd in 2001.[174] Unfortunately, the United States will remain committed to stability in the Middle East—and a handful of other critical oil producing regions—for the foreseeable future.

The growth of domestic oil supply in the United States between 2009 and 2011 is an impressive story. Nonetheless, the U.S. commitment to global oil security is largely a function of the importance of oil in the global and domestic economies, and the United States is expected to remain the world's largest oil consumer for decades. The United States has clearly placed a special significance on the security of Persian Gulf oil supplies as far back as the Carter Administration, but this has very little to do with the direct importance of those supplies to the United States. In fact, since 1981, Persian Gulf supplies have never accounted for more than 15 percent of U.S. oil supplies.[175] Instead, the American commitment to the Middle East is based on the importance of that region for the stability of the *global market,* for which Persian Gulf suppliers accounted for 30 percent of total oil supplies in 2011 and as much as 37 percent in 1974.[176]

The fact is that the world market—on which the U.S. economy depends—derives a significant quantity of its supplies from geopolitically risky countries in the Middle East and North Africa. More broadly, the number of threats to oil flows is as high today as it has ever been, and the consequences of a disruption for the U.S. economy are just as dire. Consider that, in 2010, total world oil production amounted to approximately 88 million barrels per day, and more than 50 percent was moved by tankers on fixed maritime routes.[177] The majority of these supplies transited a strategic chokepoint such as the Strait of Hormuz, the Straits of Malacca, or the Suez Canal, all narrow waterways that present hostile actors with an opportunity to disrupt large volumes of oil and the global economy.

Looking forward, it is difficult to imagine a reduced U.S. commitment to the Middle East. The International Energy Agency recently estimated that the Persian Gulf will supply 32 percent of the world's oil in 2020 and 35 percent in 2030.[178] As long as oil is priced in a global market, and oil plays a critical role in the U.S. economy, no amount of domestic production will eliminate the U.S. commitment to the security of this region or any other region critical to global oil flows.

Similarly, rising U.S. production of oil is unlikely to provide added flexibility in dealing with difficult foreign policy challenges in major oil-producing countries, including Iran. Here again, the simple fact is that Iran's

173 RAND Corporation, "Imported Oil and U.S. National Security," at 60-62 (2009)
174 DOE, EIA, *AER 2010*, Table 5.7
175 DOE, EIA, *AER 2010*, Table 5.7
176 SAFE analysis based on data from: BP, plc., *Statistical Review of World Energy June 2011*, Statistical Supplement
177 DOE, EIA, "World Oil Transit Choke Points," (2011)
178 IEA, *World Energy Outlook 2011*, Tables 3.5 and 3.6

strategic importance from an energy perspective emanates from its role in the global oil market. In 2010, Iranian oil production totaled 4.2 mbd against 1.8 mbd of consumption, implying exports of roughly 2.4 mbd.[179] Disruption of these supplies due to military conflict or other means would trigger a substantial increase in the global price of oil, which is at the core of America's vulnerability as a large oil consumer. Any additional disruption of Gulf-region oil exports through the Strait of Hormuz—which totaled 17 mbd in 2011—would cause additional, highly damaging price volatility.[180] Critically, the relative levels of U.S. oil production and imports would have no meaningful bearing on these dynamics.

IV. CONCLUSION

The new American oil boom will have profound impacts for the U.S. economy during the coming years. As U.S. levels of oil imports continue to fall, the trade deficit will improve, and the transfer of U.S. wealth abroad will decrease. This will help strengthen the dollar and increase investment in the domestic economy, where productive capital tends to have an extremely beneficial impact on growth. Overall employment will benefit as well, with tens-of-thousands of new direct jobs in the oil and gas industry driving creation of many more indirect jobs throughout the economy. In short, the domestic oil industry could be a boon for the U.S. economy at a time when it is struggling to recover from the worst recession in 70 years.

But it is important to be clear-eyed about the effect the boom in oil production will have on American energy security. Rising domestic production will not shield consumers from oil price volatility, and it will not lower gasoline prices over the long term. It will also not allow the United States to abdicate its role in the Middle East.

America's dependence on oil represents one of the most dangerous and pressing national security threats facing the country today. This threat, which is overwhelmingly a function of the importance of oil in the domestic economy, will not be substantially altered by rising levels of domestic oil production and falling imports.The fact is that as long as the United States remains dependent on oil as the primary fuel in our transportation sector, the nation will remain vulnerable to the effects of oil price volatility and debilitating price shocks. Critically, there is little the American policy apparatus can do to minimize the occurrence of volatility in oil prices, as it is primarily driven by events in dozens of consuming and producing countries around the world. The oil market is truly global in nature and scope.

In working to enhance American energy security, policymakers must set aside empty goals and slogans, like energy independence, and focus on the hard work at hand: continuing to increase the efficiency of the automotive fleet through vehicle fuel-economy standards, investing in the research and development needed to commercialize advanced vehicle drivetrain technologies that greatly reduce or eliminate oil use, and supporting deployment of current-generation non-petroleum transportation fuels such as electricity and natural gas to diversify our energy sources. On all of these fronts, the United States has made some important, initial strides in recent years. With oil markets growing increasingly volatile based on continued demand growth in emerging markets and geopolitical instability in the Middle East, now is the time to redouble our commitment to those strategies. Today, as ever, dramatically reducing our consumption of oil is the surest path to national energy security.

179 BP, plc., *Statistical Review,* at 8 and 9
180 DOE, EIA, "World Oil Transit Choke Points," (2011)

Implications for Policymakers

As lawmakers develop policies to improve U.S. energy security, it is important to work within a framework that addresses the true nature of the problem: the economy's heavy reliance on petroleum, particularly in the transportation sector. Today, petroleum fuels account for nearly 40 percent of America's energy diet, more than any other fuel.[181] Yet, more than 70 percent of U.S. oil consumption occurs in transportation, and 93 percent of the energy that fuels our cars, trucks, ships, and aircraft is petroleum-derived.[182] Today, oil has a virtual monopoly on transportation, leaving the American economy completely vulnerable to high and volatile prices driven by events in the global market. Any policy framed as an effort to improve energy security must focus squarely on that aspect of the problem.

At the same time, policy needs to continue to support domestic production of oil where possible. While no absolute level of domestic oil production can insulate U.S. businesses and consumers from the global oil market and its associated price volatility, increased domestic production has important benefits for the economy. These include a reduced trade deficit and increased job growth.

A set of implications for policymakers emerges from this framework and from the analysis laid out in this report. These implications prioritize energy security, recognizing that the best policies are those that reduce the economy's exposure to oil price volatility. They also support growth in domestic production, recognizing that the new American oil boom is poised to benefit the economy in numerous ways. The primary implications are as follows:

1. **Vehicle fuel-economy standards are the most important energy security accomplishment in decades. They must be supported and continuously improved.**
The Energy Independence and Security Act of 2007 (EISA), signed into law by President George W. Bush, authorized the first increase in automotive fuel-economy standards in a generation. Prior to the passage of EISA, the standards, which were enacted as part of the Energy Policy and Conservation Act of 1975, sat idle after reaching 27.5 miles per gallon in 1985. EISA 2007 authorized the Department of Transportation to increase the standards for light-duty vehicles and to establish the first ever standards for medium- and heavy-duty trucks.

   In 2010, the National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) finalized light-duty fuel-economy rules for the period 2012-2016. The rules, which mandate a fleet-wide fuel-economy average of 35.5 mpg by 2016, will reduce U.S. gasoline demand by 1.6 mbd in 2030.[183] In 2011, EPA and NHTSA finalized the medium- and heavy-duty truck rules, which EPA estimates will reduce U.S. demand for gasoline and diesel by a combined 400,000 b/d.[184] Finally, NHTSA and EPA are currently in the process of finalizing additional light-duty standards that will cover the period 2017-2025. Based on the current proposed rule, EPA estimates that the new rules will reduce U.S. gasoline demand by an additional 1.7 mbd in 2030.[185]

181 BP, plc. *Statistical Review,* at 41

182 DOE, EIA, *AER 2010,* Table 2.1e

183 EPA and NHTSA, "Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards," Regulatory Impact Analysis, Table 6-16

184 EPA and NHTSA, "Final Rulemaking to Establish Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles," Table 7-7

185 EPA and NHTSA, "Proposed Rulemaking for 2017-2025 Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards," Draft Regulatory Impact Analysis, Table 5.4.1

Taken together, the rules finalized and being considered by NHTSA and EPA will reduce U.S. demand for gasoline and diesel by 3.7 mbd in 2030 compared to a pre-EISA baseline. This is partially already reflected in current Department of Energy projections, which reflect declining U.S. gasoline consumption over a 25 year horizon. From 8.7 mbd in 2011, gasoline demand is expected to fall to 8.6 mbd in 2020 and 8.2 mbd in 2030.[186] Critically, these forecasts do not include NHTSA and EPA's proposed rule for 2017-2025, which will provide additional reductions. This level of reduction in oil intensity will meaningfully enhance American energy security.

2. Fuel efficiency is not enough on its own. The long-term goal of energy security policy must be to break the petroleum's stranglehold on the transportation sector.

The U.S. economy has made important strides in reducing oil intensity over the past several decades. In fact, the quantity of oil required to produce a unit of GDP has declined by nearly 60 percent since 1970.[187] Although much of that progress was made in the decade following the 1973-74 oil crisis, the United States has shown that it can continuously reduce oil intensity while growing the economy. Nonetheless, steady progress in reducing volumetric oil intensity is not enough, particularly in an era of increasingly high and volatile oil prices. Measured in terms of the share of GDP dedicated to petroleum spending, the threat of oil dependence is today at its highest level since the early 1980s.

Over the long term, the United States can achieve meaningful energy security by transitioning away from liquid fuels in the transportation sector. Vehicles that derive motive power from grid-generated electricity stored in onboard batteries are entering the market today and over time could represent a key pillar in a more secure U.S. transportation sector and economy. Plug-in electric vehicles (PEVs) are particularly promising in light-duty applications, which account for roughly 40 percent of U.S. oil demand.[188] Electricity is generated by a diverse set of fuels, and petroleum accounts for just 1 percent of net U.S. electricity generation today.[189] Retail electricity prices are also highly stable, the result of both regulation and the fact the fuel typically represents a small share of overall power plant costs.

Also promising is the potential of natural gas in the heavy-duty segment of the U.S. transportation fleet. Heavy-duty tractor trailers account for more than 10 percent of U.S. oil demand.[190] These high-mileage, low-efficiency vehicles are an ideal target for natural gas fuel, specifically liquefied natural gas (LNG). At a time when the United States is essentially capable of producing more natural gas than the economy can consume, there could be real advantages to deploying gas in heavy-duty applications, particularly if the nation is able to maintain its strategic pricing advantage in gas.

In both the case of PEVs and LNG trucks, substantial barriers to entry could limit commercialization in the near term. For PEVS, high battery costs are the primary challenge, adding as much as $10,000 to $15,000 to the suggested retail price of a vehicle. Infrastructure presents an additional challenge, though on a smaller scale as the necessary backbone is already in place—the electric grid currently reaches nearly every home and business in the country. For heavy-duty LNG trucks, incremental vehicle costs are a significant challenge, with current incremental costs typically in the tens-of-thousands. LNG refueling infrastructure is extremely limited, though targeted investment along key freight routes could allow maximum coverage at minimal cost.

186 DOE, EIA, ***AEO 2012,*** Table A.11
187 SAFE analysis based on data from: DEO, EIA; and U.S. Bureau of Economic Analysis
188 ORNL, *Transportation Energy Data Book,* Table 1.13
189 DOE, EIA, *AER 2010,* Table 8.2a
190 ORNL, *Transportation Energy Data Book,* Tables 1.12 and 5.2

The federal government has a stake in minimizing these and other barriers to commercialization of advanced vehicles through public policy. In fact, a robust set of policies already exists, including tax credits for vehicles, grants for manufacturing, and research and development on technological breakthroughs that would drive down costs and improve performance. These policies should be reinforced and expanded upon where possible, especially when limited public dollars can be effectively leveraged to break down market barriers. Research and development, infrastructure, and early stage deployment efforts stand out as ideal targets.

3. **Policy can and should support increased domestic production of oil.**
U.S. oil dependence is fundamentally an issue of consumption. As long as oil plays a substantial role in the domestic economy, the United States is unlikely to achieve a meaningful level of energy security. Nonetheless, the economic benefits of rising domestic production are significant, and policy should provide support for its expansion where it can be done effectively and safely.

The oil and gas industry should have access to produce the most cost-effective resources that can be developed in an environmentally safe manner. Without question, federal environmental regulations should hold the industry to the highest performance standards attainable. However, with such standards in place, promising tracts of federal territory—both onshore and offshore—should be offered to industry for development. This approach has the potential to further increase domestic production levels while generating significant revenues for the federal treasury.

These broad policy principles reflect the key implications of this report and convey the policy approach recommended by the Energy Security Leadership Council. America's dependence on oil represents one of the most profound dangers to the nation's economy and security, and addressing this vulnerability must be a top priority for lawmakers. As the debate continues to evolve in the coming months, the ESLC will continue to engage, including by offering additional, specific policy recommendations where appropriate.