Oil Security Index

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Securing America's Future Energy

roubini GLOBAL ECONOMICS

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Introducing the Oil Security Index

The Oil Security Index is an analytical tool developed by Securing America's Future Energy (SAFE) in partnership with Roubini Global Economics (RGE). The Index is designed to be an intuitive tool for policymakers, business leaders, and the general public to easily measure and compare the relative oil security of more than a dozen countries around the world.

The term oil security can mean different things to different countries. For some—particularly those almost exclusively reliant on imports—physical supply security takes precedence over nearly any other measure. A major oil-production outage in a key supplier can result in steep inventory draws over a period of several months. This was the case for much of Europe during the Libyan Civil War in 2011. For other countries, physical supplies may be more dependable, but overall dependence on oil and inefficient use of oil leave their economies exposed to high and volatile oil prices. This is arguably the case for the United States, where oil price shocks remain a serious concern in spite of falling import levels.

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The Oil Security Index uses seven metrics that capture the three aspects of oil security

To develop a comparable, quantitative measure of oil security, the Index uses seven metrics that capture the three aspects of oil security: the structural dependency of a country's economy on oil, a country's economic exposure to the price of oil and changes in this price, and the security of a country's oil supplies. Taken together, this comprehensive set of indicators provides a robust assessment of a country's relative vulnerability to changing conditions in the global oil market. In this iteration of the Index, the following countries are ranked; Australia, Brazil, Canada, China, Germany, India, Japan, Mexico, Russia, Saudi Arabia, South Africa, the United Kingdom, and the United States.

The rankings and results for the Index overall and its individual metrics are intended to be compared and tracked over time. In addition, a numerical result is derived for the United States overall and for each of its seven metrics from the year 2000 to the present day. Complementing these quantitative measures is a qualitative assessment of the long-term prospects for each country included in the Index. Future updates of the Index will include these quantitative and qualitative components as well as a review of relevant market and policy developments. Quarterly data is used to construct the results and rankings and is shown historically from Q1 2000. All data and analysis are also presented in an interactive online tool.

It is important to understand what this Index does and does not provide. The Index does not provide a raw score for all countries evaluated that could be used to track an individual country's absolute level of oil security. In large part, this is because the indicators used to develop the Index are not easily comparable and do not lend themselves to being rolled into a single composite score. Instead, the Index provides a country's ranking for each indicator and an overall ranking. That is, the Index is best viewed as providing a relative comparison of oil security of multiple countries over time.

The Index measures oil security across three categories comprising seven metrics:

Structural Dependency

Definition: a country's structural dependence on oil due to capital stock and other economic factors. A country's structural dependency metrics typically change slowly over time, providing relatively consistent measures of vulnerability regardless of prevailing price conditions.

Oil Intensity captures the volume of oil consumed per unit of GDP (in this case, per $1,000 of GDP). As such, oil intensity is a direct measure of the structural importance of oil in a country's economy and is perhaps the most meaningful measurement of 'oil dependence.' Oil intensity changes little over short time periods and is almost entirely determined by oil-use efficiency levels, fuel diversity, and economic growth.

Fuel Consumption Per Capita uses the size of a country's population, as opposed to the size of its economy, to contextualize oil consumption. This measure can be useful in comparing the different levels of oil consumption of countries with vastly different population sizes or GDPs. Fuel consumption per capita can give insight into a country's level of oil efficiency or its future oil demand growth potential.

Economic Exposure

Definition: a country's direct economic exposure to oil price volatility. Economic exposure is of course a function of structural dependency, but it is also more heavily driven by exogenous changes in global oil prices, and therefore variable over time. Economic exposure is measured by spending on oil across typical indicators like GDP and the current account.

Total Spending on Oil as a Percentage of GDP is the most straightforward measurement of a country's economic exposure to oil. Changes in oil prices have direct effects on the ability of governments, businesses, and consumers to effectively plan, budget, and make expenditures from quarter to quarter. A country's transportation sector is particularly sensitive to changes in oil prices, as oil is the predominant fuel in the sector and there are few substitutes (demand is therefore highly inelastic).

Total Spending on Net Oil Imports as a Percentage of GDP shows the extent to which Index countries rely on imported oil. This indicator provides a measurement of revenue either earned or spent through the oil trade and, therefore, oil's effect on a country's current account balance.

Oil Exports as a Percentage of Total Exports by Value highlights the degree to which the economies of oil-producing countries are dependent on oil revenues for economic growth. In other words, 'oil dependence' should be evaluated not only in terms of an economy's consumption requirements, but also its production and export requirements. Just as oil price spikes are devastating for many consumers, oil price collapses are highly problematic for non-diversified producers.

Supply Security

Definition: a country's vulnerability to physical supply disruptions and its response capabilities. While supply disruptions are typically addressed by the market through changes in prices, the adjustment period can be highly damaging for import-dependent nations, especially if adequate emergency inventories are unavailable.

Oil Supply Security is a proxy for the risk of disruption to a country's oil supply in both the short term (e.g., political instability) and long term (e.g., tax and regulatory schemes). This metric accounts for the differences in risk between the different types of supplies that a country relies upon to meet its needs (in some instances, both domestic production and imports from a selection of other countries).

Total Oil Stockholdings as a Percentage of Consumption indicates how prepared a country is to meet its own short-term needs in the event of a physical disruption. Total stocks include commercial inventories (held by companies) and public stocks (held by governments).

Understanding Oil Security

Oil is a critical economic input and holds a larger share of total global primary energy consumption—33 percent—than any other individual energy source.

Crude oil and its numerous derivative fuels play a vital role in the economy of nearly all countries around the world, both developed and developing, across a variety of end-use sectors.[1] And while petroleum fuels serve a variety of functions, no sector relies more heavily on oil than transportation, where products like gasoline and diesel account for more than 90 percent of delivered energy.[2]

Historically, petroleum fuel demand growth is highly correlated with economic growth, rising income levels, and expanding transportation infrastructure. In developed countries and regions like North America, Western Europe, and industrialized Asia, oil demand grew rapidly in the post-World War II era of economic growth. Millions of drivers took to the road and transport of consumer goods became increasingly important. This dynamic has remained remarkably consistent. Emerging countries today are following a similar pattern, taking up oil-reliant transportation options much more readily than any other alternatives.[3] As a result, all economies have become (to various degrees) vulnerable.

Characteristics of the Global Oil Market

The balance between global oil supply and demand has tightened sharply over the past decade, largely due to a rapid increase in oil demand from emerging markets and a supply system that is heavily reliant on unstable oil-producing countries and regions. The result has been an escalation of oil prices to record highs and a dramatic increase in oil price volatility, which have in turn caused substantial economic turmoil globally.

It is important to understand the key features of the global oil market that have driven high and volatile oil prices. Most notably, incremental investment in low-cost oil supplies is highly constrained by a set of anti-competitive forces that undermine efficiency and flexibility. By some estimates, as much as 85 percent of global proved conventional oil reserves are held by state-run national oil companies (NOCs).[4] While many NOCs operate at the frontier of industry technological capability and efficiency, others do not, and are often hamstrung by government interference. Nearly all NOCs function essentially as instruments of a central government, and revenues generated by resource production are allocated by political leadership. This often results in the diversion of oil revenues to political and social programs rather than activities that promote oil production.

In addition, the majority of the world's most resource-rich NOCs are members of a producers' cartel, the Organization of the Petroleum Exporting Countries (OPEC). Together, OPEC's 12 members control more than 70 percent of global oil reserves and account for roughly 40 percent of the oil supplied into today's global marketplace.[5] OPEC actively works to achieve intended price targets, and is often (though not always) effective in doing so. In addition to coordinated production quotas, OPEC member countries have often experienced conflict or instability that has impacted production and disrupted the global oil market. These disruptions have far exceeded seasonal outages in other countries and regions (recent examples include Venezuela, Libya, Iraq, and Iran). OPEC countries also have limited incentives, and sometimes limited capability, to effectively invest in developing their vast resources of easy-to-access conventional oil. Many are also becoming increasingly dependent on higher oil prices (in some cases today above $100 per barrel and rising) to meet growing social

1 BP, plc., Statistical Review of World Energy (Statistical Review) 2013, at 41
2 U.S. Energy Information Administration (EIA), Annual Energy Review (AER) 2011, Table 2.1e
3 "Emerging countries" refers to all non-OECD countries
4 See, e.g., U.S. EIA, Energy in Brief, Who are the major players supplying the world oil market? Last updated March 15, 2012
5 SAFE/RGE analysis based on data from: BP

FIGURE 1

OECD and Non-OECD Oil Consumption

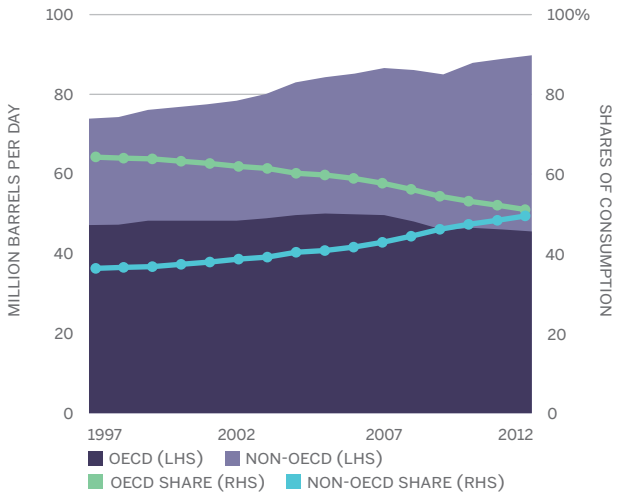
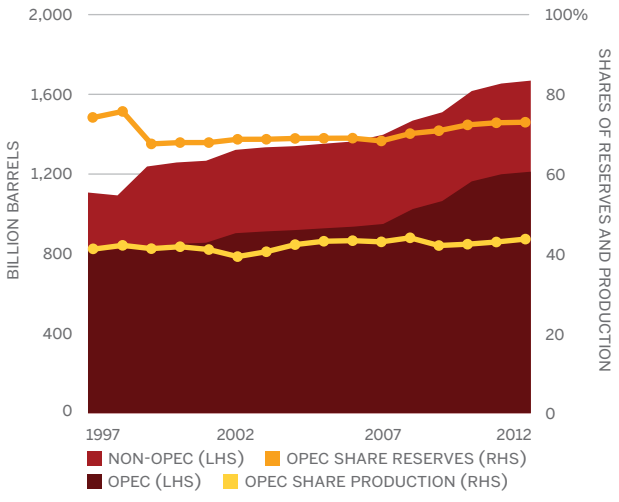


FIGURE 2

Global Oil Reserves and Production by Source



Source: BP Statistical Review 2013

spending demands. This further incentivizes policies aimed at keeping prices high.

Seeking Stronger Oil Security

Many oil-consuming countries have heeded the price trends and volatility of the past decade and are now actively working to enhance their oil security. Some are making greater strides than others, and outlooks vary, but the commonality between efforts is that countries are acting to reduce the overall oil intensity of their respective economies. In some cases, countries are also exploring for and developing new domestic oil resources. Perhaps the most prominent efforts so far include establishing standards for vehicle fuel efficiency. Such standards are becoming increasingly commonplace in both developed and emerging countries. Additional efforts are increasingly focused on support for alternative vehicle fuels, from electricity and natural gas to hydrogen, through research and development funding and/or incentives. In some countries, policies have also promoted the displacement of oil in other sectors, such as power generation. For example, the United States has reduced oil use from approximately 17 percent of total generation in the mid-1970s to less than 1 percent today. [6]

On the supply side, increasing light, tight oil production (LTO) from shales, carbonates, and other source-rock formations has made the United States the standout among a handful of production bright spots outside the OPEC cartel (others include Canada, Brazil, Colombia, and Kazakhstan). This has enabled the United States to decrease its import needs by more than 50 percent since 2005, with obvious benefits for the current account balance and domestic investment.

Nevertheless, oil retains and indeed is strengthening its importance as a vital economic input. This holds true in developed countries where oil demand remains at just below 50 million barrels per day (mbd), and in emerging countries, where demand has increased by approximately 20 mbd over the past two decades.[7] In fact, oil demand in non-OECD countries is set to become the majority share of total global oil demand next year.[8]

Currently, a global recession that has dampened oil demand, a still-weak recovery that has so far limited a strong rebound in demand, particularly in developed countries, and the emergence of new unconventional oil supplies in North America are providing some respite from tightness between oil demand and supply in the market. However, the underlying market dynamics of

6 U.S. EIA, AER 2011, Table 8.2b; and U.S. EIA, Short Term Energy Outlook (STEO), May 2013, Figure 7.2, at 94

7 BP, plc., Statistical Review 2013, Historical data

8 International Energy Agency (IEA), Medium Term Oil Market Report (MTOMR), 2013, Table 1

FIGURE 3

Quarterly Oil Price and OPEC Spare Oil Production Capacity

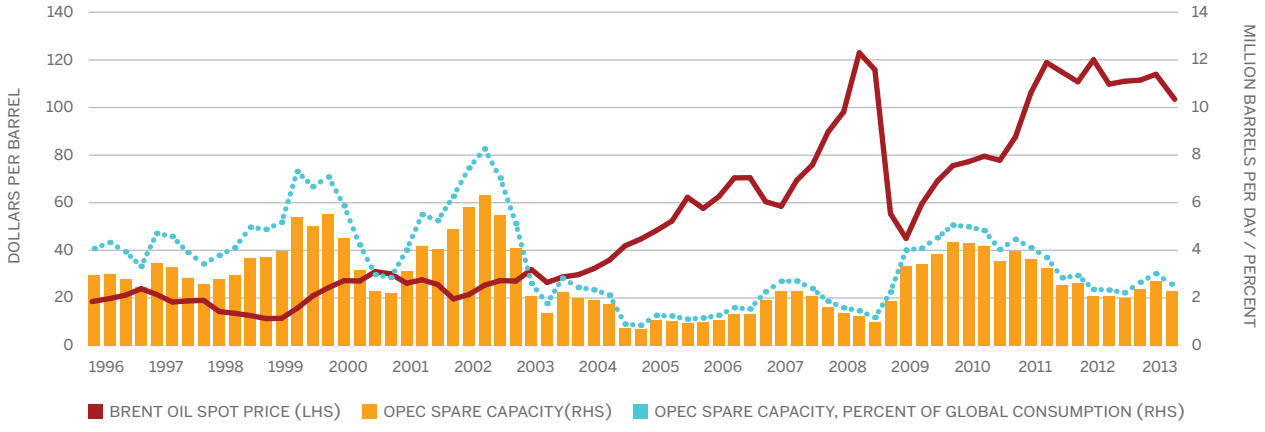


FIGURE 4

Oil Demand by Index Country, 2003 and 2012

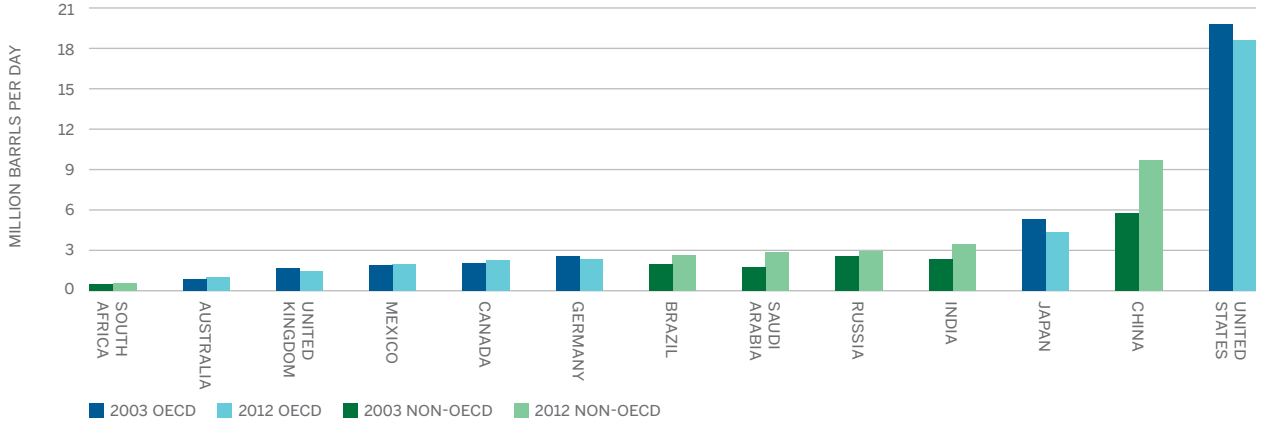


FIGURE 5

Forecast Oil Demand Growth, 2011 to 2035

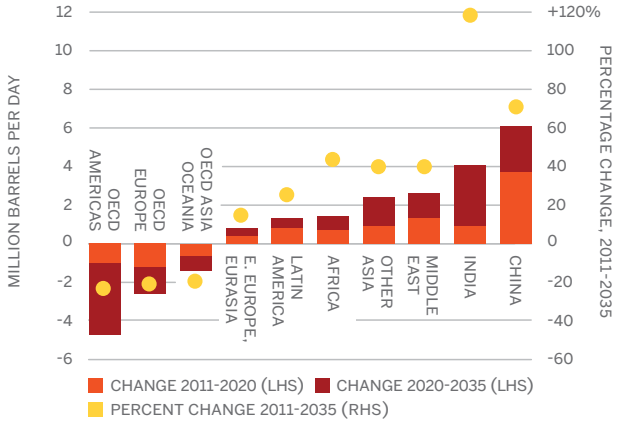
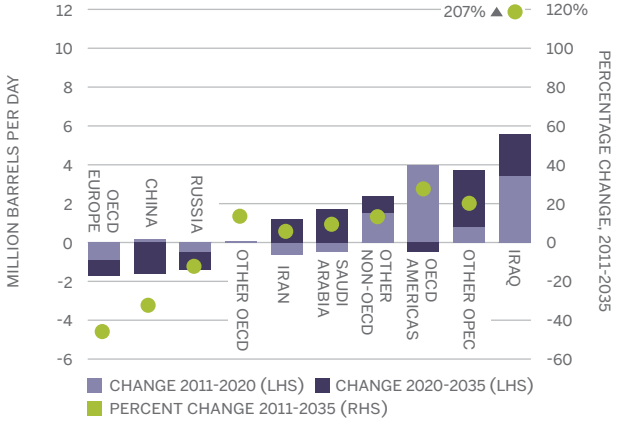


FIGURE 6

Forecast Oil Production Growth, 2011 to 2035



Source Figure 3: U.S. EIA, STEO; Figure 4: BP Statistical Review 2013; Figure 5,6: IEA, WEO 2012

increasing non-OECD oil demand and limited growth of low-cost oil supplies suggest that significant market volatility and challenges to oil security will persist.

Trends that Undermine

On the supply side, regional fallout from the "Arab Spring" continues to hinder investments in new production capacity in generally low-cost conventional Middle Eastern resources. Physical security risks to oil fields and production facilities, including those outside the Middle East, still remain. Deliberate underinvestment in production capacity by OPEC and others will also threaten the market's ability to provide adequate, affordable supplies of oil over the long term. Furthermore, the concentration of oil reserves in OPEC countries increases their influence over the market and prices. Current forecasts from the International Energy Agency (IEA) estimate that—contrary to conventional wisdom—OPEC will grow its share of global production over the next twenty years despite the improved production outlook in some non-OPEC countries.[9]

The concentration of key suppliers in the Middle East and North Africa could also carry a heightened risk due to reliance on sometimes-vulnerable supply routes. This is a concern to all oil-consuming countries, not only those importing from the countries or regions in question. Oil flow through the Strait of Hormuz (located between Iran and Oman), for example, is forecast to rise from approximately 18 mbd today (42 percent of global trade) to 25 mbd in 2035 (50 percent of global trade).[10] Finally, in other countries and regions, increasingly difficult-to-access resources remain more costly to extract—despite technological advances that render them economically viable at current prices—and therefore have so far had little impact on the global cost curve.

On the demand side, non-OECD countries are generally expected to experience brisk oil consumption growth, particularly in their transportation sectors. This growth is expected to more than offset gradual and continued declines in consumption in OECD countries. China, for example, has become the world's largest passenger car market with annual sales expected to surpass 17 million units in 2013.[11] By contrast, sales in the United States are likely to number approximately 15 million. With Chinese car ownership at roughly 70 per 1,000 people (versus 800 per 1,000 people in the United States), the potential for additional Chinese automobile demand remains substantial.[12]

The net global increase in oil consumption for transportation is expected to come despite a variety of measures to reduce the oil requirements of the underlying mobility demand growth. These measures include lower subsidies and/or higher taxes on oil products, as well as strengthened efficiency measures. Moreover, because replacing the vehicle (and capital) stock takes many years, and in some cases decades, the prospects for significant reductions in overall oil demand and consumption rates in the transportation sector are limited in the near term and strengthen substantially only a decade or more into the future. Finally, beyond light-duty passenger transportation, freight is expected to play a key role in driving global oil demand growth over the next quarter century, and expanded air travel and maritime activity will also contribute.

Pressing Need for Improvement

For countries across the globe, reliable and affordable supplies of oil are far from secure over either the short or long term. Countries heavily dependent on oil remain highly vulnerable to changes in prices. Today, and into the foreseeable future, high prices will detract from economic activity and growth. Unpredictable spikes could be even more damaging. Active steps to reduce exposure, enhance response capabilities, and ultimately strengthen oil security remain a pressing need. The Oil Security Index uses metrics that capture trends in underlying variables—oil prices, oil revenues and spending, economic growth, efficiency, oil consumption and production, stockholdings, and the risk environment—to track the evolution of oil security over time.

9 IEA, World Energy Outlook (WEO) 2012, Table 3.4, at 102
10 Id., at 79

11 SAFE/RGE analysis based on data from: China Association of Automobile Manufacturers and Motor Intelligence
12 Oak Ridge National Laboratory (ORNL), Transportation Energy Data Book (TEDB), Edition 32, Table 3.5

Metrics and Findings

The Index's seven metrics reveal important information about different aspects of a country's oil security. These metrics are organized into three categories; Structural Dependency, Economic Exposure, and Supply Security.

Descriptions of the seven metrics in addition to the results for the Index countries are presented below.

Structural Dependency

Definition: a country's structural dependence on oil due to capital stock and other economic factors. A country's structural dependency metrics typically change slowly over time, providing relatively consistent measures of vulnerability regardless of prevailing price conditions.

Oil Intensity is calculated as the number of barrels of crude oil consumed per $1,000 of GDP, which estimates the importance of oil to a country's economic activity. Economies that are heavily reliant on oil as a fuel source are inherently more vulnerable to the impacts of supply disruptions and oil price volatility than those that are not. This is particularly true for economies where the ability to switch rapidly to substitute fuels—whether for industrial, transportation, electric power, or other uses—is limited. Historically, many developed economies have been heavily reliant on oil as a fuel in the transportation sector. Today's developing

CALCULATION
OIL INTENSITY

This metric is calculated as the volume of oil consumed in a country divided by constant GDP (2005 U.S. dollars).

FIGURE 7
Oil Intensity, 2011 and 2012

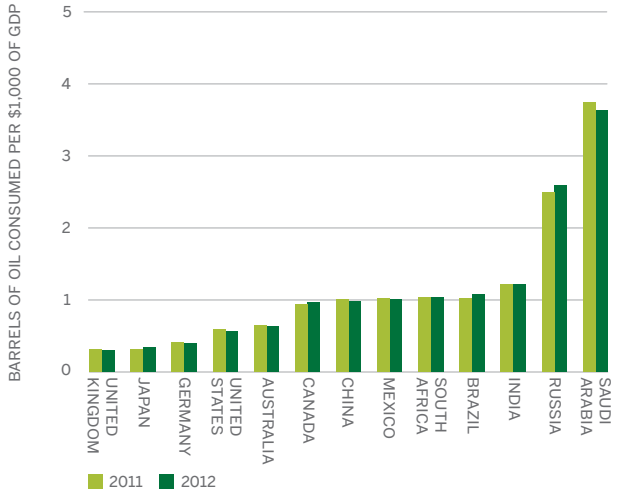
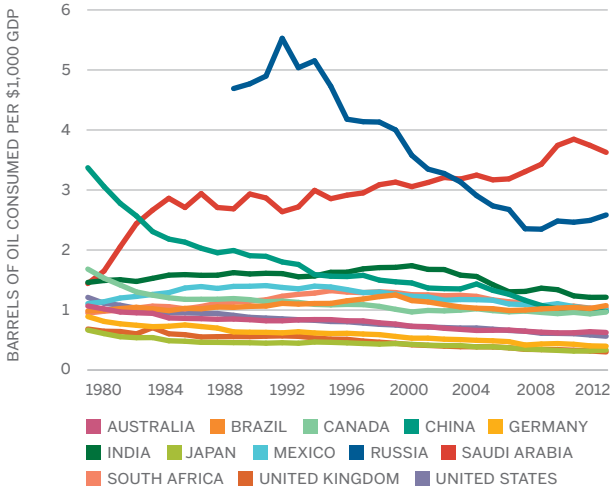


FIGURE 8
Oil Intensity, 1980 to 2012



Source Figure 7: SAFE/RGE analysis; Figure 8: SAFE/RGE analysis based on data from BP Statistical Review 2013 and World Bank

economies—whose rapidly expanding middle classes are using newfound spending power to increase personal mobility—are following a similarly oil-dependent path despite near-global efforts to improve the efficiency of road vehicles and diversify fuel sources.

Change in this metric comes as a result of very large, gradual shifts in the energy mix used to power the capital stock. A country's rate of economic growth (or contraction) and efficiency of its oil use are also critical determinants of oil intensity over time. Because it is a volume-based measurement, oil intensity tends to remain relatively constant over shorter time periods. Oil intensity, therefore, provides a stable, endogenous metric that can only show meaningful improvement through some combination of technological change and economic growth. By contrast, some other metrics will see "improvement" due to exogenous changes in the market, such as price decreases. This price-change-based "improvement" will not, however, be a true indication of ongoing and overall vulnerability.

Most countries included in the Index have been observing gradual declines in oil intensity over the past three decades. Highly efficient European nations and Japan lead the way, consuming between 0.30 and 0.40 barrels of oil per $1,000 of GDP. The United States and Australia consume roughly twice as much oil per unit of economic output (0.56 and 0.63, respectively) as the United Kingdom and Japan (0.32 and 0.33, respectively)—although all four have approximately halved their oil consumption per unit of output since 1980. Significant declines in oil intensity have been observed almost exclusively in developed countries, which also began the period with relatively more efficient use of oil per unit of GDP. Although China has experienced the largest decline in oil intensity over the past several decades, this is more a function of its rapid economic growth outpacing its oil demand growth than of its improved levels of efficiency. Russia and Saudi Arabia remain particularly heavy consumers of oil per unit of economic output, at 2.58 and 3.62, respectively.

Fuel Consumption per Capita provides an estimate for the vulnerability of individuals and households to high and volatile oil prices. As prices have increased over the past decade, the percentage of

CALCULATION
FUEL CONSUMPTION PER CAPITA

This metric is calculated as the volume of fuel consumed in a country divided by the country's population. The fuel volume includes gasoline, gas oil, and diesel oil.

FIGURE 9

Fuel Consumption per Capita, Q1 2012 and Q1 2013

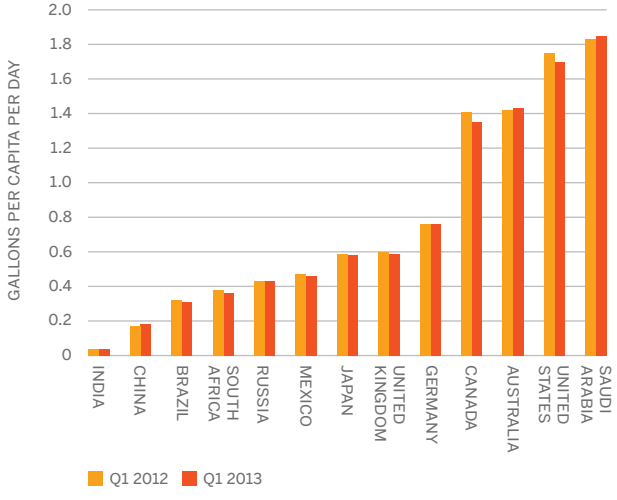
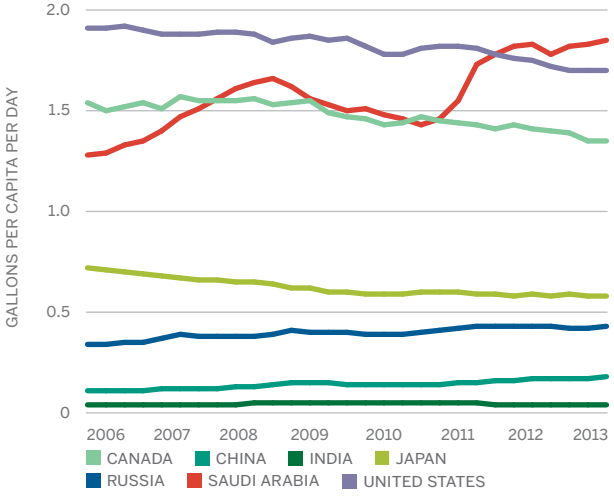


FIGURE 10

Fuel Consumption per Capita, Select Index Countries, Q1 2006 to Q1 2013



Source: SAFE/RGE analysis

their budgets that individuals must dedicate to fuel purchases has also risen, although the use of more efficient products (and subsidies for oil consumption) can have a mitigating (or offsetting) effect.

Shelter, sustenance, travel, healthcare, and many other items combine to form a portfolio of personal spending needs. Without a corresponding increase in income in the short term, when the cost of one portfolio item increases on a per unit basis, a greater proportion of spending must be allocated to that item unless consumption can be readily reduced. Personal travel—the primary fuel-dependent item in most individual portfolios, particularly in highly-motorized economies—tends to be fairly inflexible in the short run, making fuel consumption price inelastic. As a result, those that must travel must offset the higher cost with a decrease in spending on other items.

Saudi Arabia (1.85 gallons per capita per day) and the United States (1.70) had the highest levels of consumption in Q1 2013. Saudi Arabia's high per capita fuel use is largely a function of fuel subsidies that promote inefficient oil use. The oil consumption of other wealthy countries with higher-than-average per capita consumption, like Australia (1.43) and Canada (1.35), is driven by their large geographic size and distributed populations. More densely-populated and efficient European countries, as well as Japan, consume approximately one third the fuel of the United States on a per capita basis. These countries also tax fuel at a higher rate, which increases its price and, all other things equal, further encourages lower levels of consumption either through the use of alternatives to oil or greater efficiency. In most developed countries, fuel consumption per capita is trending downwards. Fuel consumption per capita in less developed countries is currently substantially lower, but growing rapidly, driven in part by increased vehicle ownership. For example, per capita fuel consumption in China has more than doubled from 0.08 in Q1 2000 to 0.18 in Q1 2013.

CALCULATION
TOTAL SPENDING ON OIL AS A PERCENTAGE OF GDP

This metric is calculated as the volume of oil consumed in a country multiplied by the nominal oil price in U.S. dollars, divided by the country's nominal GDP in U.S. dollars. The oil volume includes crude oil, gas oil, diesel oil, gasoline, kerosene, and fuel oil. Consumption is calculated from production, import, export, and stock data. Oil prices are taken as the average wholesale spot market price across a selection of countries and regions.

FIGURE 11

Total Spending on Oil as a Percentage of GDP, Q1 2012 and Q1 2013

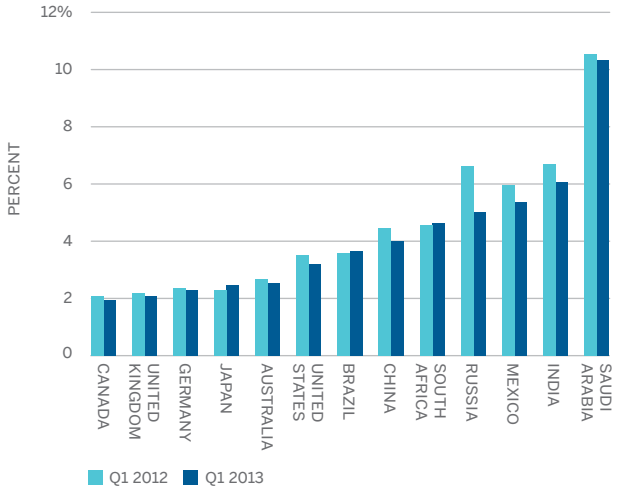
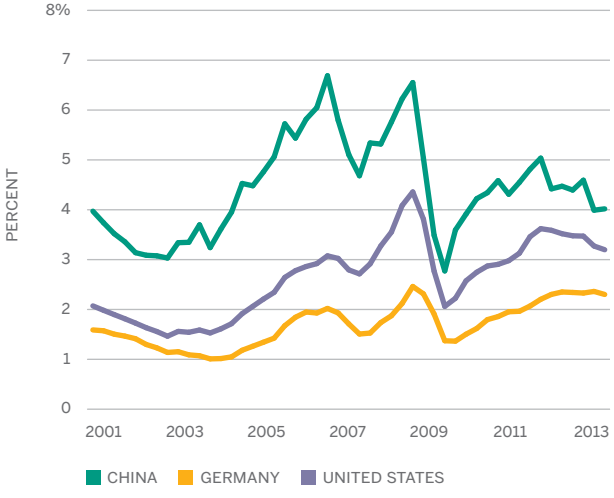


FIGURE 12

Total Spending on Oil as a Percentage of GDP, Select Index Countries, Q1 2001 to Q1 2013



Source: SAFE/RGE analysis

Economic Exposure

Definition: a country's direct economic exposure to oil price volatility. Economic exposure is of course a function of structural dependency, but it is also more heavily driven by exogenous changes in global oil prices and therefore variable over time. Economic exposure is measured by spending on oil across typical indicators like GDP and the current account.

Total Spending on Oil as a Percentage of GDP estimates the current cost of oil consumption and accounts effectively for—sometimes rapidly—changing oil prices. This metric is an important inclusion in the Index, because even as many economies become less oil intense, high oil prices push industrial and consumer spending on petroleum fuels to levels that can have severe, negative impacts on growth (demand destruction), and even play a role in triggering recessions.

For governments, businesses, and citizens, there are few substitutes for gasoline or diesel, and most oil demand is relatively inelastic. Although there will be some reduction in consumption as a result of higher prices, it will be less than proportional. Furthermore, without a corresponding gain in efficiency (which is difficult to achieve in the short term), any given use of oil will be no more productive, but simply more costly. The net result for the economy as a whole is that higher prices for petroleum products leave less money available for other items. Higher oil prices therefore function as a negative stimulus to the economy, or effectively, as a tax. This metric therefore provides insight into the impact of volatile prices on the economy as a whole.

The results show substantial variation—variation that noticeably correlates with changes in oil prices over time. The countries with lower levels of oil intensity experience both lower spending on oil as a percentage of GDP and less fluctuation in these percentages over time. High national GDP moderates the effect of relatively inefficient oil use. This is true of the United States (3.2 percent), for example, at least in comparison to European peers such as Germany (2.3) and the United Kingdom (2.1). For Q1 2013, the lowest percentage is observed in Canada (1.9) and the highest in Saudi Arabia (10.3). Countries with smaller and less efficient economies fare worse.

Total Spending on Net Oil Imports as a Percentage of GDP provides an estimate for the exposure of a country's trade balance to the cost of oil. Approximately 60 percent of daily global oil consumption occurs in a country different than where it was produced.[13] For those countries that either export large volumes or rely heavily on imported volumes, volatile oil prices and inconsistent levels of domestic production can have a substantial impact on the size of their trade deficit or surplus.

Running large and persistent trade deficits can pose challenges to an economy, because it creates a dependency on consistent capital inflows from foreign entities. This compounds a nation's international debt burden, the service obligations of which can amount to a sizeable drag on economic growth. Measuring a country's exposure to such dynamics is therefore an important inclusion in the Index.

Total import spending as a share of GDP is a function of relative import/export volumes, which are themselves a function of domestic consumption and production, prices, and GDP. Oil price changes are typically much more immediate than changes in production or consumption quantities. For exporters, the question is largely one of revenue generation and stability for budgeting and planning purposes. For importers, reducing domestic oil consumption and increasing domestic oil production act to limit the exposure of the trade balance to oil price fluctuations. Such changes will not happen from quarter to quarter, but they can occur in as little as a few years, for example as a result of recessionary conditions that cause significant declines in consumption or major developments on the domestic supply side. The United States provides the most obvious recent example, with a combination of rising domestic oil production and a decline in oil consumption resulting in a fall in net oil and petroleum product imports of more than 40 percent between 2005 and 2012, from 12.6 mbd to 7.4 mbd.[14]

Although absolute spending on net oil imports remains highest in countries like the United States and China, once adjusted for economy size, India and South Africa experience the largest import costs, at 4.8 and 4.9 percent of their respective GDPs in Q1 2013. Net oil exporters Saudi Arabia, Russia, Canada, and Mexico

13 SAFE/RGE analysis based on data from: BP
14 U.S. EIA, STEO, May 2013, at 5

earn revenue from oil exports, effectively observing negative spending on net oil imports. In countries where oil production and consumption are closely aligned, such as Brazil and the United Kingdom, spending on net oil imports is equivalent to only a very small percentage of GDP—0.2 and 0.8, respectively in Q1 2013.

Oil Exports as a Percentage of Total Exports by Value provides a measure of a country's reliance on oil exports for revenue. Typically, countries with more diversified export bases are better able to maintain fiscal stability whether the price of oil is high or low. However, a country that is heavily reliant on oil export revenues to meet its budgetary needs (a common phenomenon in many major oil-exporting countries and especially those where NOCs are dominant) is less able to withstand negative price shocks.

For most countries in the Index, oil export revenues are not a meaningful share of total export revenue, and many actually spend heavily on net oil imports. Saudi Arabia (88 percent) and Russia (51 percent) are the obvious exceptions, deriving most of their export revenues from oil sales. With oil playing such a key role, even moderate swings in price have a substantial impact on both oil export revenues and total export revenues. For example, the value of Saudi Arabia's oil exports fell from $281 billion in 2008 (when oil prices averaged almost $100 per barrel) to just $162 billion in 2009 (when oil prices averaged close to $60 per barrel).[15] Saudi Arabia's total export revenues shifted in concert, falling from $313 billion to $192 billion, a drop of approximately 40 percent.[16] Russia fared similarly in this time period, as did other major oil producers that rely heavily on oil for export revenues. While home to more diverse economies, Canada and Mexico (which both export crude oil), and India (which both exports petroleum products) also observe a strong contribution to total export revenues from oil exports and are impacted by price fluctuations.

15 OPEC, Annual Statistical Bulletin 2012, Tables 2.3 and 2.4
16 Id.

CALCULATION
TOTAL SPENDING ON NET OIL IMPORTS AS A PERCENTAGE OF GDP

This metric is calculated as the volume of net oil imports multiplied by the oil price, divided by nominal GDP. For net oil-exporting countries, this measures the revenue from net oil exports as a percentage of GDP. Again, this volume includes crude oil, gas oil, diesel oil, gasoline, kerosene, and fuel oil, and the oil price is the average wholesale market price.

FIGURE 13

Total Spending on Net Oil Imports as a Percentage of GDP, Q1 2012 and Q1 2013

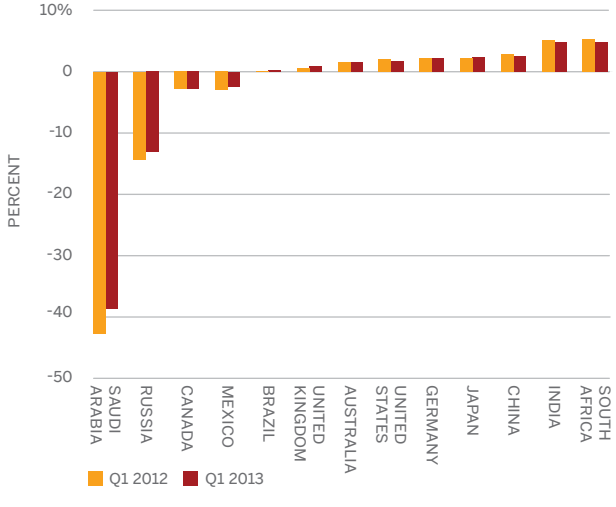
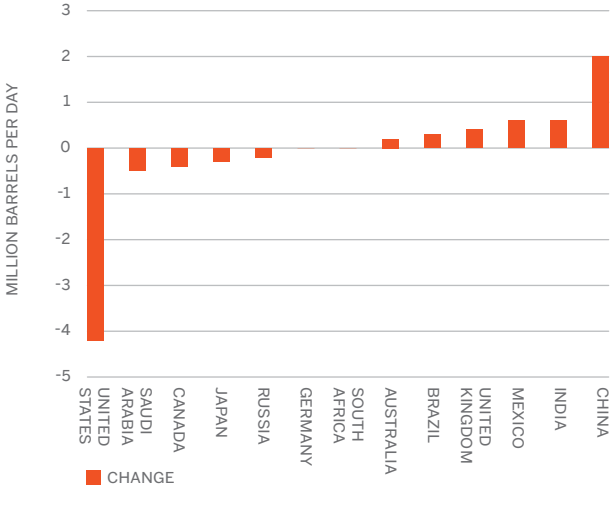


FIGURE 14

Change in Estimated Net Oil Imports, 2007 to 2012



Source Figure 13: SAFE/RGE analysis; Figure 14: SAFE/RGE analysis based on data from BP Statistical Review 2013

Supply Security

Definition: a country's vulnerability to physical supply disruptions and its response capabilities. While supply disruptions are typically addressed by the market through changes in prices, the adjustment period can be highly damaging for import-dependent nations, especially if adequate emergency inventories are unavailable.

Oil Supply Security provides a measure of disruption risk to a country's oil supply in the near term (i.e. supply shock) and longer term (e.g. as a result of insufficient investment in production capacity). Some countries are more susceptible to supply chain disruptions and unplanned outages than others. In the event of a disruption, these countries will experience additional costs beyond those caused only by the increase in price. The additional costs might include product mismatching, supply rerouting, forced contract-to-spot-market switching, drawdown of stockpiles, etc. The regulatory and tax frameworks required to encourage investment in future production also vary across countries.

This metric uses RGE's Social, Institutional and Regulatory Risk (SIRR) indicator, which scores countries from 0 (worst) to 10 (best) based on a number of factors to provide a proxy for the security of a country's crude oil output. The factors included in the indicator are; social and political risk, government effectiveness, business environment and regulatory quality, and property rights protection and corporate governance. Based on these scores, an aggregated result is derived for each Index country that combines the risk score from its domestic production and the weighted risk scores of its imports.

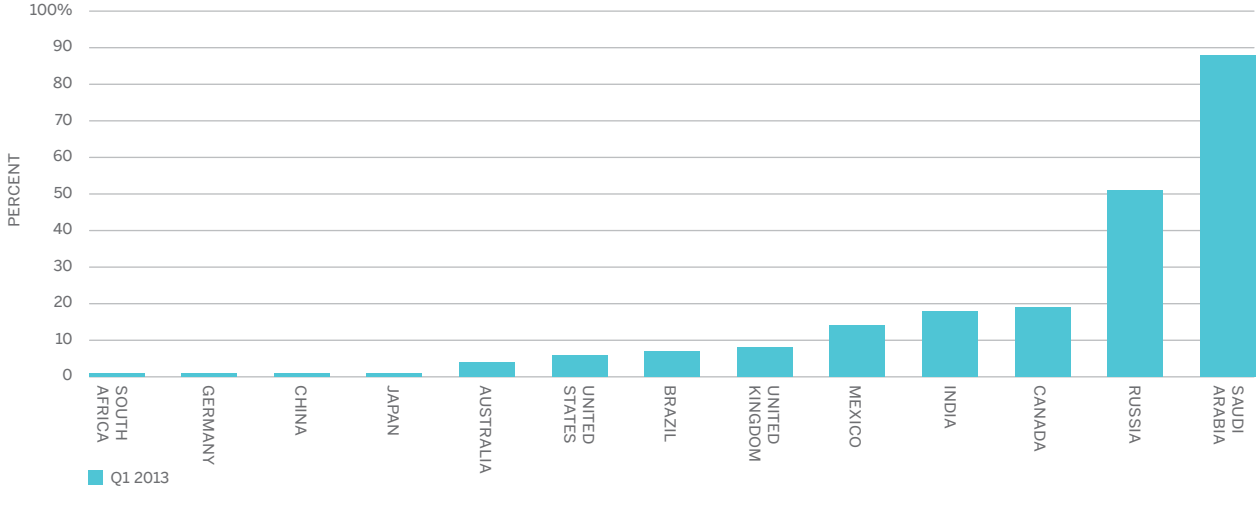
Many of the major oil exporters that supply Index countries score poorly on this metric. These exporters include Azerbaijan (3.8), Nigeria (3.3), Iran (3.2), Russia (3.0), Angola (2.7), Algeria (2.7), Venezuela (2.6), Iraq (2.2), and Libya (2.1). Other major oil producers like Norway (8.5), Canada (8.3), the United

CALCULATION
OIL EXPORTS AS A PERCENTAGE OF TOTAL EXPORTS BY VALUE

This metric is calculated as the value of oil exports divided by the value of total exports. The value of oil exports is calculated using the volume of exports multiplied by the oil price. Again, this volume includes crude oil, gas oil, diesel oil, gasoline, kerosene, and fuel oil, and the oil price is the average wholesale market price.

FIGURE 15

Oil Exports as a Percentage of Total Exports by Value, Q1 2013



Source: SAFE/RGE analysis

Kingdom (7.9), and the United States (7.6) are considered less at risk.

Of the Index countries, Russia (3.1) is considered the most susceptible to a supply disruption. And while this might appear counter-intuitive given its status as a major oil producer and exporter, Russia's production occurs in a very poor domestic business and regulatory environment. Russia is followed by China (4.4), Germany (4.4), India (4.6), and Japan (4.7), which are all highly dependent on oil imports. Canada (7.8), the United Kingdom (6.7), and the United States (6.6) are the least at risk of supply disruptions thanks to significant levels of domestic production and imports from relatively secure neighbors. Notably, the United Kingdom's score has declined markedly in recent years (from 8.4 as recently as 2005) as it has become more dependent on imports to meet its consumption needs. Conversely, the United States' score has risen as greater domestic production reduces the country's reliance on imports from unstable countries (from 5.8 in 2006). Canada leads the other major oil exporters as the lowest risk country in the Index due to its very low import requirements and strong regulatory, legal, and tax frameworks.

Total Oil Stockholdings as a Percentage of Consumption focuses specifically on a country's ability to respond to supply shocks. Crude oil and product stocks provide an important market buffer that can limit oil price volatility and allow time for supply chains to adjust or be reestablished. The United States used releases from strategic stockpiles in the aftermath of Hurricane Katrina, while IEA member countries collectively used releases to help offset the Libyan supply outage in 2011. Because oil is fungible, releases from stockpiles benefit all consumers in the global market from a price perspective, not just those who directly receive the oil that is released. Verbal affirmations that stockpile releases are an option and will be used if necessary have also been used to provide reassurance to the market and limit oil price volatility, notably as

CALCULATION
OIL SUPPLY SECURITY

Using RGE's SIRR indicators, this metric is calculated as a weighted average of the SIRR scores for each country an Index country imports oil from (proportional to its share of total imports), and a SIRR score for the Index country's domestic oil production (which can be zero). Combined this provides a composite risk score for a country's estimated oil consumption (calculated as the total volume of domestic production plus net imports).

FIGURE 16

Oil Supply Security, Select Index Countries, Q1 2000 to Q1 2013

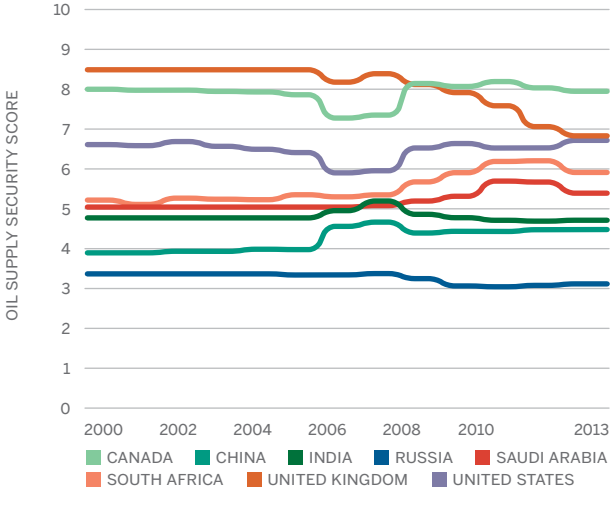
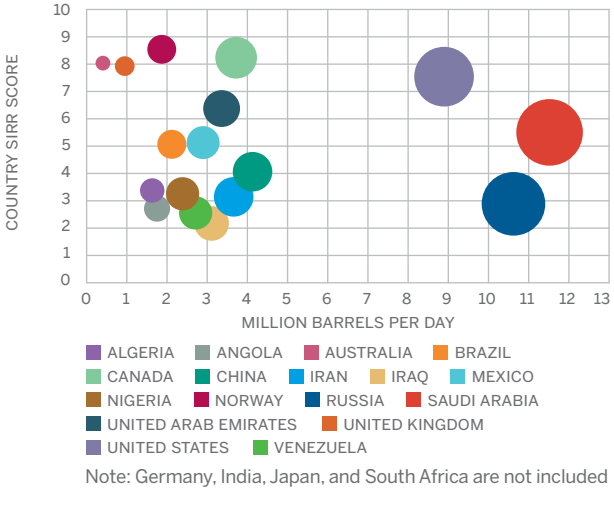


FIGURE 17

SIRR Score and Oil Production, Select Index and Other Countries, 2012



Note: Germany, India, Japan, and South Africa are not included

Source Figure 16: SAFE/RGE analysis; Figure 17: SAFE/RGE analysis based on data from BP Statistical Review of 2013

sanctions have removed Iranian crude oil exports over the past 18 months. However, the nature and severity of the supply shock are also important. For example, in the event of regional war in the Middle East, U.S. domestic stockpiles would be critical to avoiding shortages in the short term as the country sought alternatives for crude from Saudi Arabia and others. Countries more directly (and heavily) reliant on Middle East oil imports, such as China, would face greater challenges in such a scenario.

IEA member countries have the largest oil stockpiles and are required by statute to hold stocks equivalent to at least 90 days of net oil imports.[17] IEA countries may release reserves unilaterally or in a coordinated action. Emerging countries, in particular China, have taken several years to build up stockpiles, but continue to approach the process aggressively. Most oil exporters have built up their stockpiles slowly, but some, like Russia, with currently near-zero, are now doing so. There has been a marked shift in global oil stockpiling from developed to emerging market economies in recent years.

Russia scores lowest on this metric (11 percent of quarterly consumption) and Saudi Arabia highest (185 percent). Brazil, China, and India all also score less than 30 percent.

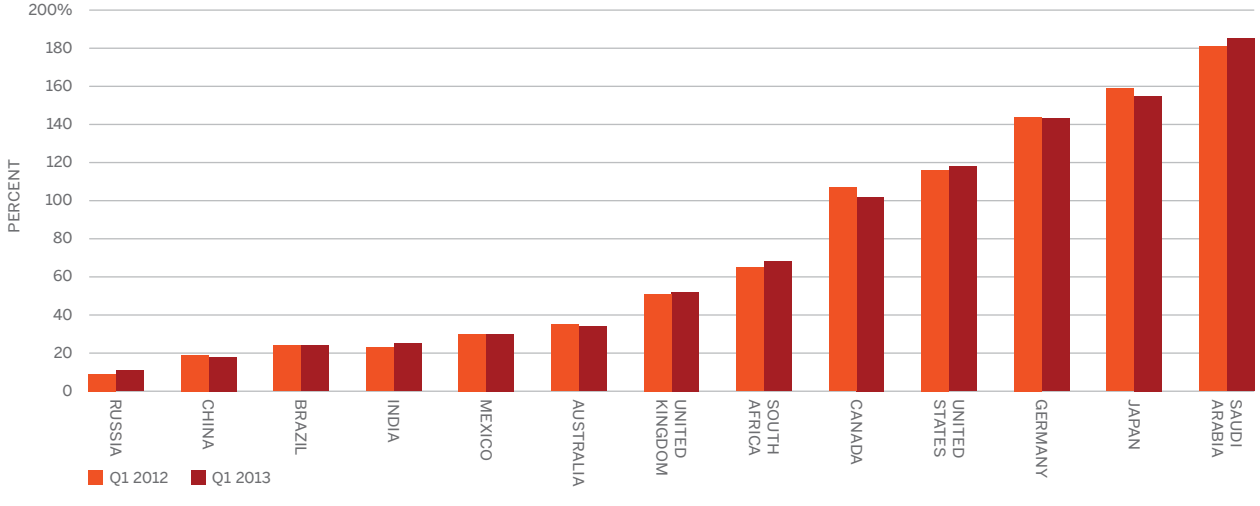
17 Of the countries included in the Index, six are IEA member countries. These countries are Australia, Canada, Germany, Japan, the United Kingdom, and the United States. There are currently three net-oil-exporting IEA member countries including Canada (plus Denmark and Norway) which do not have a stockholding obligation.

CALCULATION
TOTAL OIL STOCKHOLDINGS AS A PERCENTAGE OF CONSUMPTION

This metric is calculated as the total volume of oil stocks divided by the total volume of quarterly oil consumption. Again, the oil volume includes crude oil, gas oil, diesel oil, gasoline, kerosene, and fuel oil. The lack of reliable data for China, Russia, and South Africa necessitates the use of estimates. Consumption is implied from production, import, export, and stock data.

FIGURE 18

Total Oil Stockholdings as a Percentage of Quarterly Consumption, Q1 2012 and Q1 2013



Source: SAFE/RGE analysis

Country Rankings

To compare the results of different countries, the raw results for each quarterly time period of every metric are normalized by the mean and standard deviation. The overall country rankings are created by adding the normalized scores for each country into a single combined score, then ordering these scores.

Relatively oil-efficient countries like Japan, the United Kingdom, and Germany rank at or near the top of the Index overall, scoring in the upper tier for Oil Intensity, Total Spending on Oil as a Percentage of GDP, and Fuel Consumption per Capita.

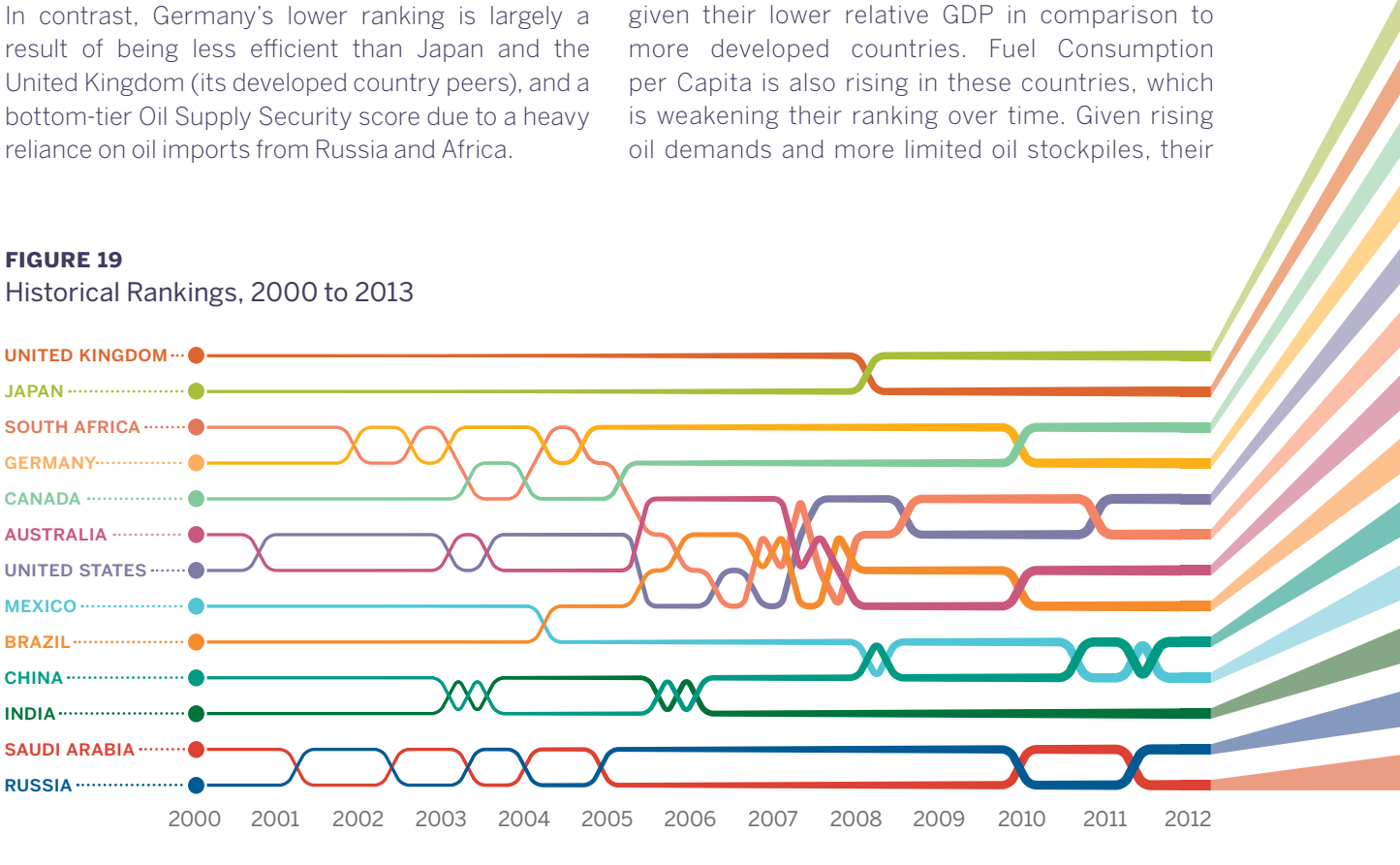
Although Canada's Oil Exports as a Percentage of Total Exports by Value is relatively high (and rising), it ranks third thanks to a combination of upper- and middle-tier scores on other metrics. Canada scores particularly well on production-related metrics including Oil Supply Security and Total Spending on Net Oil Imports as a Percentage of GDP.

In contrast, Germany's lower ranking is largely a result of being less efficient than Japan and the United Kingdom (its developed country peers), and a bottom-tier Oil Supply Security score due to a heavy reliance on oil imports from Russia and Africa.

Geographically larger and relatively less oil-efficient countries follow. Both the United States and Australia score in the bottom tier for Fuel Consumption per Capita and the middle tier for Oil Intensity, but high relative GDP and scores in the upper tier for Oil Supply Security (thanks to relatively high levels of domestic oil production) help both of these countries to a middle ranking.

Large developing countries like Brazil, China, and Mexico lie in the bottom half of the ranking. These countries each produce sizeable quantities of oil, but their scores for Total Spending on Oil as a Percentage of GDP are among the highest given their lower relative GDP in comparison to more developed countries. Fuel Consumption per Capita is also rising in these countries, which is weakening their ranking over time. Given rising oil demands and more limited oil stockpiles, their

FIGURE 19
Historical Rankings, 2000 to 2013

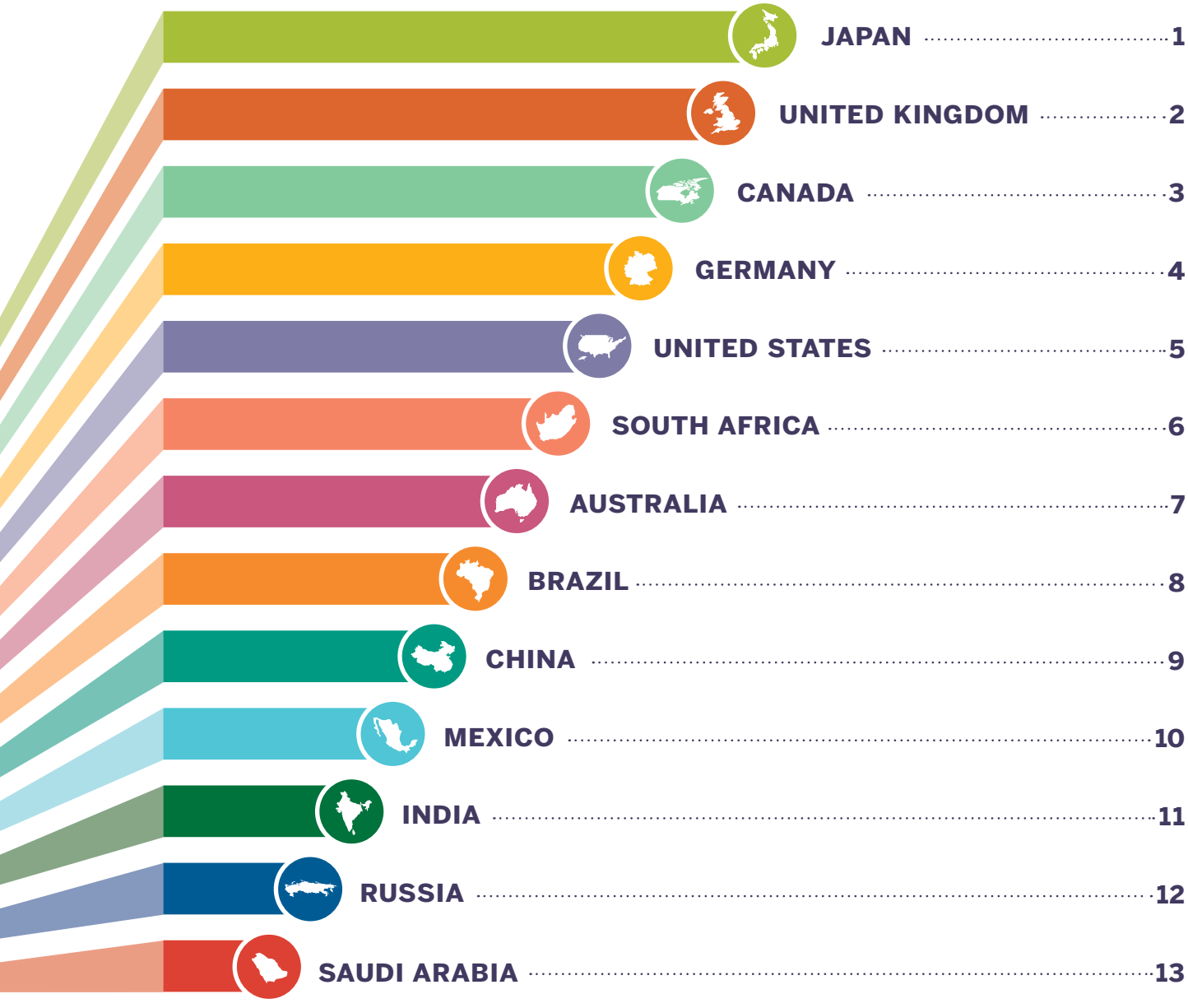


Total Stockholdings as a Percentage of Consumption scores are in the bottom tier.

Despite having the lowest Fuel Consumption per Capita, India's bottom-tier scores for several metrics, including Oil Intensity, Total Spending on Oil as a Percentage of GDP, and Total Spending on Net Oil Imports as a Percentage of GDP, push it towards the bottom of the rankings.

Russia and Saudi Arabia score in the upper tier for Total Spending on Net Oil Imports as a Percentage of GDP due to their oil exports, but rank at the bottom overall thanks to exceedingly high relative levels of inefficiency (between eight and ten times higher than the most efficient countries) and extremely high percentages for the Oil Exports as a Percentage of Total Exports by Value metric, indicating their overwhelming dependence on oil exports for revenue.

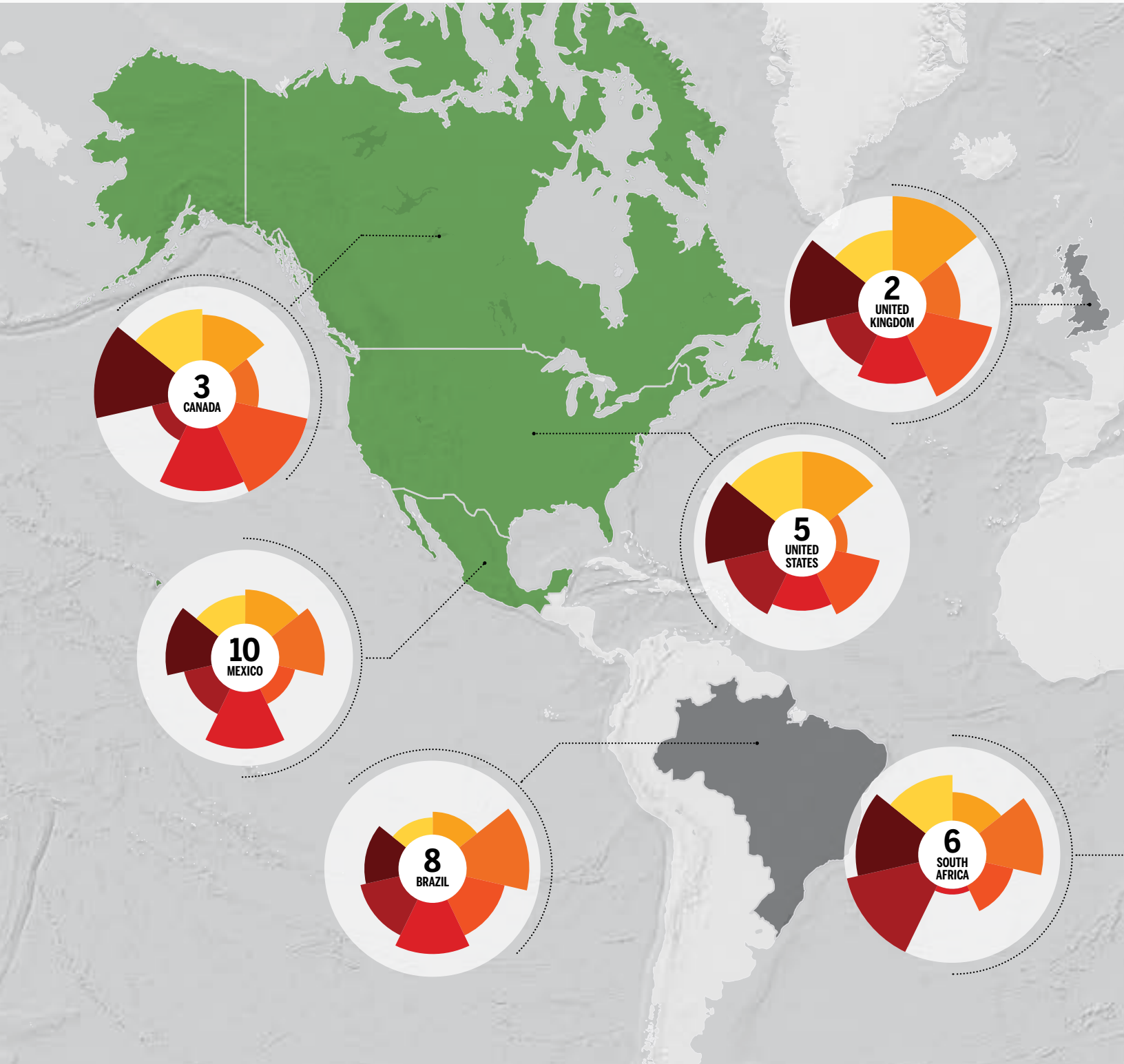
Rankings of the 13 Index countries can also be determined for each of the seven individual metrics. Some countries perform very well on certain metrics and very poorly on others, while other countries perform consistently in the upper, middle, or bottom tiers across all seven metrics. Overall rankings, metric rankings and results, and additional data are available in an interactive online tool.



2013

Global Results and Trends

Oil security varies markedly across the 13 countries. Some countries perform well on certain metrics and poorly on others, while other countries are more consistently strong or weak performers. Forecast and expected changes in the underlying data used to construct the individual metrics for a given country are informative of the overall trend in its oil security.



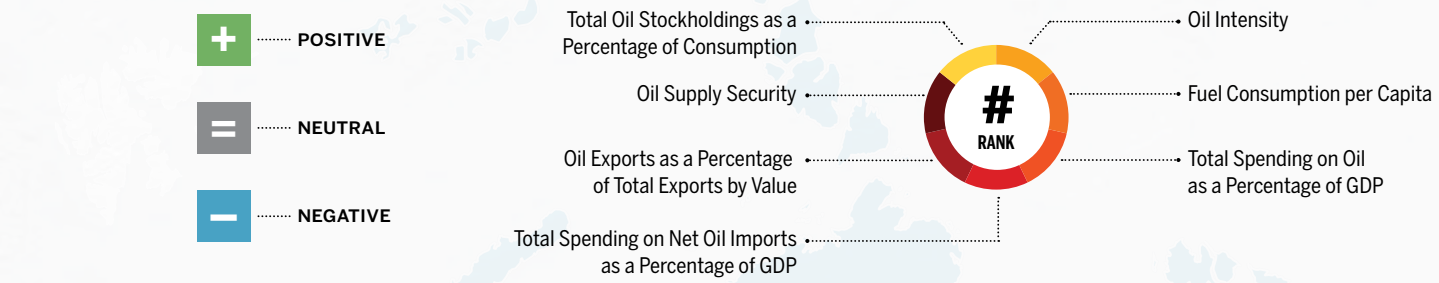
OIL SECURITY TREND

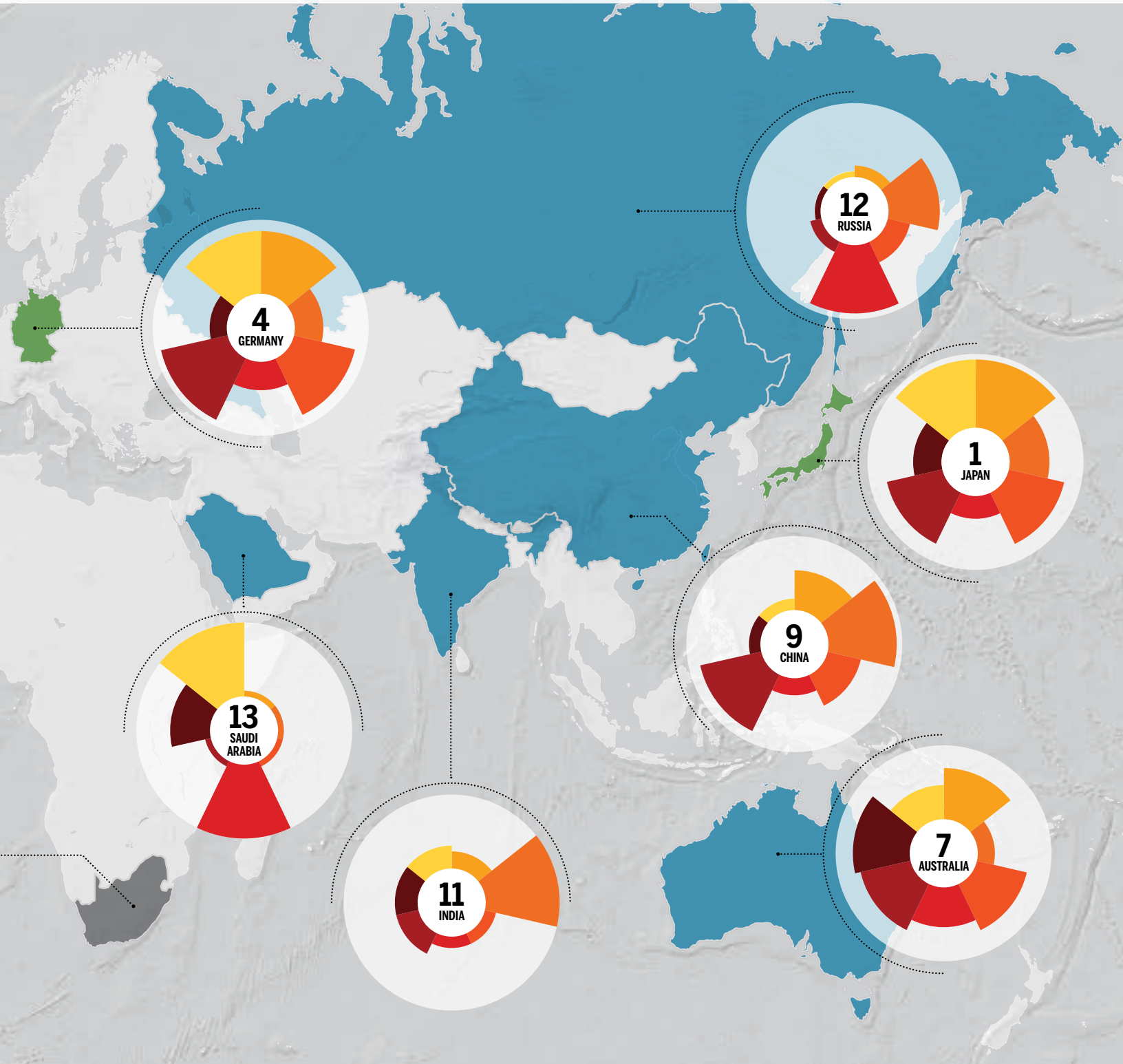
+ POSITIVE

= NEUTRAL

− NEGATIVE

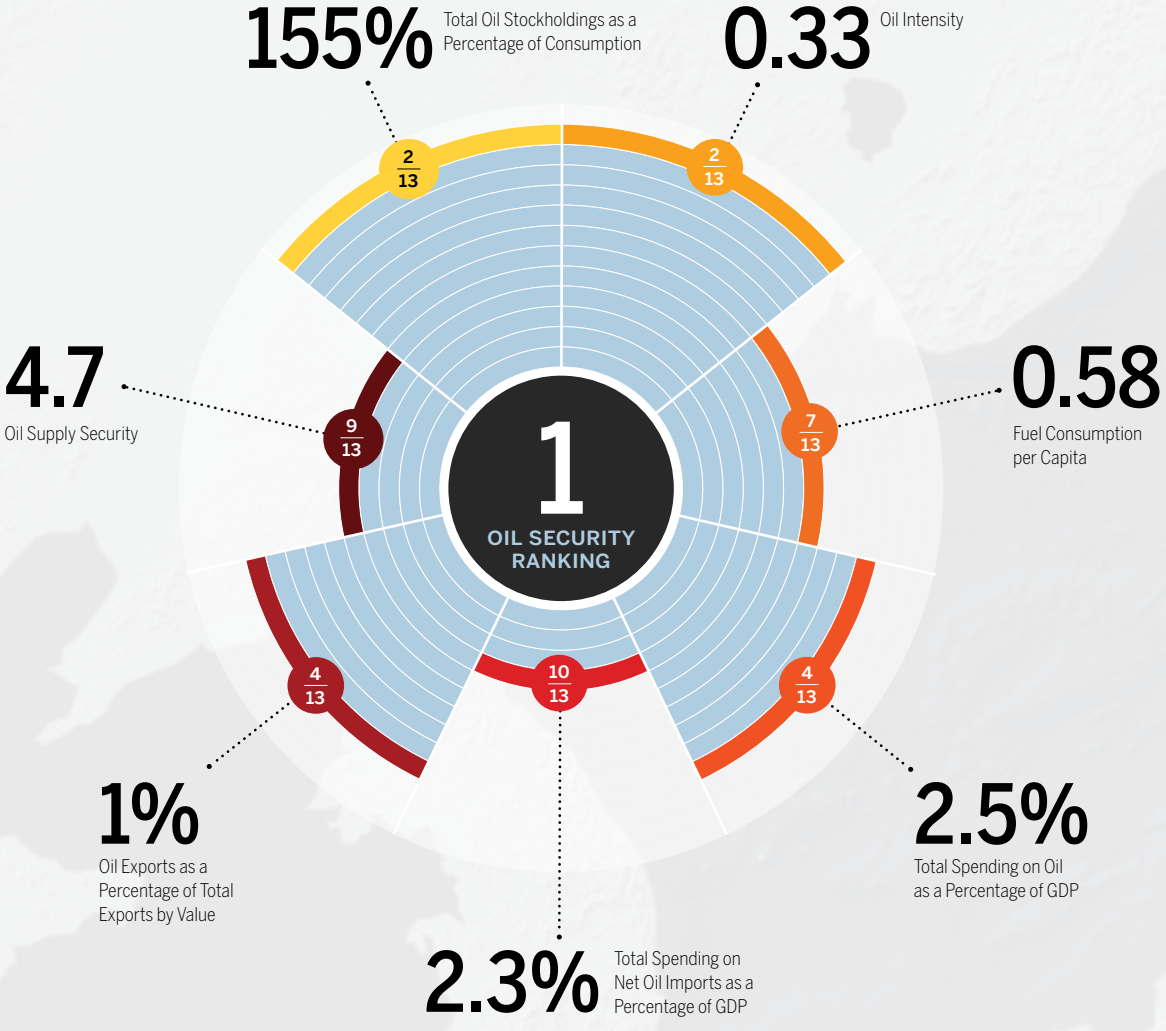
KEY





Japan

OIL SECURITY TREND



Facts and Figures

0.0 BBL
Oil Reserves (2012)

0.0 MBD
Production (2012)

4.7 MBD
Consumption (2012)

1.9%
GDP Forecast (2013)

0.0% of Global Total (2012)	**0.0 MBD** Change (2008-2012)	**-0.2 MBD** Change (2008-2012)	**-0.1%** GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Japan's extensive conservation efforts and ample stockholdings substantially mitigate the vulnerability posed by a reliance on oil imports.

ASSESSMENT

Japan's highly-efficient vehicle fleet helps cap oil demand, rendering Fuel Consumption per Capita the lowest among developed countries. Sizeable oil stockpiles also provide some cushion against the possibility of supply shocks. Japan's Total Spending on Oil and Total Spending on Net Oil Imports (as Percentages of GDP) are in fact as low as several countries that produce at least some oil domestically (such as the United States, United Kingdom, China, and Australia).

Japan ranks highly despite increased oil burn in the power sector as a result of the post-Fukushima shutdown of nuclear power generating capacity. A modest improvement in Japan's economic output could lead to a temporary increase in oil consumption and greater exposure to prices, but this will almost certainly be offset by the reduction in oil use for power generation in the short-to-medium term.

BACKGROUND

Japan is the third largest energy consumer in the world, but only 16 percent energy self-sufficient.[18] Japan's high level of oil consumption and lack of self sufficiency also makes it the third largest net importer of crude oil. Eighty-seven percent of Japan's oil is sourced from the Middle East (particularly Saudi Arabia, the United Arab Emirates, and Qatar), but the country has moved to diversify the origins of its imports by increasing trade with Russia, South East Asia, and Africa.[19]

Japan supports overseas oil exploration and development through its banking and manufacturing sectors (e.g., through loans from the Japan Bank for International Cooperation). By 2030, the government hopes that 40 percent of Japanese crude oil imports will originate from Japanese-owned concessions, up from 19 percent today.[20] The country has also taken steps to become a storage hub in Asia for Gulf Cooperation Council (GCC) producers, including Saudi Arabia and the United Arab Emirates (Japan will hold oil in spare storage capacity that it will then have the right to use in an emergency situation).[21] These measures add to its already extensive domestic stockholdings.

14%

Decline in Japanese oil consumption between 2003 and 2012

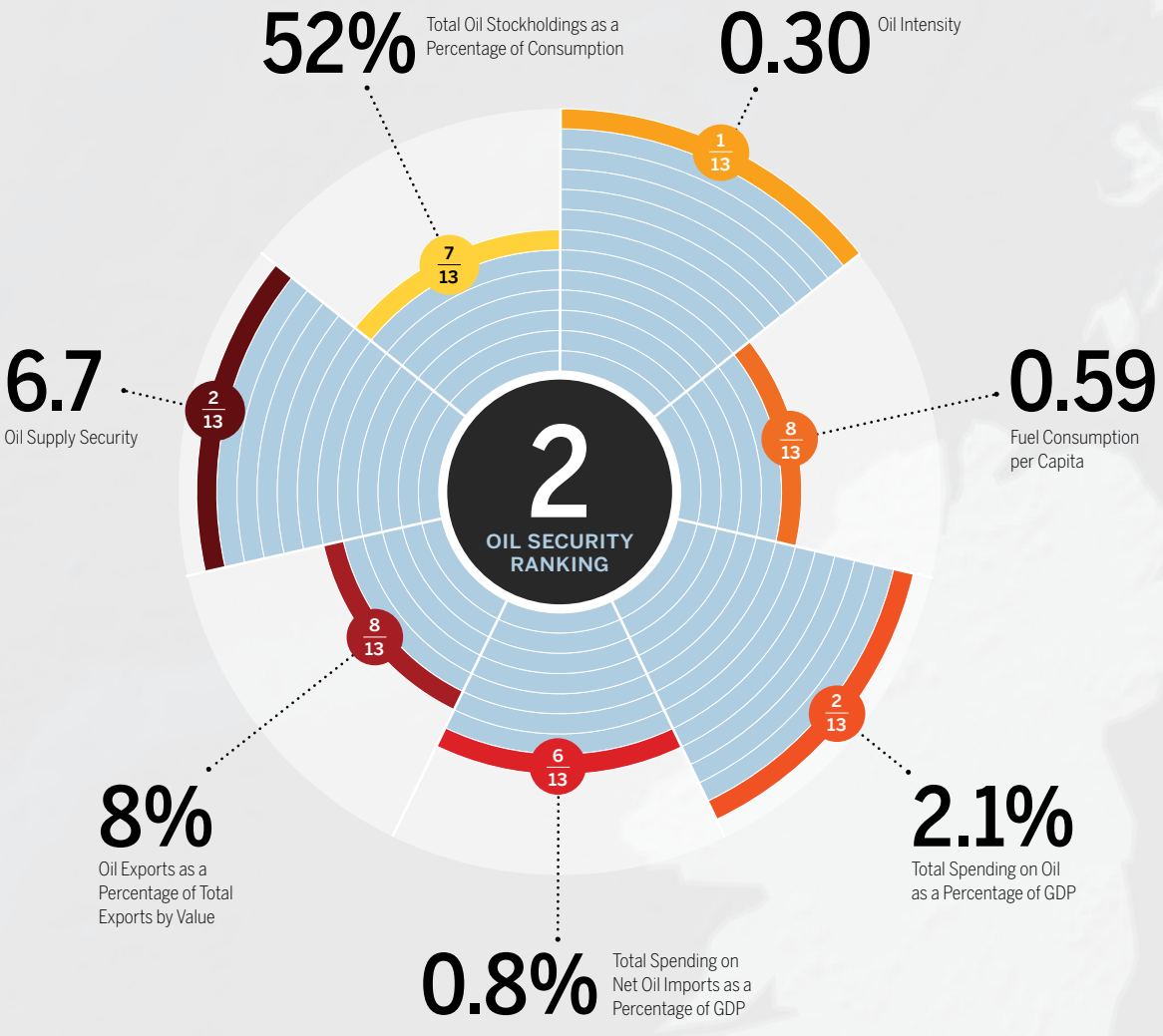
Very aware of its lacking domestic energy resources, Japan launched a series of energy efficiency and conservation measures in the 1970s, which have been extended in recent decades. As a result, Japan's economy is among the world's most energy efficient, and it boasts a more efficient vehicle fleet than other developed economies.

Japan's heavy reliance on oil has been exacerbated in the last two years due to the reduction in nuclear power output following damage caused by a tsunami which struck its coast in 2011. Due to lengthy repairs and policy decisions, 48 of the 50 nuclear reactors remain offline today. Japan has replaced its nuclear output by burning natural gas, crude oil, and fuel oil for electricity. The gradual return of nuclear power generation and continued improvement in vehicle efficiency is likely to resume Japan's declining trend in oil consumption in the coming years (approximately -1.4 percent per year), but the timeline remains largely uncertain.[22]

18 U.S. EIA, Country Analysis Briefs, Japan, last updated June 4, 2012
19 Id.
20 Id.
21 IEA, MTOMR 2013, at 115
22 Id., at 34

United Kingdom

OIL SECURITY TREND



Facts and Figures

3.1 BBL
Oil Reserves (2012)

1.0 MBD
Production (2012)

1.5 MBD
Consumption (2012)

0.8%
GDP Forecast (2013)

0.2% of Global Total (2012)	**-0.6 MBD** Change (2008-2012)	**-0.2 MBD** Change (2008-2012)	**-0.4%** GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

The United Kingdom is the leading producer of oil in the European Union. However, the country is becoming increasingly reliant on oil imports as its production declines.

ASSESSMENT

The United Kingdom has suffered declining domestic oil production in recent years, which has been only partly offset by easing demand. Although the country receives most of its oil imports from relatively stable European sources, especially Norway, the reduction in domestic production has nonetheless precipitated a substantial weakening in its Oil Supply Security (from 8.4 in 2000 to 6.7 in Q1 2013). Nevertheless, low Oil intensity (1st) and Total Spending on Oil as a Percentage of GDP (2nd) metric scores help the United Kingdom maintain its place near the top of the rankings overall.

Stringent vehicle fuel-efficiency standards and efforts to revitalize domestic oil production suggest that while more vulnerable to direct supply interruptions than in the past, the United Kingdom could begin to strengthen its long-term oil security outlook.

BACKGROUND

The United Kingdom controls the largest oil reserves in the European Union with 3.1 billion barrels.[23] Most of these reserves are located offshore where 90 percent of production occurred in 2012.[24] A combination of aging oil wells and high taxes for the oil industry have discouraged investment in the sector and contributed to a sharp 13 percent drop in production between 2011 and 2012.[25]

With the government dependent on billions of dollars in oil tax revenue and with the gap between consumption and production widening, the United Kingdom is in the process of attempting to reverse the downward trend of production through the use of incentives, especially for the development of unconventional resources. In July 2013, the government proposed cutting taxes from 63 percent to 30 percent on some income generated from onshore shale gas extraction.[26] Future measures could similarly encourage the oil industry. Compared to the United States, environmental and regulatory burdens are higher.

58%

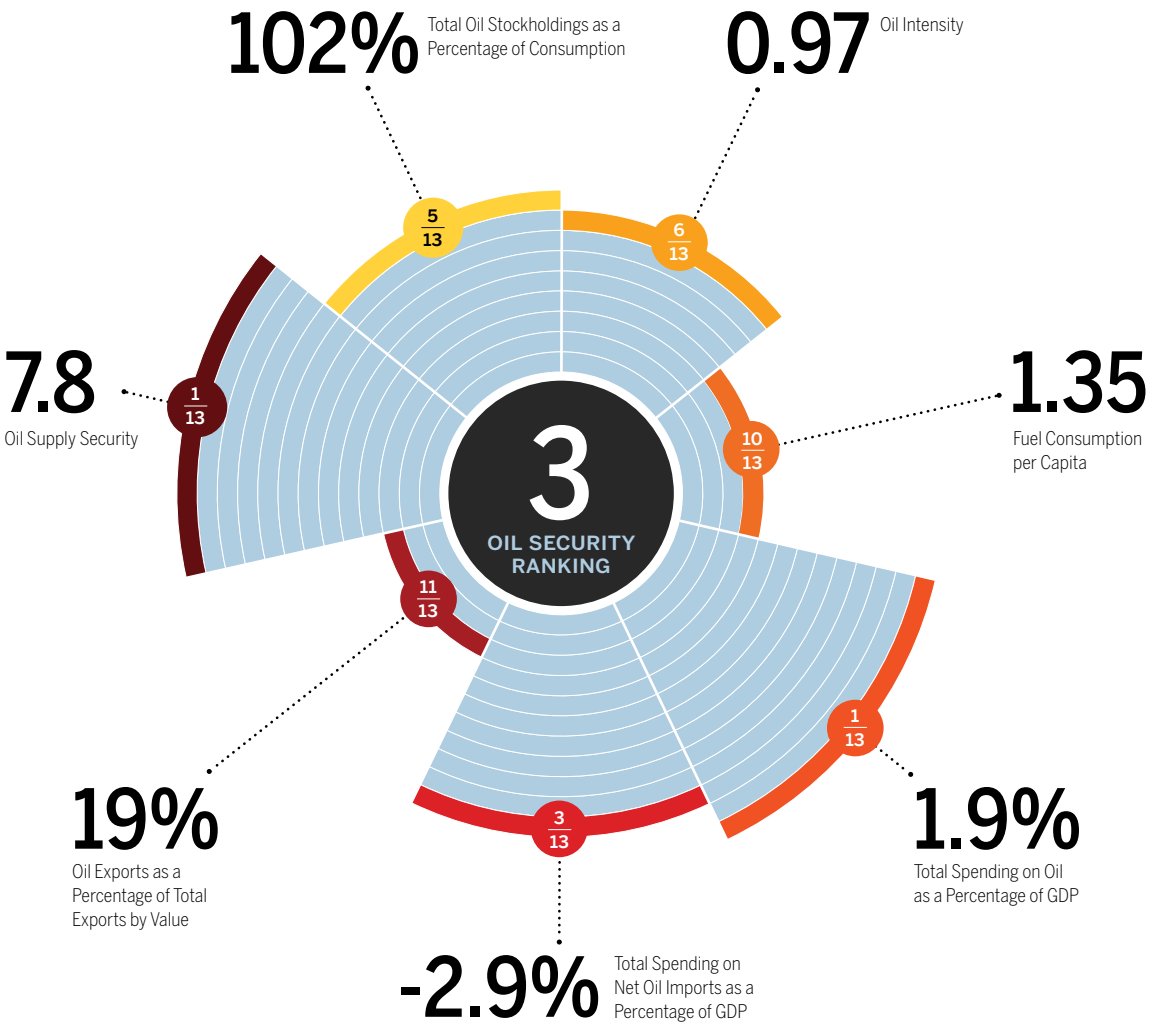
Decline in oil production in the United Kingdom over the past decade

From 2004 to 2012, total energy consumption in the United Kingdom declined 10 percent as a result of high prices and recessionary conditions.[27] Oil consumption also declined over the same period from 1.8 to 1.5 mbd, but remains 34 percent of total energy consumption.[28] This downward trend is also partly the result of technological advances being applied to help raise vehicle fuel efficiency (common and relatively stringent standards are set for all European Union member countries).

23 BP, plc., Statistical Review 2013, historical data
24 U.S. EIA, Country Analysis Briefs, United Kingdom, last updated May 14, 2013
25 BP, plc., Statistical Review 2013, at 8
26 Government of the United Kingdom, Her Majesty's Treasury, Harnessing the potential of the UK's natural resources: a fiscal regime for shale gas, July 19, 2013
27 U.S. EIA, Country Analysis Briefs, United Kingdom
28 BP, plc., Statistical Review 2013, historical data

Canada

OIL SECURITY TREND



Facts and Figures

173.9 BBL
Oil Reserves (2012)

3.7 MBD
Production (2012)

2.4 MBD
Consumption (2012)

1.3%
GDP Forecast (2013)

10.4%
of Global Total (2012)

0.5 MBD
Change (2008-2012)

0.1 MBD
Change (2008-2012)

1.2%
GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Canada is a major oil producer and home to some of the world's largest oil reserves. The country is the United States' largest foreign oil supplier.

ASSESSMENT

High and rising domestic oil production more than meets Canada's domestic demands and attracts sizeable direct foreign investment. A high level of revenues from oil exports (negative Total Spending on Net Oil Imports as a Percentage of GDP) is also a boon, with Canada placing behind only export behemoths Saudi Arabia and Russia on this metric. Canada's Total Spending on Oil as a Percentage of GDP is the lowest in the Index (1.9 percent), and its Oil Supply Security the highest (7.8). Canada's high Fuel Consumption per Capita and the meaningful reliance of its economy on oil export revenues offset these positives.

Despite relatively high Oil Intensity for its income level (0.97), the prognosis for Canada's oil security is generally positive as it is expected to maintain its production and export base in the coming years while increasing efficiency in the transportation sector (which will prompt a gradual decline in fuel consumption).

BACKGROUND

Canada is the sixth largest oil producer in the world and a major exporter, with almost all of its exports going to the United States.[29] The two countries share a system of pipelines to facilitate the transportation of oil. In recent years, economic and, to a lesser extent, political considerations have also prompted Canada to consider strengthening its energy relationships with emerging markets in Asia, where global oil demand growth is concentrated. Canada has welcomed foreign investment in its energy sector, though new regulations cap the involvement of foreign government-owned companies, which likely have sought deals to gain expertise in unconventional oil and natural gas production.

29 U.S. EIA, Country Analysis Briefs, Canada, last updated September 17, 2012

Canada's economy relies heavily on the revenues generated by oil production and export. And petroleum companies made up 20 to 30 percent of the value of the Toronto Stock Exchange in 2011.[30] Canada holds substantial oil reserves, of which 98 percent are unconventional and located in the oil sands region (170 billion barrels).[31] Notably, while most of Canada's oil production takes place in its western provinces, the majority of Canada's population lives in the central and eastern provinces. As a result, some oil used in the east is imported by ship, pipelines, or rail from the United States.[32] Provincial and federal governments are considering the construction of a cross-country pipeline to better meet these needs.

170 BILLION

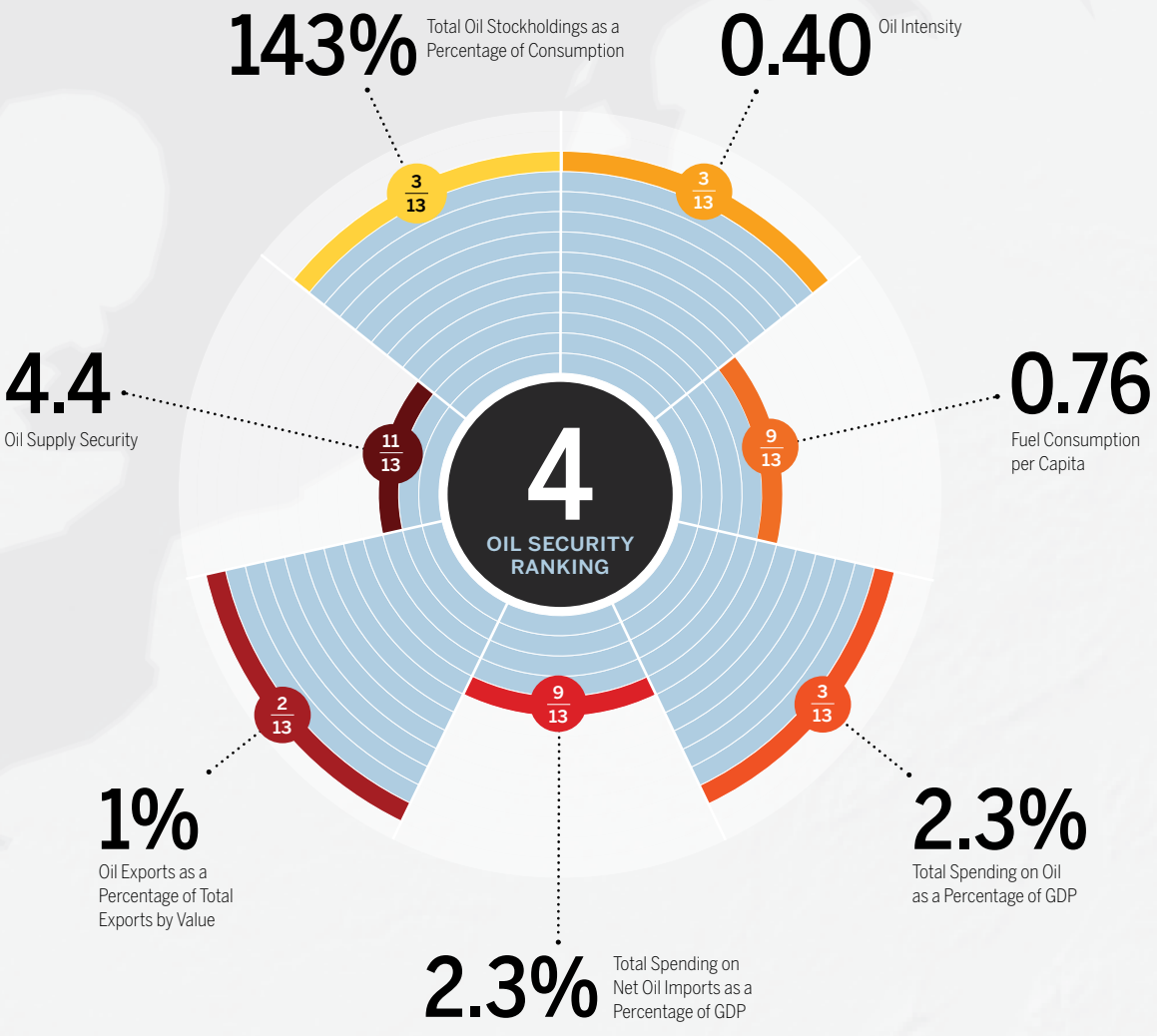
Barrels of estimated unconventional oil reserves located in the oil sands region

Canadian unconventional production sits at the upper end of the global cost curve, which suggests that production could be temporarily shuttered if oil prices were to fall sharply. Despite being a net oil exporter, domestic retail fuel prices track global oil prices and are slightly higher than those in the United States. Thanks to a well-performing oil sector and strong banks, economic growth drove oil demand increases of approximately 2 percent per year between 2010 and 2012.[33]

30 Natural Resources Canada (NRC), Canadian Crude Oil, Natural Gas and Petroleum Products: Review of 2009 & Outlook to 2030, 2011, at 5
31 U.S. EIA, Country Analysis Briefs, Canada
32 NRC, Canadian Crude Oil, Natural Gas and Petroleum Products, at 6
33 IEA, MTOMR 2013, at 37-38

Germany

OIL SECURITY TREND



Facts and Figures

0.0 BBL
Oil Reserves (2012)

0.0 MBD
Production (2012)

2.4 MBD
Consumption (2012)

0.5%
GDP Forecast (2013)

0.0% of Global Total (2012)	**0.0 MBD** Change (2008-2012)	**-0.1 MBD** Change (2008-2012)	**0.8%** GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Germany is the largest energy and oil consumer in Europe and relies almost exclusively on imports to meet its needs.

ASSESSMENT

Despite being a sizeable net importer of oil, high levels of efficiency (it currently ranks 3rd in Oil Intensity) and a well-developed pipeline infrastructure mitigate Germany's oil security risk. Germany also has sizeable oil stockpiles (higher than the United States relative to consumption) to guard against supply shocks. These could prove useful given Germany's relatively poor Oil Supply Security (4.4)—a result of most oil imports being sourced from Russia, the Middle East, and Africa.

The efficiency of its manufacturing sector, as well as subsidies for some energy-intensive industries, cushions its exposure to oil price volatility. However, as Germany exits recession and demand becomes more robust, oil use could rise slightly—increasing its vulnerability over the medium term.

BACKGROUND

Oil consumption in Germany has been gradually decreasing since 1998.[34] Nevertheless, oil retains its place as the country's primary energy source at 36 percent of the total.[35] The transportation sector accounts for approximately half of total oil consumption with the industrial sector a distant second.[36] Although Germany has substantial refining capacity, it has virtually no domestic production, and it relies on imports to meet consumption needs of approximately 2.4 mbd.[37] Russia, Norway, the United Kingdom (where oil production is currently in decline), Libya, and Nigeria have been the country's largest crude oil suppliers in recent years (it is, however, less reliant on Russia than many countries in Eastern Europe).[38] Although geologists suggest that the country may have ample supplies of shale gas and oil, there is currently a moratorium in place.

Germany is already one of the world's most efficient oil users, and its demand-side policies appear set to help it maintain this position in the coming decades. These policies include the promotion of biofuels and other alternatives, and efficiency standards for buildings and vehicles. In transportation specifically, European Union regulations, to which Germany is subject, constitute some of the world's most stringent fuel-economy requirements. Germany is also aggressively pursuing electric vehicles. In 2010, the government presented its Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply strategy for the period up to 2050. This strategy included achieving the deployment of 1 million and 6 million electric vehicles on German roads by 2020 and 2030, respectively.[39] Funding for hydrogen and fuel cell demonstration projects were also included as part of this strategy.[40]

6 MILLION

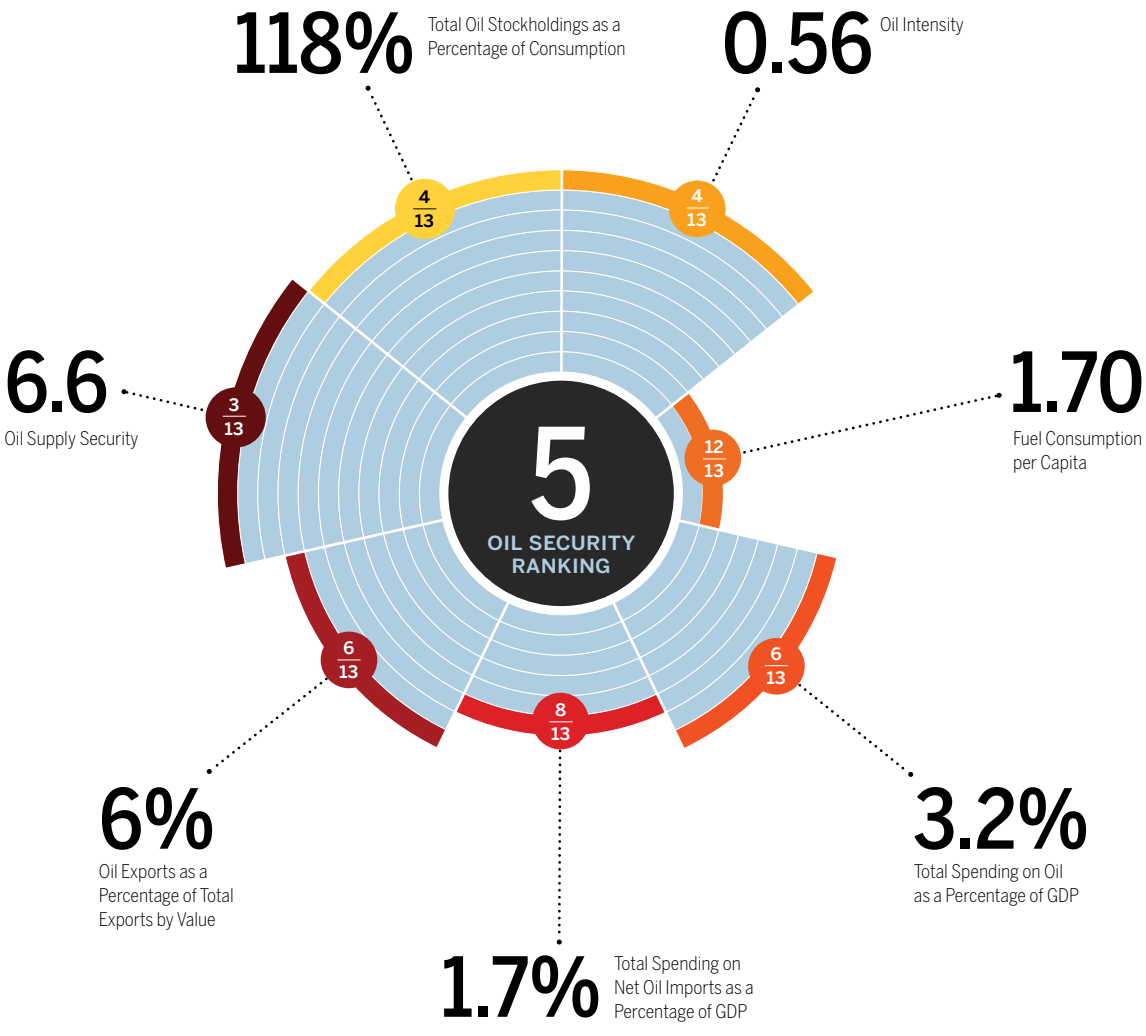
Electric vehicle deployment goal set by the German government for 2030

34 BP, plc., Statistical Review 2013, historical data
35 Id., at 41
36 IEA, Oil and Gas Security, Emergency Response of IEA Countries, Germany, 2012, at 7
37 Id., at 9
38 IEA, Oil, Gas, Coal, and Electricity, Quarterly Statistics, Fourth Quarter 2012, at 260

39 Federal Ministry of Economics and Technology (Germany), Germany Trade and Invest, Germany's Energy Concept, last updated 2013
40 Id.

United States

OIL SECURITY TREND



Facts and Figures

35.0 BBL
Oil Reserves (2012)

8.9 MBD
Production (2012)

18.6 MBD
Consumption (2012)

1.8%
GDP Forecast (2013)

2.1%
of Global Total (2012)

2.1 MBD
Change (2008-2012)

-0.9 MBD
Change (2008-2012)

0.6%
GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

The United States is the world's largest oil consumer and one of the largest producers. Its military plays a key role in protecting energy infrastructure and supply routes.

ASSESSMENT

Most measures of U.S. oil security and reliance have improved over the past decade despite the sharp increase in oil prices. For example, U.S. oil intensity has fallen by one third, and the quantity of oil imports has also declined as consumption has eased and production has risen. However, Fuel Consumption per Capita is among the highest in the Index (1.7 gallons per day). The increase in domestic oil production has facilitated a strengthening in Oil Supply Security (from 5.9 in 2007 to 6.6 in 2013) and the country holds ample stocks on which it can call if necessary.

Long-term trends in fuel efficiency and oil production growth suggest reason for optimism, but heavy oil dependence still renders the country highly vulnerable to price fluctuations in the short-to-medium term, particularly as economic growth (and fuel demand) recovers.

BACKGROUND

Each day, the United States consumes more oil than China, Japan, and Russia combined. At almost 19 mbd, the country accounts for approximately 20 percent of total global oil consumption.[41] And although domestic oil production has been increasing in recent years, the country remains a sizeable net importer of crude oil—imports are forecast to account for more than half of total crude supplies in 2013.

The first efforts to significantly reduce the oil use and intensity of the U.S. economy came in response to the OPEC Oil Embargo (1973-74) that increased prices fourfold from approximately $3 per barrel to $12 per barrel.[42] Responses included the establishment of Corporate Average Fuel Economy (CAFE) standards for light-duty cars and trucks, the development of the Strategic Petroleum Reserve that today holds around 700 million barrels of crude oil (the world's largest emergency stockpile),[43] marketing campaigns intended to influence behavior, a phase-out of oil use in power generation, and the establishment of the U.S. Department of Energy.

These and subsequent efforts have had a substantial impact, and the oil intensity of the U.S. economy has fallen by approximately 60 percent since the early 1970s.[44] However, some efforts stalled. For example, vehicle fuel economy remained largely unchanged from the mid-1980s until the mid-2000s.[45] The establishment of more stringent regulations since 2007 appears to be placing the country once again on a more efficient path (although not as efficient as European and Japanese peers).

Oil use in power generation was reduced from approximately 17 percent of total generation in the mid-1970s to less than 1 percent today.[46] Fuel substitution has also begun to gain modest traction in the transportation sector, with the increased use of electricity, ethanol (biomass), and natural gas. Still, petroleum fuels account for more than 93 percent of delivered energy in the sector today.

Notably, higher oil prices have increased the total cost of the net oil import burden in recent years, even as imported volumes have declined. In fact, in 2011, despite a third straight year of growth in domestic production and a first year of net petroleum product exports since 1949, the U.S. petroleum trade deficit increased to $327 billion.[47] However, in 2012, this trend finally began to reverse, as the petroleum deficit fell to $291 billion. Continuation of this trend would support the U.S. external balance and strengthen the U.S. dollar.

41 BP, plc., Statistical Review 2013 at 9
42 Id., historical data
43 U.S. DOE, Office of Fossil Energy, Strategic Petroleum Reserve, last accessed June 7, 2013
44 SAFE/RGE analysis based on data from: BP; and World Bank
45 U.S. DOT, NHTSA, Summary of Fuel Economy Performance, April 25, 2013
46 U.S. EIA, AER 2011, Table 8.2b; and U.S. EIA, STEO, May 2013, Figure 7.2, at 94
47 SAFE/RGE analysis based on data from: U.S. Census Bureau

SPOTLIGHT ON THE UNITED STATES

For many decades, America's dependence on oil has had an enormous impact on the economic and national security of the country. As a result, oil security has been a major concern of policymakers.

The Oil Security Index not only compares U.S. oil security with other countries around the globe, but also provides a numerical score of U.S. oil security. This numerical score shows changes in oil security over time. It is calculated by combining results for each metric that are normalized over the entire time series. The score is indexed at 100 in Q1 2000, the first time period.

The combined score for the United States has shown only moderate improvement since Q1 2000. However, it has experienced sizeable upward and downward shifts over the period, fluctuating between a low of 99.0 and a high of 100.4.

The score reached a low point in Q2 2008, reflecting a sharp decline in oil security. This was a result of increasing global oil prices and rising U.S. consumption and imports. As oil prices receded from record highs, and U.S. oil consumption declined, oil security improved somewhat. However, the rise in the score was short-lived, as both oil prices and domestic consumption rebounded in 2010.

Since 2012, the combined score has been rising steadily, reaching its highest levels yet in both Q4 2012 and Q1 2013. This improvement comes as a result of ongoing economy-wide improvements in efficiency, lower per capita oil consumption, increasing domestic oil production, and somewhat lower global oil prices since the "Arab Spring" (and in particular, Libyan outages) in early 2011 (which resulted in the most recent low point for the score). These changing underlying dynamics have seen the United States move from a low of 8th in the Index rankings to its current high of 5th (since Q1 2012).

Both Structural Dependency metrics have shown improving trends. Oil Intensity has observed steady improvement since 2000, falling from 0.73 barrels per $1,000 of GDP in 2000 to 0.56 in Q1 2013, corresponding to a normalized metric score of 103.0 (the best of any metric score over the time period). This improvement is predominantly due to the efficiency of oil use rising at a faster average rate than GDP since 2000. Consumers have also decreased consumption in response to higher oil prices since 2007. In part this shift has been the result of greater efficiency. However, a decline in vehicle miles traveled (VMT) was a much larger contributor, particularly during the recession, due to high unemployment and reduced economic activity overall. Though VMT rebounded slightly in 2010, oil demand growth has not returned in earnest. In 2013, unemployment remains stubbornly high by historical standards and economic growth is slow—both due in part to high oil prices. Over the long term, as economic growth recovers, rising automotive efficiency will play a greater role in moderating total oil consumption.

Changes in Economic Exposure metrics have largely corresponded with changes in global oil prices. This is particularly obvious in the Total Spending on Oil as a Percentage of GDP metric. Specifically, record-high prices that reached $147 per barrel in July 2008 resulted in oil spending of 4.4 percent of GDP in Q3 2008. This corresponded to a normalized metric score of 96.2, the worst score of any metric over the entire time period. Total Spending on Net Oil Imports as a Percentage of GDP has also tracked price movements to a certain extent, and its evolution is similar to Total Spending on Oil as a Percentage of GDP. However, the impact of declining net oil imports (as a result of rising domestic oil production and lower consumption) is noticeable in recent years as the evolution of the Total Spending on Net Oil Imports as a Percentage of GDP metric has diverged somewhat from the Total Spending on Oil as a Percentage of GDP metric. Although Oil Exports as a Percentage of Total Exports by Value have increased, the U.S. economy remains highly diversified, limiting its economic exposure to any decreases in oil revenue that could result from lower global oil prices. Moreover, its exports are almost exclusively of petroleum products, which are of higher economic value than crude oil and require a refining infrastructure that complements domestic exploration and production activities.

100.4

The highest combined score achieved by the United States since 2000 (Q1 2013)

The United States' Supply Security metrics have also observed substantial shifts as a result of changes in consumption and production since 2000. Most obvious is the sharp decline in the Oil Supply Security metric as imports rose to exceed 12 mbd in the 2005 to 2007 period and oil had to be sought from additional (and on average less stable) locations. However, a concurrent decline in consumption accelerated into 2008 as prices hit historical highs. This decline was then intensified by the onset of recession, which coincided with the emergence of meaningful increases in domestic oil production. As a combined result of this consumption decline and production surge, the

FIGURE 20

U.S. Index Score and Structural Dependency Metrics, Q1 2000 to Q1 2013

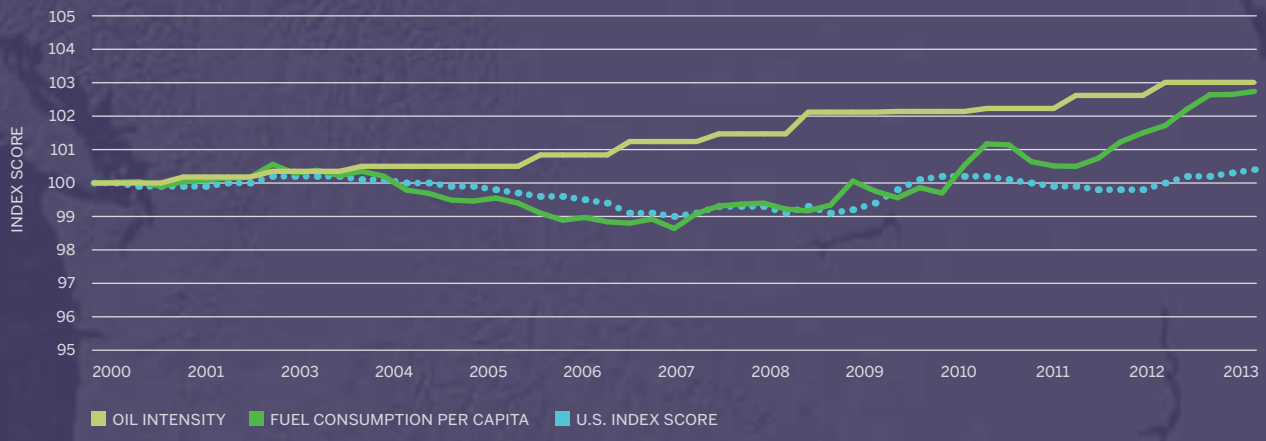


FIGURE 21

U.S. Index Score and Economic Exposure Metrics, Q1 2000 to Q1 2013

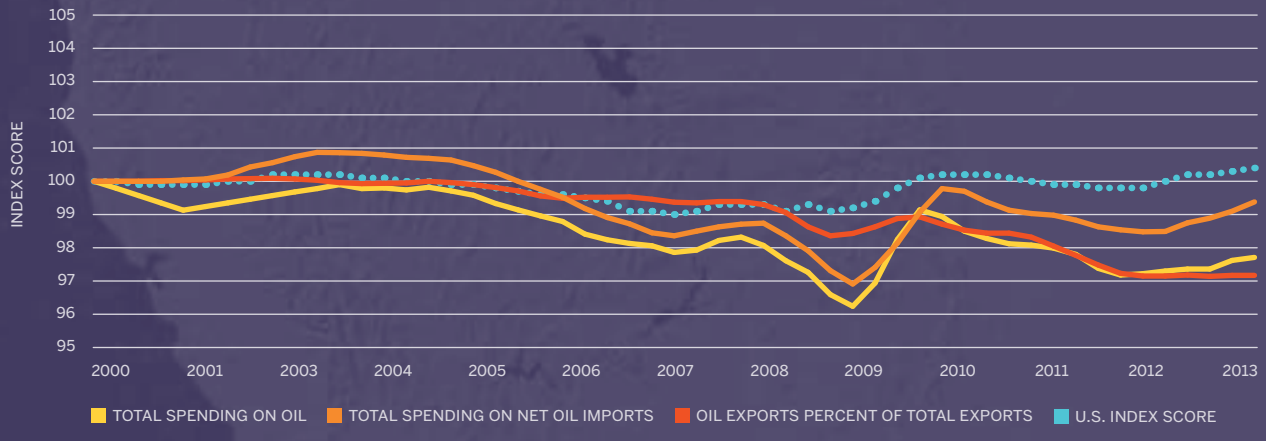
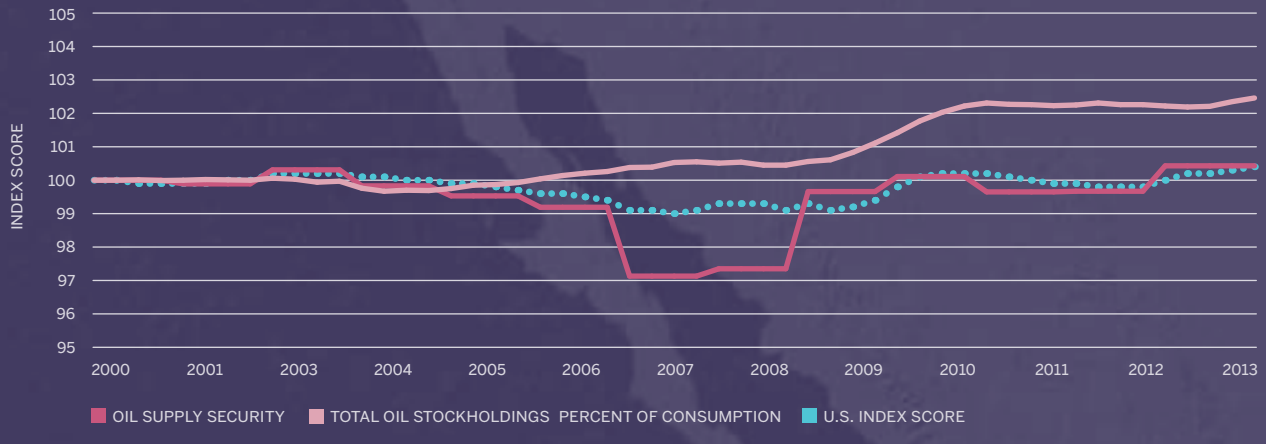


FIGURE 22

U.S. Index Score and Supply Security Metrics, Q1 2000 to Q1 2013



Source: SAFE/RGE analysis

increase in imports observed through 2007 began to reverse. Net oil imports declined from 2008, strengthening the Oil Supply Security metric score substantially from its low point and in fact propelling it to new highs in recent quarters. With stockholdings observing very little change over the time period, declining consumption has had a similarly positive effect on Total Oil Stockholdings as a Percentage of Consumption.

AN UNCERTAIN HORIZON

While many of the United States' individual metric scores have shown improvement, a return of high and volatile oil prices represents a serious and unpredictable threat to U.S. oil security. A recent example is supply outages in Libya in early 2011 that caused global oil prices to spike and contributed to a decline in U.S. oil security. This decline occurred despite positive trends of rising efficiency and falling oil imports (and even though U.S. imports of crude oil from Libya averaged less than 1 percent of total imports in late 2010 and early 2011).[48] Continued improvement in the Oil Intensity and Fuel Consumption Per Capita metrics in particular will help insulate the economy from the effects of higher and volatile prices. Increasing domestic production will also have a positive effect on the Total Spending on Net Oil Imports as a Percentage of GDP and Oil Supply Security metric scores, both of which either remain or have been below 100 for most of the time period, dragging down the combined score.

48 SAFE/RGE analysis based on data from: U.S. EIA

99.0

The lowest combined score encountered by the United States since 2000 (most recently in Q4 2007)

The 0.2 point increase in the combined score over the past three quarters is clear evidence that the trends of increased domestic oil production and improved efficiency are strengthening U.S. oil security, even in a historically high-price environment. Continued improvements in the Economic Exposure metrics (assuming that they are not caused by temporary declines in oil prices or U.S. economic activity) will be indicative of a growing resilience to oil price spikes. However, even with these improvements in its oil security, the United States would remain far from being truly insulated from the high and volatile oil prices characteristic of the global oil market, as its scores for the Total Spending on Oil as a Percentage of GDP and Total Spending on Net Oil Imports as a Percentage of GDP metrics in particular attest.

South Africa

OIL SECURITY TREND =

Facts and Figures

0.0 BBL	0.0 MBD	0.6 MBD	2.1%
Oil Reserves (2012)	Production (2012)	Consumption (2012)	GDP Forecast (2013)
0.0% of Global Total (2012)	**0.0 MBD** Change (2008-2012)	**0.0 MBD** Change (2008-2012)	**1.9%** GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Most of South Africa's domestic energy production centers on its large coal reserves and significant coal-to-liquids conversion.

ASSESSMENT

Although South Africa's economy is not particularly reliant on oil, oil makes up a large share of its import bill (it ranks 13th in Total Spending on Net Oil Imports as a Percentage of GDP). Consumption-led growth is also increasing the country's demand for petroleum products with Fuel Consumption per Capita tripling since 2000. This suggests a substantial, and growing, vulnerability to supply shocks and changing prices.

Worse still, South Africa remains reliant on oil imports from countries at higher relative risk of disruption despite an ongoing shift from the Middle East toward African counterparts. However, the country's relatively low (in absolute terms) demand for oil suggests that its (relatively high) exposure to unreliable supply sources is likely to at least remain somewhat stable in the short-to-medium term. Reducing oil intensity through efficiency improvements represents South Africa's primary opportunity to strengthen oil security.

BACKGROUND

All of South Africa's just 15 million barrels of proven total oil reserves are located offshore of the south and western coasts.[49] Home to 95 percent of the total coal reserves in Africa (and the ninth largest reserves in the world), coal accounts for the majority of its energy production.[50] As a result, South Africa's Sasol has developed the only large-scale coal-to-liquid industry currently in operation (although China is also now building plants), which became necessary when apartheid-era sanctions required a greater emphasis on energy self-sufficiency. Of the 180,000 barrels of oil produced daily in South Africa, 160,000 barrels are synthetic.[51] Sasol has also proposed the construction of a gas-to-liquids plant in the United States.

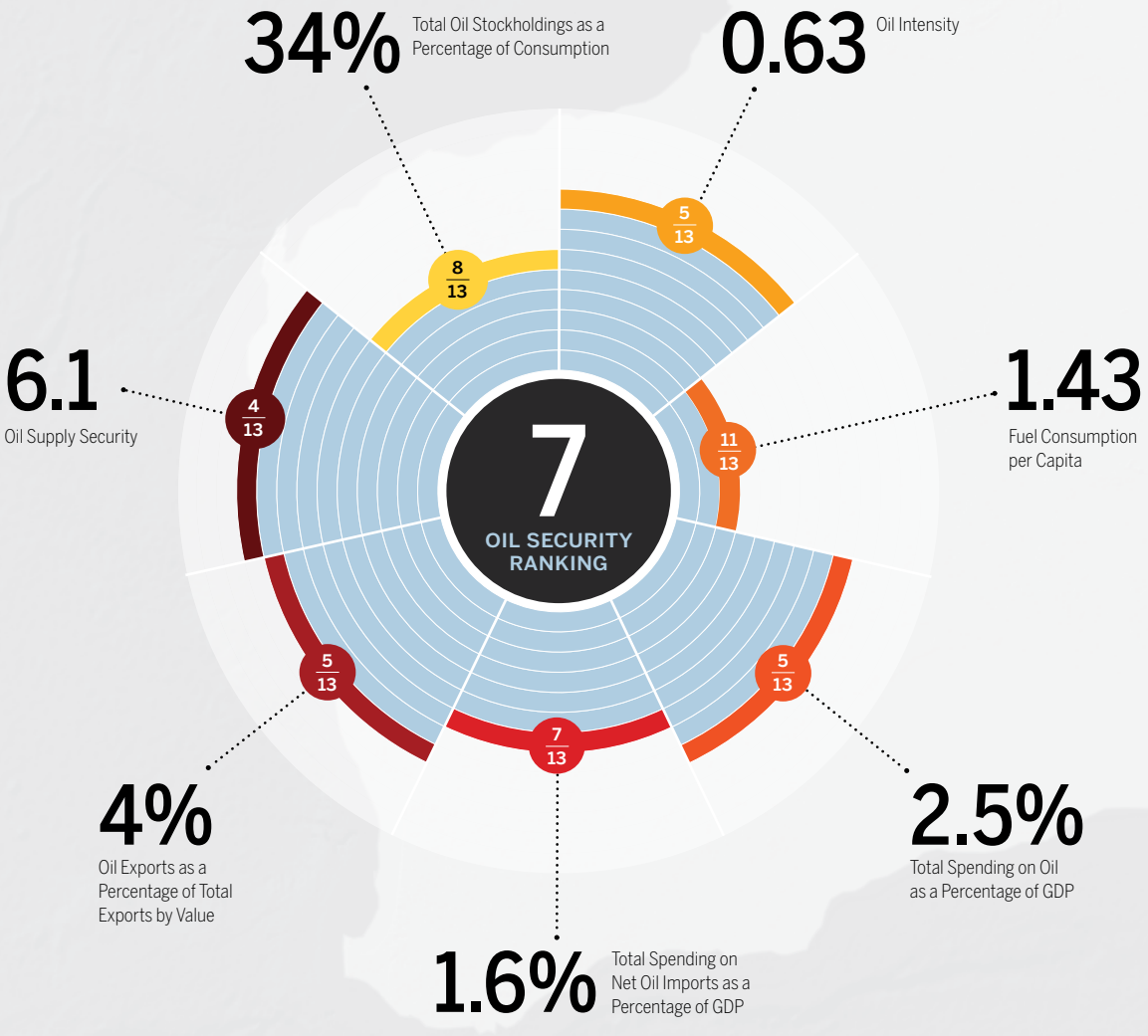
Until very recently, South Africa imported most of its oil from OPEC countries in the Middle East, particularly Iran. Due to U.S. and international sanctions on the Iranian oil industry, these imports have since been replaced by imports from Saudi Arabia, in addition to Nigeria and Angola. South Africa's government is actively seeking deeper ties with regional partners.[52]

South Africa is exploring additional ways to diversify its energy sector so that it will be less reliant on coal and imports of oil products. In order to decrease environmental impacts caused by the carbon dioxide emissions from coal and to strengthen energy security, the country is focusing particularly on the development of potentially sizeable shale gas resources (a moratorium that had been in place since April 2011 was lifted in September 2012), and energy efficiency and innovation. In 2010, for example, the Policy to Support the Energy Efficiency and Demand Side Management was established. This policy provides incentives for individuals and industries to purchase less energy-intense products.[53] Earlier this year, the government also released its Electric Vehicle Industry Roadmap, which includes incentives for manufacturers that build more than 5,000 electric vehicle units. The Roadmap also includes plans to install charging stations.[54] However, the recent sharp slowdown in economic growth has without question severely hampered implementation.

49 U.S. EIA, Country Analysis Briefs, South Africa, last updated June 17, 2013
50 Notably, increasing U.S. natural gas production and a subsequent rise in cheap U.S. coal exports have partly displaced South Africa's own coal exports, forcing them to seek new markets.
51 U.S. EIA, Country Analysis Briefs, South Africa
52 Id.
53 IEA, Policies and Measures, South Africa, last updated 2013
54 Republic of South Africa, South African Government News Agency, Electronic vehicle industry road map launched, May 2, 2013

Australia

OIL SECURITY TREND



Facts and Figures

3.0 BBL
Oil Reserves (2012)

0.5 MBD
Production (2012)

1.0 MBD
Consumption (2012)

2.5%
GDP Forecast (2013)

0.2% of Global Total (2012)	**-0.1 MBD** Change (2008-2012)	**0.1 MBD** Change (2008-2012)	**2.5%** GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

With rising oil consumption and falling production, Australia is increasingly dependent on oil imports to meet its needs.

ASSESSMENT

In recent years, improvement in Australia's oil intensity has stagnated due to the increase in energy-intensive mining driven in large part by China's booming demand for commodities. Australia's Fuel Consumption per Capita is also among the highest in the Index (11th). Despite a decline in domestic oil production, Australia's oil imports are relatively modest. This to some extent limits the country's exposure to direct shortages, and as a result it scores in the upper tier for Oil Supply Security. The country's oil stockpiles are relatively low in comparison to other developed countries, particularly given its remote location.

Perhaps the most important factor in Australia's oil demand outlook is the possibility of an economic slowdown in China, which could affect commodities (metals and natural gas) demand and by consequence reduce oil demand in Australia's mining sector. This is particularly true in the short-to-medium term. While China's slowdown will, on the positive side, dampen Australia's oil consumption in this way and therefore decrease its vulnerability to oil price changes, it will also have a negative impact on Australian economic growth.

BACKGROUND

Australia is heavily dependent on oil as its primary energy source (36 percent of the country's total energy use).[55] And though the country has proved reserves of 3.9 billion barrels, it has become increasingly dependent on oil imports that today total more than 0.5 mbd (up from less than 0.15 mbd on average through the 1980s and 1990s).[56] This divergence reflects a 0.3 mbd decline in production since 2004 and a 0.2 mbd increase in consumption.

International firms dominate Australia's oil industry, and the pipeline network is privately owned and operated. Shale oil is not currently being produced commercially, but the U.S. Energy Information Administration (EIA) estimates Australia holds more than 17 billion barrels of recoverable shale oil.[57] With ample reserves, a stable government, and a strategic location near major Asian oil markets, Australia has the potential to be one of the next countries with commercially viable shale oil production.[58] However, due to the remoteness of many of Australia's shale oil basins, in addition to other factors that increase costs, their development will likely advance at a slow pace.

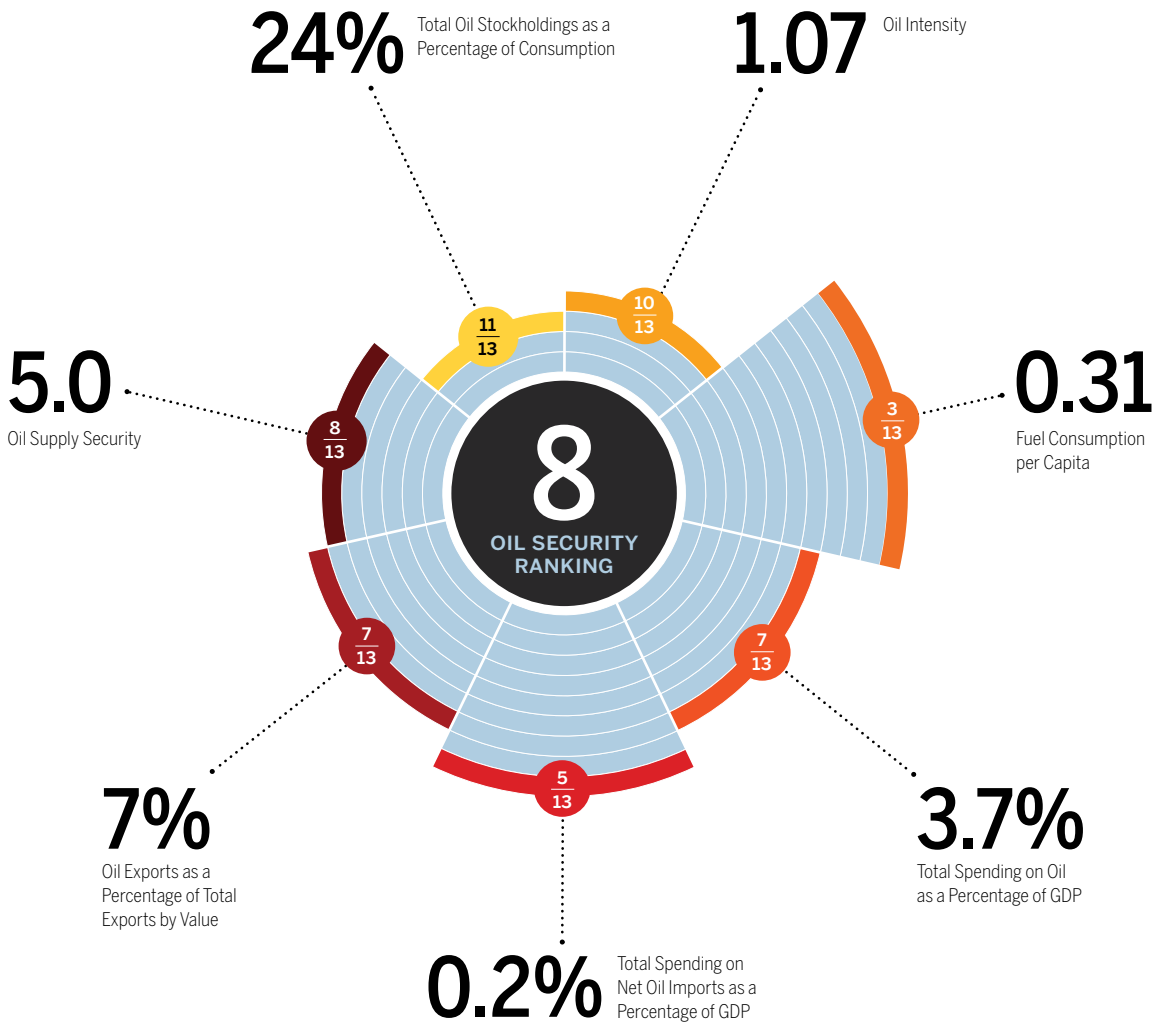
17 BILLION
Barrels of estimated recoverable reserves of shale oil in Australia

The transportation sector accounts for 74 percent of Australia's total oil consumption.[59] The mining, refining, and petrochemicals industries are also meaningful consumers and have contributed to most of Australia's oil demand growth in recent years.[60]

55 U.S. EIA, Country Analysis Briefs, Australia, last updated June 21, 2013
56 BP, plc., Statistical Review 2013, at 6
57 U.S. EIA, Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States, June 13, 2013, Table 4, at 8
58 Id., at III-1 or 85
59 U.S. EIA, Country Analysis Briefs, Australia
60 Id.

Brazil

OIL SECURITY TREND



Facts and Figures

15.3 BBL
Oil Reserves (2012)

2.1 MBD
Production (2012)

2.8 MBD
Consumption (2012)

2.5%
GDP Forecast (2013)

0.9%
of Global Total (2012)

0.3 MBD
Change (2008-2012)

0.4 MBD
Change (2008-2012)

3.2%
GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Brazil is a leading oil consumer and producer. The country uses substantial quantities of ethanol as a transportation alternative to oil and also recently discovered one of the largest oil reservoirs in the world.

ASSESSMENT

Despite (and occasionally because of) the sizeable use of ethanol as an alternative to oil in the transportation sector, Brazilian consumers pay a relatively high price for retail fuel but consume among the lowest quantities on a per capita basis (it currently ranks 3rd in Fuel Consumption per Capita). The country's Oil Intensity is, however, among the worst in the Index (10th). Like most developing countries, Brazil also has limited oil stockpiles upon which to call in the event of a supply shock.

Over the longer term, the return of domestic oil production growth (and even exports) would be particularly welcome. Further diversification of transportation fuels (including alternatives to ethanol blending that provides few price benefits) is also likely to help strengthen Brazil's oil security.

BACKGROUND

Brazil is the world's seventh largest oil consumer and thirteenth largest oil producer.[61] Although production plateaued in 2010, the medium- and long-term forecast is positive thanks to the discovery of new and very large deepwater reserves known as pre-salt, which are expected to help increase output by 30 to 35 percent by 2018.[62]

Petrobras, the country's largest oil company, will be the primary developer of the pre-salt formations. While Petrobras is known as one of the most technologically advanced oil companies in the world, the depth of the pre-salts will make extraction costly.[63] Such rising costs, in addition to high inflation and rising interest rates, could hinder or prompt delays in development. The government's desire to boost domestic manufacturing (e.g. through local content requirements) and employment is also likely to raise costs and extend timelines. Partly due to the technological complexity associated with developing these deepwater reserves, Petrobras has moved to partner with other oil companies, seeking both capital and expertise.

2%

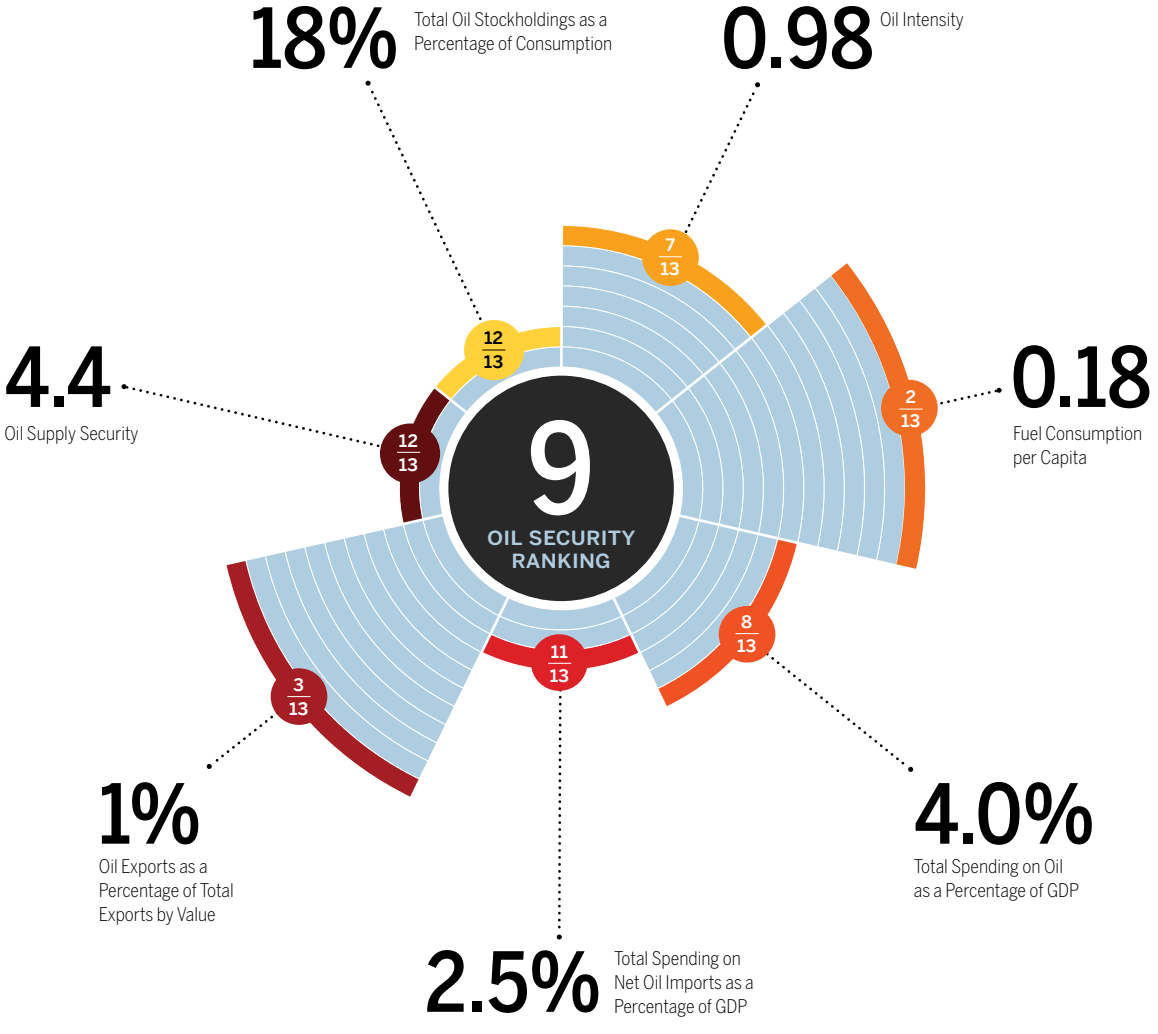
Decline in Brazilian oil production between 2011 and 2012 (the first decline since 2004 and largest since 1988)

Brazil has also actively looked to diversify its transportation fuel sources through the use of ethanol, and since the introduction of flex-fuel cars (capable of functioning on both gasoline and ethanol) in 2003, both ethanol production and consumption have generally increased at a steady pace. However, a combination of high global sugar prices, a poor domestic sugar cane harvest, and petrol and diesel price controls helped caused a decline in domestic ethanol production in 2011. This forced Brazil to import corn ethanol from the United States.[64] In response to the shortage, the government temporarily lowered the gasoline blend requirement from 25 to 20 percent.[65] Although ethanol production has not yet returned to pre-2011 levels, in May 2013 the blending requirement was raised once again to 25 percent.[66]

61 BP, plc., Statistical Review 2013, at 8 and 9
62 IEA, MTOMR 2013, at 50
63 See, e.g., Forbes, "Brazil: Strategic Planning For Pre-Salt," July 8, 2010
64 U.S. EIA, Country Analysis Briefs, Brazil, last updated February 28, 2012
65 Id.
66 IEA, MTOMR 2013, at 76; and Renewable Fuel Association, Statistics, World Fuel Ethanol Production, annual data for Brazil 2008 to 2012

China

OIL SECURITY TREND



Facts and Figures

17.3 BBL
Oil Reserves (2012)

4.2 MBD
Production (2012)

10.2 MBD
Consumption (2012)

7.5%
GDP Forecast (2013)

1.0%
of Global Total (2012)

0.3 MBD
Change (2008-2012)

2.3 MBD
Change (2008-2012)

9.3%
GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

China is the world's second largest oil consumer. Although also a major oil producer, the country is becoming increasingly reliant on imports to keep pace with growing demand.

ASSESSMENT

Despite improvements in vehicle efficiency, China remains heavily reliant on oil and, increasingly, oil imports (the country ranks 11th in Total Spending on Net Oil Imports as a Percentage of GDP). The country also relies heavily on relatively unstable and unpredictable regimes in the Middle East and West Africa, as well as Russia.

China's strategic reserves are small relative to consumption but have increased rapidly in recent years and are set to rise further. Substantial further improvement in efficiency and the use of alternative transportation fuels will be necessary to limit the country's rapidly growing oil consumption over the longer term.

BACKGROUND

Until the early 1990s, Chinese oil production outpaced consumption and China was a net oil exporter.[67] Since then, economic growth has spurred an increase in demand of more than 7 mbd (to more than 10 mbd in total) and an increasingly heavy reliance on imports.[68] This increase has underpinned global demand growth (40 percent of the total increase between 2011 and 2012 is attributed to China).[69] This dynamic is forecast to continue as commercial freight and personal motor vehicle ownership rates increase.[70]

China has produced an average of 3.8 mbd over the past decade.[71] However, large domestic oil fields in the northeast have been harvested since the 1960s, and production is expected to decline in the coming years. To compensate for expected future declines, exploration has moved to the western provinces and offshore locations. There are plans to construct more than 12,000 miles of pipeline by 2015 to accommodate new resources and currently unconnected parts of the country.[72]

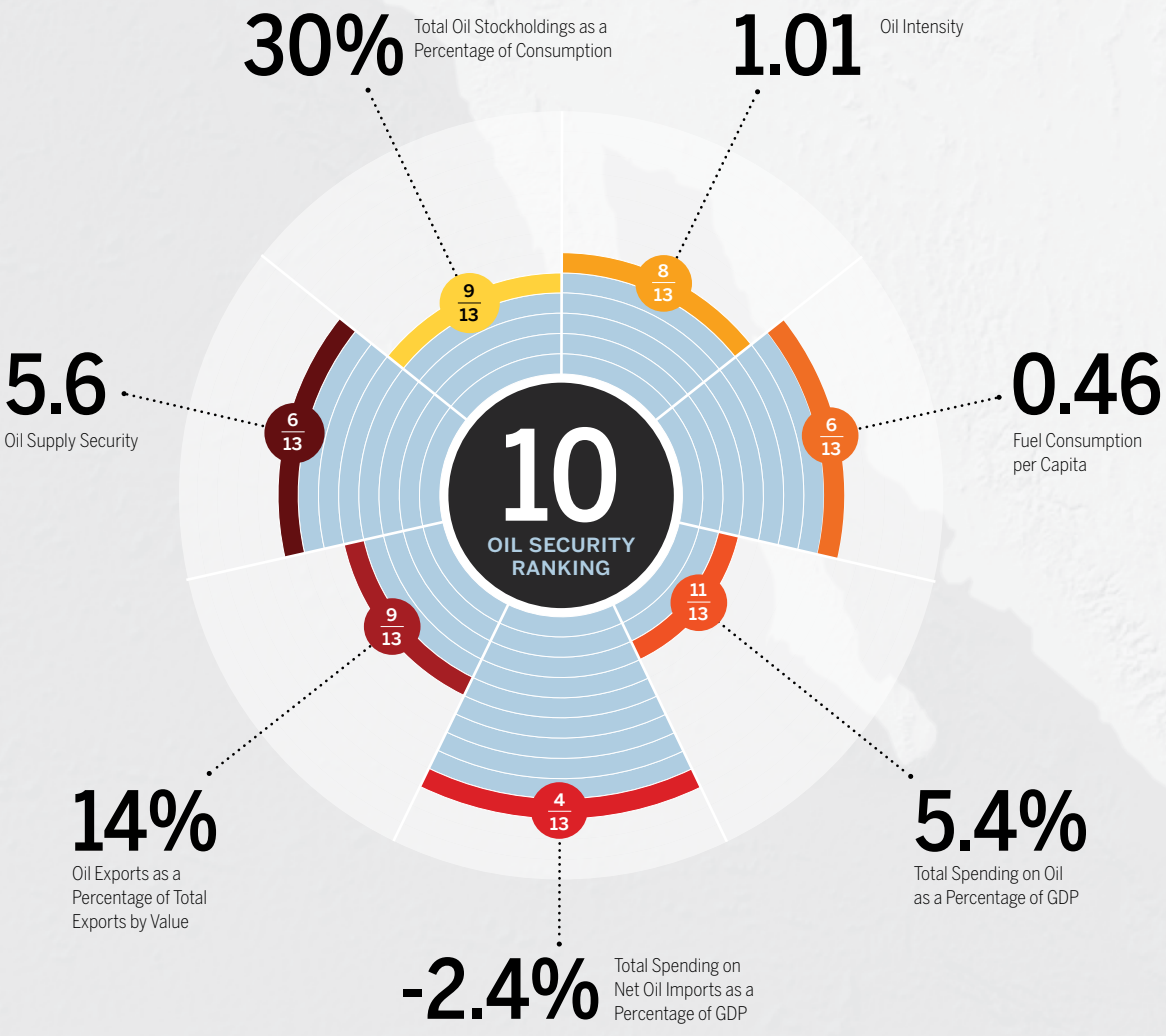
Due to its increasing reliance on the global oil market, China has actively promoted oil exploration and development in 31 countries across multiple regions, including the Middle East, Latin America, and Africa.[73] Since 2009, Chinese NOCs have invested $18 billion in energy acquisitions for oil and natural gas on five different continents.[74] With imports expected to comprise 75 percent of China's oil supply by 2035, diversification of its import sources is a priority.[75] China's investments also help strengthen its vertical supply chains. China announced the construction of strategic reserves of crude oil in 2001 and completed Phase 1 (of 3) in 2008 (approximately 100 million barrels). Phase 2 is expected to be completed by the end of 2015 (approximately another 240 million barrels). Although China does not publish official estimates, estimates by the IEA suggest that at least 150 million barrels of storage are already filled.[76]

In response to the widening gap between oil consumption and domestic production, China's most recent Five-Year Economic Plan includes a goal to achieve 11.4 percent non-fossil fuel consumption by 2015. The country has also implemented vehicle fuel efficiency standards similar to those established in the European Union (47 miles per gallon by 2025).[77]

67 U.S. EIA, Country Analysis Briefs, China, last updated April 22, 2013
68 BP, plc., Statistical Review 2013, historical data
69 IEA, MTOMR 2013, at 33
70 Automotive News, "Ford says its China sales growth will outpace industry," June 26, 2013
71 BP, plc., Statistical Review 2013, historical data
72 U.S. EIA, Country Analysis Briefs, China
73 Radio Free Asia, "China's Economy Slows Oil Growth," May 27, 2013
74 Wall Street Journal, "China Push in Canada Is Biggest Foreign Buy," July 24, 2012
75 U.S. EIA, Country Analysis Briefs, China
76 IEA, MTOMR 2013, at 119
77 Green Car Reports, "China Imposes Much Tougher Fuel-Efficiency Standards On New Cars," March 22, 2013

Mexico

OIL SECURITY TREND



Facts and Figures

11.4 BBL
Oil Reserves (2012)

2.9 MBD
Production (2012)

2.1 MBD
Consumption (2012)

2.9%
GDP Forecast (2013)

0.7% of Global Total (2012)	**-0.3 MBD** Change (2008-2012)	**0.0 MBD** Change (2008-2012)	**1.7%** GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Despite marked declines in oil production since 2004, Mexico remains one of the world's major oil producers.

ASSESSMENT

Mexico's relatively high level of oil production and oil exports, and improving demand-side efficiency, have helped improve its oil security outlook in recent years, though fiscal reliance on oil remains a vulnerability. The country's Total Spending on Oil as a Percentage of GDP is also among the highest in the Index (5.4 percent).

The current government's commitment to industry reform is on a promising track, particularly after the 2013 local elections, and suggests there could be a reversal in the downward oil-production trend. Such reform would be supportive of economic growth as well as Mexican and North American oil security in the medium term. However, implementation may be slow.

BACKGROUND

The Mexican government created Petróleos Mexicanos (PEMEX) when it nationalized its oil industry in 1938. Today, PEMEX is the largest company in Mexico and plays a vital role in the Mexican economy, with oil accounting for 34 percent of total government revenues in 2011.[78] Because its revenues support other sectors of the economy, Pemex has had to compete for funding to direct toward upstream capital expenditure, which has undermined production and led to a loss of skilled workers.

Mexico holds 11.4 billion barrels of proven oil reserves, and approximately 75 percent of those reserves are located offshore in the Gulf of Mexico.[79] PEMEX is one of the largest oil companies in the world, yet last year it posted negative net income, limiting its ability to invest in exploration and production. (PEMEX's oil production has in fact fallen steadily since 2004, from 3.8 mbd to just 2.9 mbd in 2012.)[80] Absent other policy changes, Mexico's oil production is currently forecast to decline by 1.4 mbd by 2025.[81] However, due to the close link between oil production and Mexico's economic prosperity, recently elected President Enrique Peña Nieto has made energy reform a top priority, with a focus on making the oil industry more productive and sustainable. Part of the proposed reform is additional investment of $10 billion per year through 2025. The government forecasts that oil production would rise by 1 mbd as a result.[82]

$10 BILLION

Proposed annual Mexican government investment in the oil industry through 2025 as part of a recently-announced reform package

Mexico has developed a symbiotic oil trade relationship with the United States. Last year, the United States received a majority of Mexico's oil exports (approximately 1 mbd), while Mexico received nearly 0.6 mbd of U.S. refined petroleum products (Mexico experienced modest economic growth in 2012 of 3.9 percent that spurred demand for oil products such as gasoline).[83, 84] Despite Mexico's declining production, this partnership remains extremely valuable for each country with energy trade between the two topping $65 billion in 2012.[85]

78 U.S. EIA, Country Analysis Briefs, Mexico, last updated October 17, 2012
79 Id.; and BP, plc., Statistical Review 2013, historical data
80 BP, plc. Statistical Review 2013, at 8
81 Id., at 46; and U.S. EIA, Country Analysis Briefs, Mexico
82 Financial Times, "Reform will boost oil investment by $10bn a year, says Pemex chief," August 15, 2013
83 U.S. EIA, Today in Energy, "Mexico Week: Crude oil moving north, products moving south characterizes U.S.-Mexico trade," May 15, 2013
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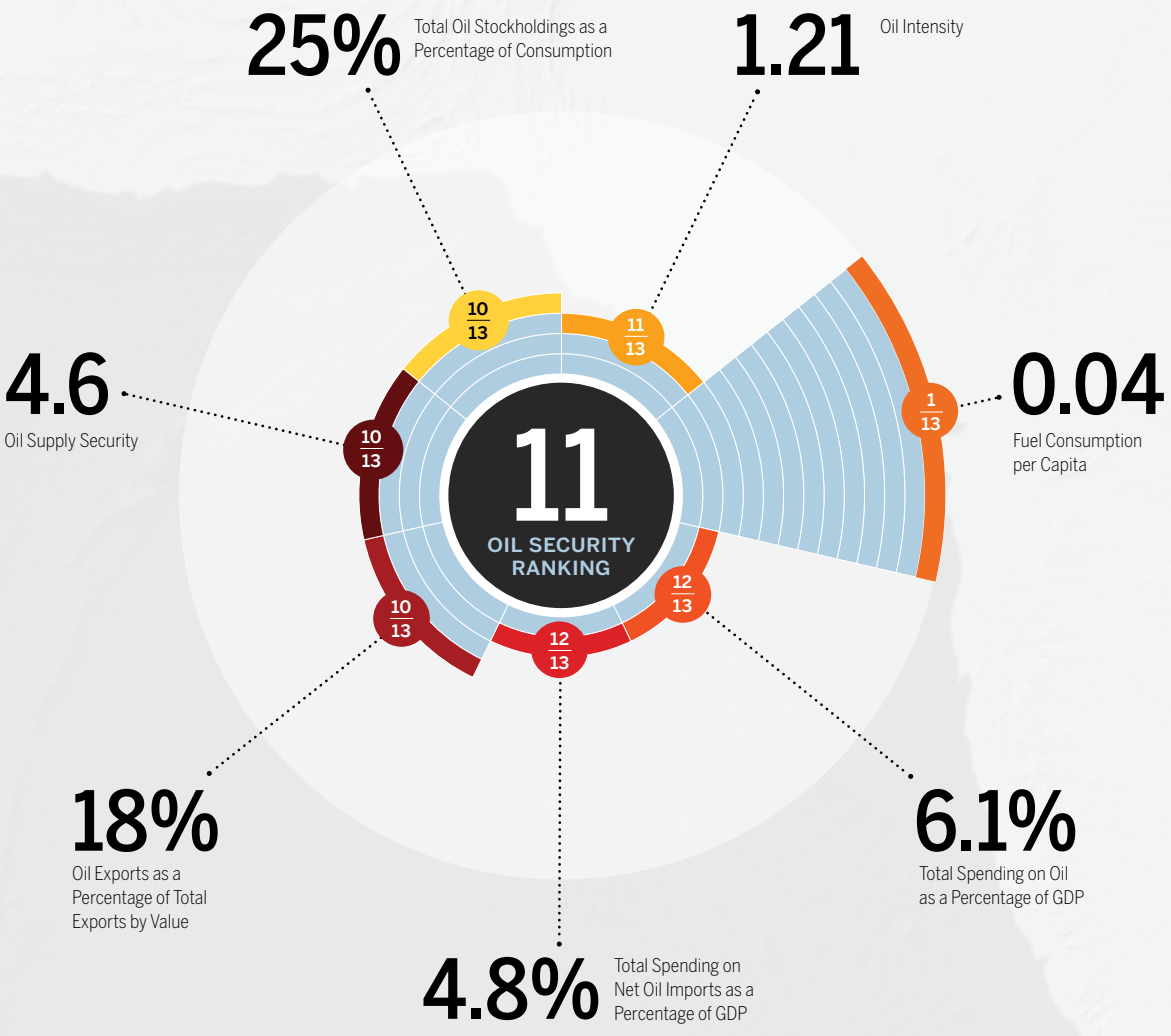
85 Id., "Mexico Week: U.S. is Mexico's primary energy trade partner amid shifting trade dynamics," May 13, 2013

India

OIL SECURITY TREND



Facts and Figures

5.7 BBL
Oil Reserves (2012)

0.9 MBD
Production (2012)

3.7 MBD
Consumption (2012)

5.4%
GDP Forecast (2013)

0.3%
of Global Total (2012)

0.1 MBD
Change (2008-2012)

0.6 MBD
Change (2008-2012)

7.3%
GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

India is already the fourth largest oil consumer in the world and has significant potential for future demand growth.

ASSESSMENT

Although the oil intensity of India's economy has decreased by 30 percent since 2000, the volumes of oil being consumed and imported have risen sharply, undermining its fiscal and external balances (it currently ranks 12th in Total Spending on Net Oil Imports as a Percentage of GDP). Furthermore, despite a reduction in consumption subsidies, population and income growth are increasing per capita fuel consumption from today's low levels (currently 1st on this metric)—a trend that should continue in the long term despite recent sluggish growth.

India's state-owned enterprises are increasing involvement abroad to establish more diversified oil supplies (this includes Africa, from where it imported no oil less than a decade ago, Iraq, and Venezuela). Efficiency measures will almost certainly be required over the longer term also if the country is not to observe further erosion of its oil security.

BACKGROUND

Like most developing nations, India's strong economic growth has triggered an increase in energy and oil consumption. Between 1990 and 2011, India's energy consumption doubled. India's largest energy source is coal (42 percent) followed by oil and biomass (both 23 percent).[86] India's oil consumption grew from 2.5 mbd in 2003 to 3.7 mbd in 2012.[87] It is forecast to grow further (4.4 mbd in 2018) as the size of the vehicle fleet increases.[88] As in most countries, oil in India is used primarily for transportation, especially in personal vehicles, although widespread use of natural gas in public transportation could diminish demand for oil products to some extent.

The government has recently focused on accommodating the rapid increases in energy demand and set a goal of being energy self-sufficient by 2030.[89]

The country is currently the world's fourth largest oil importer, relying on imports for 70 percent of its needs. Imported oil is primarily sourced from the Middle East, including Saudi Arabia and Iran (although it is important to note that with international sanctions on Iran's oil sector being strengthened, pressure will likely rise on India to stop buying oil from Iran). Efforts are underway to strengthen stakes in foreign production activities, and stimulate domestic exploration and production, though Indian overseas companies lack the investment capital of their Chinese counterparts. The efforts also include developing onshore and offshore reserves (estimated at 5.5 billion barrels) and investing in refinery capacity (including reform of customs duties on petroleum products).[90] Finally, India is building oil stocks equivalent to 60 days of consumption (or approximately 150 million barrels) in order to increase oil security in the event of a direct supply disruption.[91]

47%

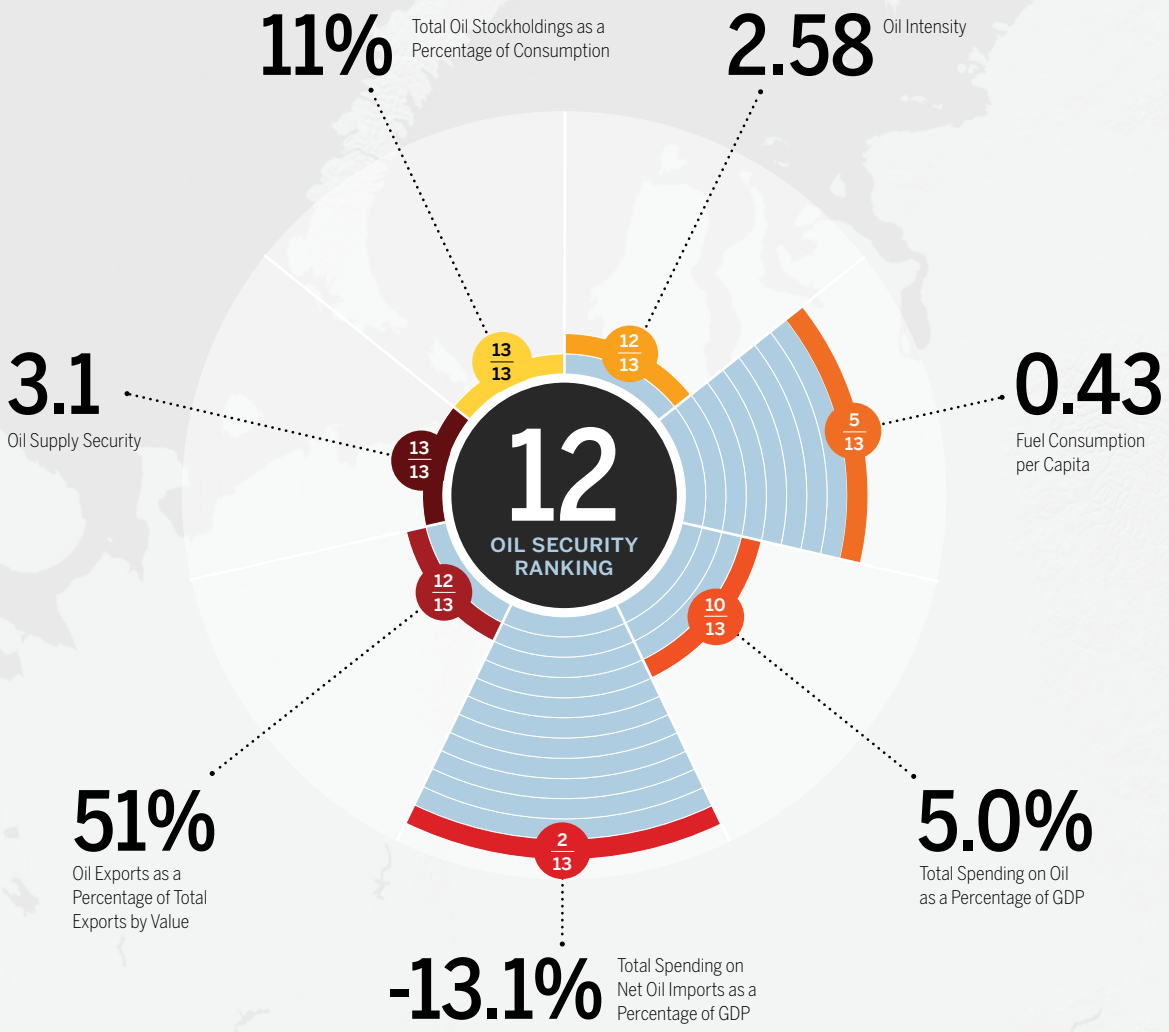
Increase in Indian oil consumption between 2003 and 2012

To help facilitate market-based adjustments on the consumption side, between 2002 and 2010, the government deregulated end-use prices that historically were heavily subsidized.[92] Nevertheless, gasoline demand is still forecast to rise by an average of 5.4 percent per annum through 2018.[93]

86 U.S. EIA, Country Analysis Briefs, India, last updated March 18, 2013
87 BP, plc., Statistical Review 2013, at 9
88 IEA, MTOMR 2013, at 24, and Table 2, at 143
89 U.S. EIA, Country Analysis Briefs, India
90 Id.
91 IEA, Oil and Gas Emergency Policy - India 2007 update, last updated 2013
92 Id.
93 IEA, MTOMR 2013, at 24

Russia

OIL SECURITY TREND: -



Facts and Figures

87.2 BBL
Oil Reserves (2012)

10.6 MBD
Production (2012)

3.2 MBD
Consumption (2012)

1.8%
GDP Forecast (2013)

5.2% of Global Total (2012)	**0.7 MBD** Change (2008-2012)	**0.3 MBD** Change (2008-2012)	**1.8%** GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Russia is currently the world's second largest oil producer and exporter and home to the eighth largest proved reserves.

ASSESSMENT

Russia's high oil intensity, limited oil stockpiles, and heavy dependence of its fiscal account on oil export revenues contribute to a low ranking. As a result of its poor business environment and policy uncertainty, Russia's Oil Supply Security is also the lowest (3.1) despite being a major oil producer.

Rising levels of vehicle ownership and limited efforts to strengthen fuel efficiency suggest that per capita fuel consumption is set to increase. Russia is also yet to invest extensively in new export channels, leaving it reliant on Europe, where demand is shrinking and buyers are wary of Russia's closely-linked energy and foreign policy goals. An emergent shift towards Asia is likely to help mitigate this concern over the long term.

BACKGROUND

Russia is currently the world's largest non-OPEC oil producer and second largest oil producer overall—rivaling Saudi Arabia. With reserves of 87 billion barrels, production could increase with additional infrastructure investment, but capital expenditure is somewhat capped due to fiscal and regulatory constraints.[94]

Russia's oil exports account for approximately 15 percent of GDP, 50 percent of total goods exports, and more than half of its government revenues. The economy is as a result sensitive to oil price movements. For example, the economy contracted 7.8 percent in 2009 after oil prices declined from 2008 highs, reducing government revenues, accelerating capital outflows, and leading to sharp reductions in inventories (especially of natural gas).[95] Seventy-eight percent of Russia's oil exports go to European markets—of which Germany, Netherlands, and Poland are the main recipients.[96] Russia's second largest market is Asia and the country is currently increasing oil supplies to China at an annual rate of 50 percent.[97]

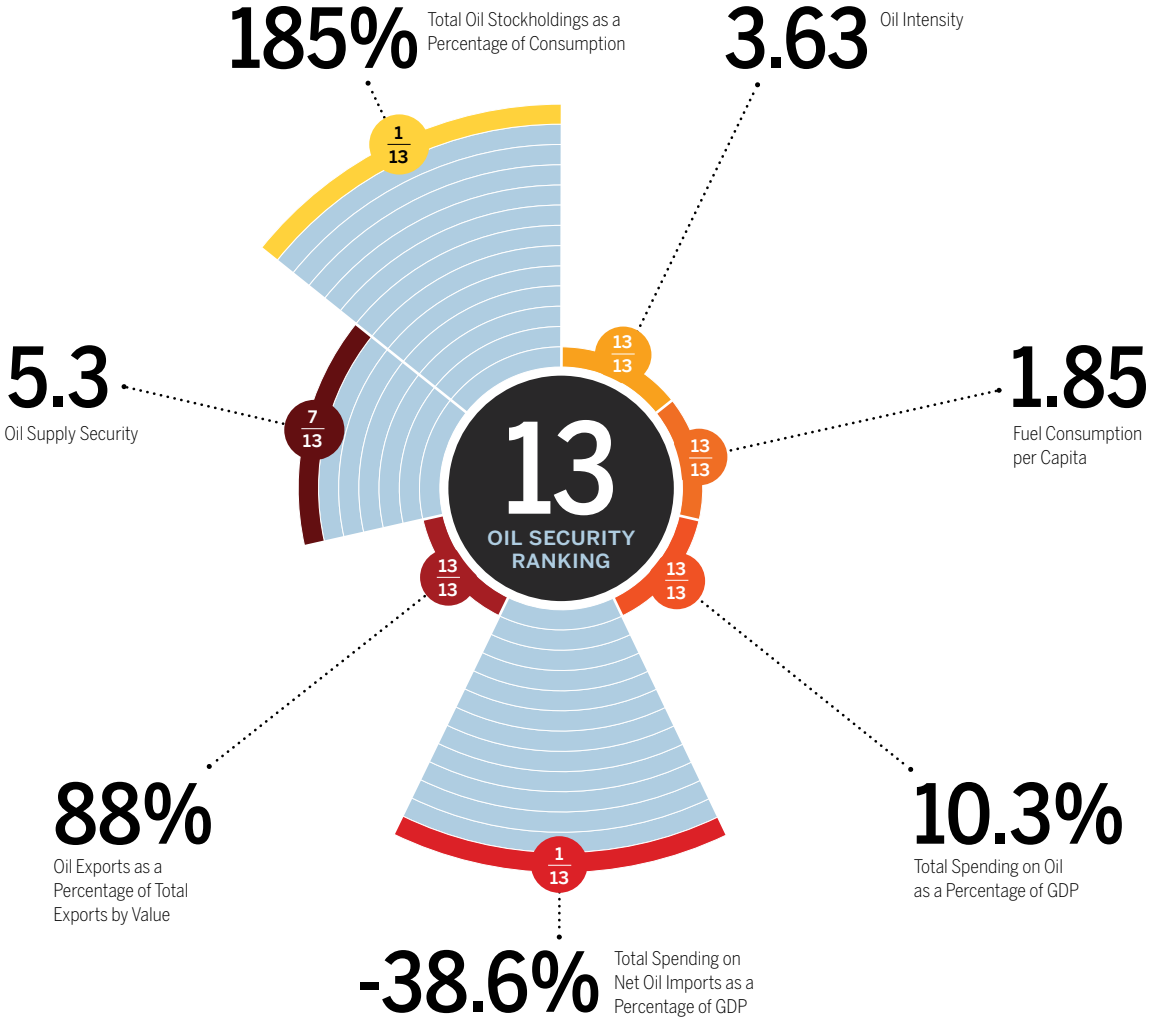
Oil production is dominated by domestic firms, of which state-owned Rosneft is the largest. Some international oil companies do have operations in Russia (mainly through joint-venture), although these have not been without their challenges (e.g. TNK-BP, which was mired by disputes over ownership before being acquired by Rosneft in 2013, approximately a decade after being created). Transneft, a state-owned monopoly, controls Russia's pipeline network. Russia's oil and gas sector continues to be affected by high taxes and export duties (and a recent proposal would raise the fuel export duty from 66 to 72 percent), but the government is also planning to implement tax incentives to encourage the development of a number of resources including tight oil and those in the Arctic shelf.[98] Uncertainty about taxes and royalties undermine investment and leave Russia's companies seeking capital from foreign partners, mostly from Asia, to build necessary infrastructure.

On the demand side, Russia's oil consumption averaged 3.3 mbd in 2012 and is projected to grow by 3 percent in 2013.[99] A major contributing factor is car ownership, which has increased 35 percent (to 271 vehicles per 1,000 people) since 2004.[100] Although considered economically and financially viable, improvements to public transportation and implementing fuel-economy standards remain a low political priority and therefore unlikely to materialize in the short term.

94 BP, plc., Statistical Review, at 6
95 World Bank, Data, GDP growth (annual %)
96 U.S. EIA, Country Analysis Briefs, Russia, last updated September 18, 2012
97 Globe and Mail, Reuters, "Russia ramps up oil exports to China in strategic shift," June 18, 2013
98 IEA, MTOMR 2013, at 60
99 Id., Table 2, at 143; and BP, plc., Statistical Review, at 9
100 World Bank, Data, Motor vehicles (per 1,000 people)

Saudi Arabia

OIL SECURITY TREND: -



Facts and Figures

265.9 BBL
Oil Reserves (2012)

11.5 MBD
Production (2012)

2.9 MBD
Consumption (2012)

5.1%
GDP Forecast (2013)

15.9%
of Global Total (2012)

0.9 MBD
Change (2008-2012)

0.6 MBD
Change (2008-2012)

4.3%
GDP (2008-2012)*

*Average Annual Growth

COUNTRY PROFILE

Saudi Arabia is currently the world's largest oil producer and exporter. The country holds the world's second largest proved oil reserves and the only sizeable quantities of spare oil production capacity.

ASSESSMENT

Saudi Arabia's high oil intensity, rising domestic energy use, and fiscal reliance on oil make it very vulnerable to changing oil prices. The oil intensity of the economy and the average fuel use per capita is high and rising, about 10 times and 3 times greater respectively than the most efficient countries.

Efficiency measures and the phase-out of subsidies will be important in tempering demand growth over the long term and maintaining oil-export levels. Economic diversification is also necessary to reduce the country's vulnerability to disruptive events in the marketplace such as weak economic conditions or closures of oil shipment routes.

BACKGROUND

Although Saudi Arabia's oil consumption has risen rapidly over the past decade to nearly 3 mbd, the country is more commonly recognized as an oil producer, exporter, and the de facto leader of OPEC by virtue of holding the cartel's only meaningful spare capacity (an estimated 2.3 mbd in Q2 2013).[101] The country's oil exploration, development, and production are controlled by the government-backed Saudi Aramco, with foreign companies restricted only to service contract roles.

Saudi Arabia is estimated to require average oil prices of at least $85 per barrel to balance its fiscal outlays in 2014.[102] It has historically depended on oil export revenues for almost 90 percent of its total export revenues and 85 percent of fiscal revenues.[103] Although government spending accelerated in 2008-09, helping to stimulate the economy and bring additional wealth to Saudi citizens in the aftermath of the "Arab Spring," Saudi leaders have continued to increase social and infrastructure spending, and also implemented a minimum wage. In 2013, spending was increased by almost 20 percent to a record $219 billion.[104] These measures have reinforced the need for oil revenues.

While the country remains the second largest exporter to the United States, the destinations of its approximately 7.5 mbd oil exports in 2012 continue to pivot towards Asia—Japan (1.1 mbd), China (1.1 mbd), South Korea (0.8 mbd), and India (0.7 mbd).[105] Arguably, one of Saudi Arabia's greatest vulnerabilities is therefore the blockage or closure of a major transit route for its Asia-bound exports, such as the Strait of Hormuz. Pipeline bypasses in the event of such a disruption remain limited, with full operational capacity estimated at just 1 mbd to 2.8 mbd.[106]

The rapid rise in oil consumption is primarily a result of strong population growth and heavily subsidized fuel prices. The burning of oil for power generation adds to the government's dilemma. This problem is particularly acute in the summer months, when direct oil burn tends to more than double to above 0.7 mbd.[107] While only minimal steps have been taken to eliminate subsidies, Saudi leaders have begun to promote efficiency and alternatives to oil. Saudi Aramco has, for example, sought natural gas to displace oil use—though exploration has so far borne little fruit, suggesting any evolution could be slow.[108] The planned development of nuclear and renewable power plants (16 plants over the next 20 years and an ambitious solar power build-out) could also reduce the reliance on oil in the power mix.[109]

101 U.S. EIA, STEO, August 2013, at 3
102 IMF, Regional Economic Outlook, Middle East and Central Asia, Statistical Appendix, Table 6
103 OPEC, Annual Statistical Bulletin 2012, Tables 1.2 and 2.4, at 11 and 17
104 See, e.g., Reuters, "Analysis: Arab Spring diverts part of Gulf petrodollar flows," January 30, 2013
105 U.S. EIA, Country Analysis Briefs, Saudi Arabia, last updated February 26, 2013
106 Id., World Transit Chokepoints, last updated August 22, 2013
107 Oxford Institute for Energy Studies (OIES), Summer Again: The Swing in Oil Demand in Saudi Arabia, Figure 2, at 5, July 2013
108 See, e.g., Rigzone.com, "Saudi Aramco to Drill 7 Gas Exploration Wells in Tabuk Province," December 31, 2012
109 OIES, Summer Again, at 6-7

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Securing America's Future Energy

Securing America's Future Energy (SAFE) is a nonpartisan, not-for-profit organization committed to reducing America's dependence on oil and improving U.S. energy security in order to bolster national security and strengthen the economy. SAFE has an action-oriented strategy addressing politics and advocacy, business and technology, and media and public education. More information can be found at SecureEnergy.org.

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Data Sources
Data for the Index is gathered from a variety of sources including BP, International Energy Agency, World Bank, Joint Oil Data Initiative, United Nations, OPEC, Bloomberg, Haver, and Roubini Global Economics.

OIL SECURITY INDEX

The Oil Security Index is an analytical tool developed by Securing America's Future Energy in partnership with Roubini Global Economics. The Index is designed to be an intuitive tool for policymakers, business leaders, and the general public to easily measure and compare the relative oil security of more than a dozen countries around the world.

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