

Oil Security Index

Quarterly Update



October 2014



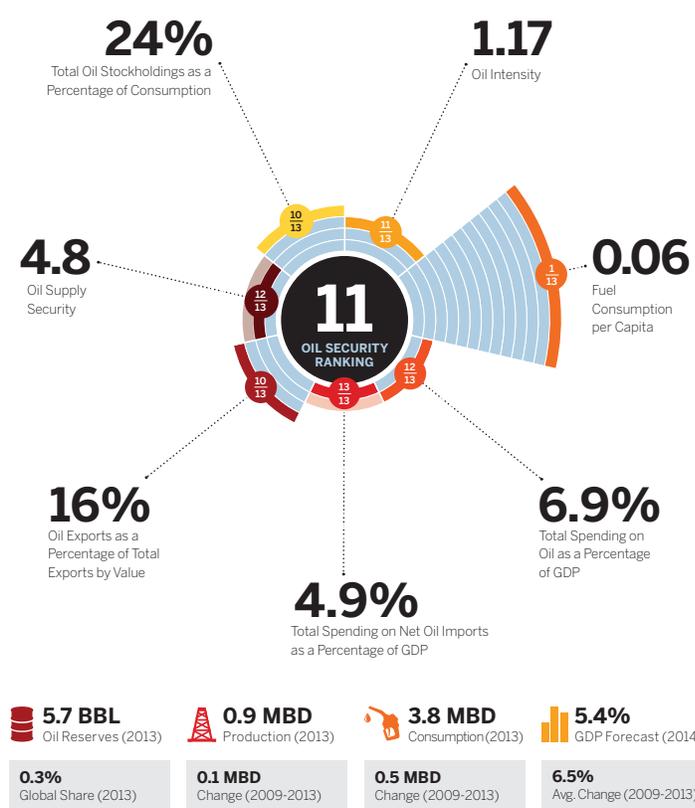
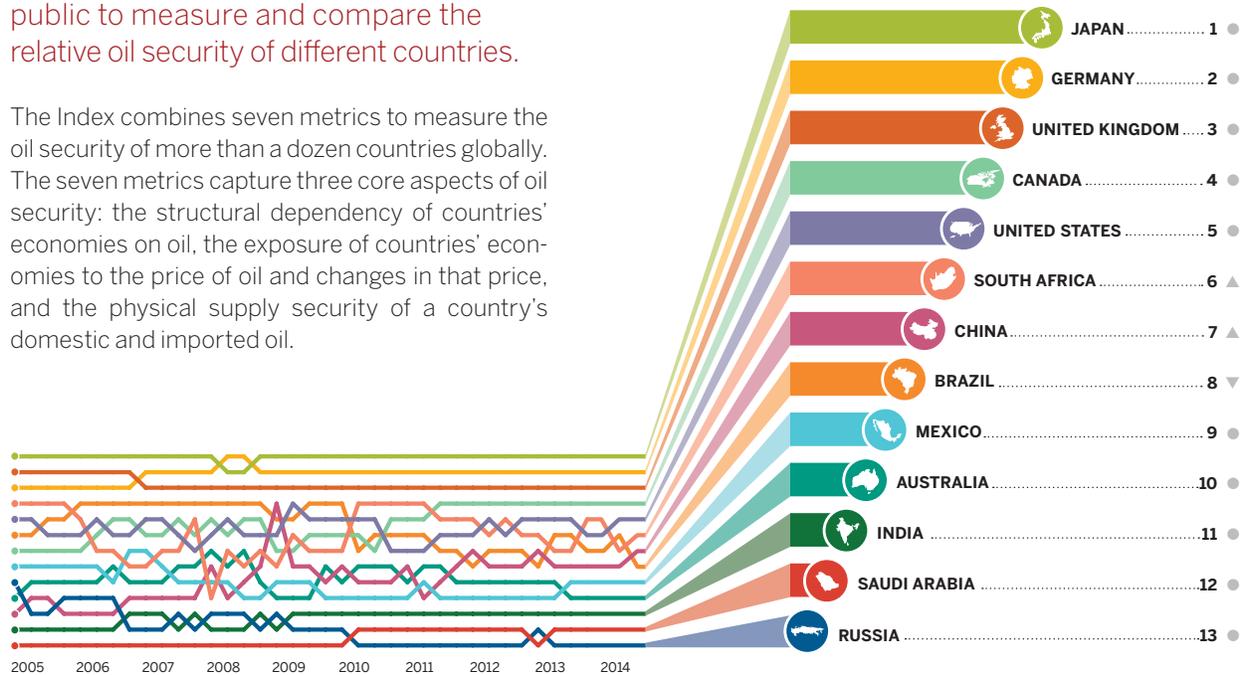
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Oil Security Index Rankings

The Oil Security Index is designed to enable policymakers and the general public to measure and compare the relative oil security of different countries.

The Index combines seven metrics to measure the oil security of more than a dozen countries globally. The seven metrics capture three core aspects of oil security: the structural dependency of countries' economies on oil, the exposure of countries' economies to the price of oil and changes in that price, and the physical supply security of a country's domestic and imported oil.



Spotlight on India

India is the world's fourth largest oil consumer, trailing only the United States, China, and Japan, and relies heavily on oil imports, primarily from the Middle East, to meet its rising consumption needs.

Although the oil intensity of India's economy has decreased by approximately 30% since 2000, the volumes of oil being consumed and imported have risen sharply, by nearly 75% and 100% respectively. Furthermore, and despite some reform to consumption subsidies, rising incomes and demands for mobility are forecast to spur increases in gasoline consumption of approximately 6% per year through 2019. India's reliance on oil imports, particularly from the Middle East, its limited oil stockholdings, and its poor relative levels of efficiency result in a position near the bottom of the Index rankings.

Q2 2014 Global Highlights

Changes in oil demand and supply in different countries around the world impact both those countries' oil security and the global oil market.



- A** **Iran's oil production increased by 0.15 mbd year-over-year (y-o-y) in Q2, its second consecutive quarterly increase.** Sanctions on Iran's oil sector resulted in a production decline of almost 1 mbd between 2011 and 2013—to a low of 2.6 mbd in Q3 2013. However, the negative rate of growth began to slow in Q1 2013 and turned positive in Q1 2014, with crude oil production increasing to 2.8 mbd in Q2.¹
- B** **Growth in non-OPEC oil supply was substantial and driven primarily by the United States.** Non-OPEC production grew by 2.0 mbd y-o-y in Q2, outpacing global demand growth, which declined from 1.0 mbd in Q1 (y-o-y) to 0.7 mbd. The United States accounted for roughly three-quarters of the total net increase. Brazil and Canada also experienced meaningful y-o-y increases (0.2 mbd and 0.4 mbd respectively).²
- C** **Unplanned oil supply outages were substantial.** Outages increased by approximately 0.4 mbd between Q1 and Q2, reaching an average of 3.4 mbd, due primarily to greater disruptions to supply in Libya and persistent outages in Iran, Iraq, and Nigeria. Non-OPEC outages contributed approximately 20% of the global total, led by Syria, where oil production of almost 0.3 mbd is offline.³
- D** **Growth in Russia's oil production remained steady in Q2, increasing 0.1 mbd y-o-y.** However, due to ongoing geopolitical tensions, business uncertainty, and sanctions, the IEA forecasts that Russia's total oil production will increase by only 0.04 mbd in 2014 (versus 0.15 mbd in 2013) and decrease for the first time since 2008 in 2015.⁴
- E** **China's oil demand increased by almost 0.3 mbd y-o-y in Q2, its fastest rate since Q2 2013.** This was the largest increase observed in any individual country and nearly half the total net global increase in oil demand. China also filled its strategic petroleum reserve at an estimated rate of 0.8 mbd in Q2 (roughly equivalent to the daily oil consumption of Turkey).⁵
- F** **Total OECD oil demand fell below 45 mbd in Q2, its lowest level for more than two decades.** Oil demand in OECD countries declined more than 0.6 mbd y-o-y in Q2. Alongside continued oil demand growth in non-OECD countries, this left OECD countries accounting for a clear minority share (less than 49%) of global oil demand for the first time ever.⁶

1 SAFE analysis based on data from: International Energy Agency (IEA), Oil Market Report (OMR), July and August 2014

2 SAFE analysis based on data from: IEA, OMR, August 2014

3 SAFE analysis based on data from: U.S. Energy Information Administration (EIA), Short Term Energy Outlook (STEO), August 2014

4 SAFE analysis based on data from: IEA, OMR, August 2014

5 SAFE analysis based on data from: IEA, OMR, July and August 2014

6 SAFE analysis based on data from: IEA, OMR, August 2014

Focus on Japan's Top Ranking

Japan's energy conservation policies and its ample stockholdings help mitigate the vulnerability posed by a near-exclusive reliance on crude oil imports from Russia and the Middle East.

SUMMARY

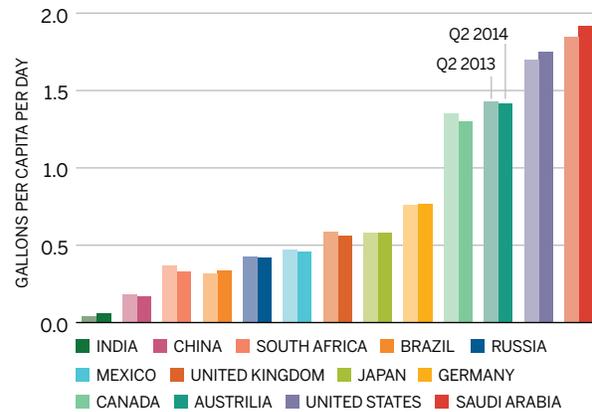
Twice in the 20th century, Japan's heavy reliance on oil imports contributed to crippling oil security crises. In the lead-up to WWII, Japan's dependence on oil supplies from the United States gave American policymakers strategic leverage that undermined Imperial Japan's expansion in the Pacific. In fact, Japan's lack of domestic oil resources was an important factor in its ultimate defeat. Three decades later, Japan's dependence on Middle Eastern trade partners for 90% of its oil made it especially vulnerable to the 1970s oil crises, and its economy experienced a significant restructuring away from heavy industry as a result. It is perhaps slightly counterintuitive, therefore, that Japan ranks so highly in the Oil Security Index, especially above major global oil producers like the United States.

Today, Japan is the world's third-largest oil consumer and importer behind the United States (largest consumer and second-largest importer) and China (second-largest consumer and largest importer). However, Japan's economy is also one of the world's most energy efficient and its oil intensity is approximately 15% lower than that of the United States. As a result, Japan's total spending on oil and spending on net oil imports as percentages of GDP are not dissimilar to several countries that are far more self-sufficient in oil supply, including Australia, the United Kingdom, and the United States.¹

Saudi Arabia and the United Arab Emirates are Japan's two largest suppliers at approximately one third and one quarter of total crude oil imports, respectively.² Due to its lack of domestic oil resources—estimated at just 44 million barrels³—and heavy dependence on imports from the Middle East, Japan and its oil companies pursue partnerships in oil exploration and development projects overseas. Japan is also a growing oil storage and trading hub for several Gulf Cooperation Council (GCC) producers and has first rights to purchase oil from these stores, which complement its own public and industry stockholdings, in an emergency.

FIGURE 1

Fuel Consumption per Capita, Index Countries, Q2 2013 and Q2 2014



Source: SAFE/RGE analysis

COMPREHENSIVE ENERGY EFFICIENCY POLICYMAKING

Japan's position at the top of the Oil Security Index is in large part a function of the relatively efficient nature of its economy. As was the case for many countries, the global oil price spikes of the 1970s served as the impetuses for the policymaking and the innovations that have enabled Japan's efficiency gains for more than four decades. The country's goals and policies have, however, been more ambitious and consistent than most.⁴ As a result, Japan has meaningfully and more effectively improved energy efficiency throughout its economy, including light- and heavy-duty vehicles.

The oil intensity of the Japanese economy fell to approximately 0.41 barrels of oil consumed per \$1,000 of GDP in Q2 2014, down from 0.56 in 2000.⁵ By comparison, the oil intensity of the U.S. economy today is approximately 0.47 and was 0.62 in 2000.⁶ Therefore, not only does the Japanese economy remain less oil-intense than the U.S. economy, but it is becoming still less so at a faster rate. In 2000, the Japanese economy was roughly 10% more efficient than the United States and it became almost 20% more efficient by 2010. Japan's oil intensity advantage vis-à-vis the United States declined somewhat

1 SAFE/RGE analysis

2 SAFE analysis based on data from: IEA, Oil Information 2014

3 See, e.g. U.S. EIA, Country Analysis Briefs, Japan

4 See, e.g., Ministry of Economy, Trade and Industry (METI) (Japan), "The Strategic Energy Plan of Japan," Presentation, June 2010

5 SAFE analysis based on data from: IEA; U.S. EIA; OECD; and IMF

6 Id.

Structural Dependency

Definition: A country's structural dependence on oil due to capital stock and other economic factors. The 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 measure 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 in 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 demand growth potential.

Economic Exposure

Definition: A country's direct economic exposure to oil price volatility. Economic exposure is 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. Transportation can be 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 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.

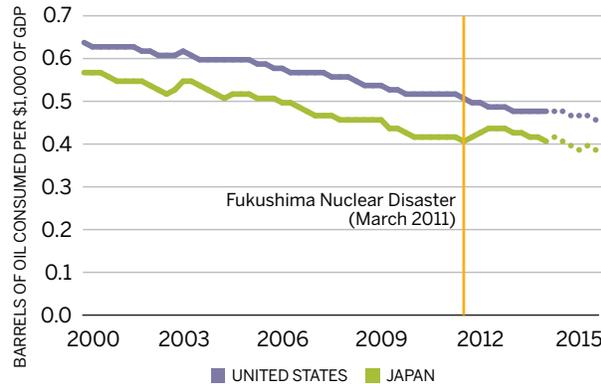
Supply Security

Definition: A country's vulnerability to physical supply disruptions and its response capabilities. While supply disruptions are typically addressed by price changes, the adjustment period can be highly damaging for import-dependent countries, especially if adequate and appropriate 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 terrorism) and long term (e.g. tax and regulatory schemes). This metric accounts for the different levels of risk in the sources of supply 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 to oil supplies. Total stockholdings include commercial inventories (held by companies) and public reserves (held by governments).

FIGURE 2
Oil Intensity, Q1 2000 to Q4 2015



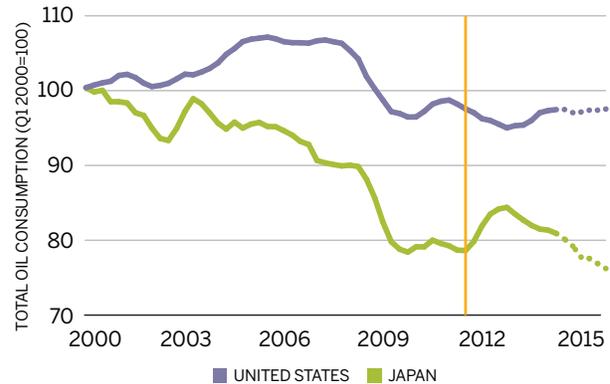
Note: Q3 2014 to Q4 2015 estimates are forecast
Source: SAFE analysis based on data from IEA and OECD

post-Fukushima, as it experienced an abnormal increase in oil demand for power generation (more details below), but this is expected to be temporary.⁷ Nonetheless, if the U.S. economy were currently as efficient as Japan's, it would consume approximately 16.4 mbd instead of 18.7 mbd.

Forecasts for oil consumption and GDP suggest that the divergence between the United States and Japan in terms of efficiency is set to intensify over the coming years.⁸ It is notable that in addition to consistently reducing the oil intensity of its economy, Japan's total oil consumption is 20% lower in Q2 than it was in 2000. Total U.S. oil consumption by contrast is just 4% lower and has increased y-o-y for the past six quarters.⁹

A prominent component of Japan's efficiency policy is the Top Runner program. The program uses the most efficient, currently available product offering as a target that all similar product offerings must meet by a particular year, effectively generating a "race to the top" among manufacturers.¹⁰ Those failing to meet the targets are publicly identified and their products labeled as such—thus the desire to maintain positive brand image is used as another incentive to innovate.¹¹

FIGURE 3
Oil Consumption, Q1 2000 to Q4 2015 (Indexed)



ADAPTATION AND RECOVERY POST-FUKUSHIMA

In March 2011, a magnitude 9.0 earthquake—the fifth most powerful in recorded history¹²—occurred off the Pacific coast of Japan. Triggering a tsunami that damaged several nuclear facilities, the event caused meltdowns in three of six reactors at the Fukushima Daiichi Nuclear Power Plant. In the aftermath of the disaster, the Japanese government required all nuclear facilities to undergo and pass stress tests and obtain approval from local governments to return to operation.¹³ By May 2012, all of Japan's nuclear capacity was offline for the first time in more than 40 years.¹⁴ Ultimately, Japan's electricity generation from nuclear declined from nearly 30% of the total in 2010 to less than 2% in 2012.¹⁵

With no nuclear capacity to draw upon, Japan was forced to import and use more crude oil, low-sulfur fuel oil, coal, and natural gas—imported in the form of liquefied natural gas (LNG)—for its power generation. As a result, Japan's total oil consumption increased from approximately 4.5 mbd in 2010 to 4.7 mbd in 2012. The oil intensity of Japan's economy also temporarily reversed its downward trend, rising from approximately 0.40 barrels of oil consumed per \$1,000 of GDP in 2010 to 0.43 in 2012.¹⁶

Combined, oil and natural gas increased their share of Japan's primary energy demand from 57% in 2010 (40% oil, 17% natural gas) to 68% (46% oil, 22% natural gas) in 2012.¹⁷ The increased cost of importing greater quantities of oil and natural gas contributed

7 Id.

8 Id.

9 SAFE analysis based on data from: IEA; U.S. EIA

10 See, e.g., METI, "Top Runner Program: Developing the World's best Energy-Efficient Appliances," Revised Edition, March 2010

11 See, e.g., Atsushi Kodaka, METI, "Japan's Top Runner Program: The Race for the Top," Presentation

12 USGS, Earthquake Hazards Program, Magnitude 8 and Greater Earthquakes Since 1900

13 U.S. EIA, Country Analysis Briefs, Japan

14 Id.

15 SAFE analysis based on data from: U.S. EIA

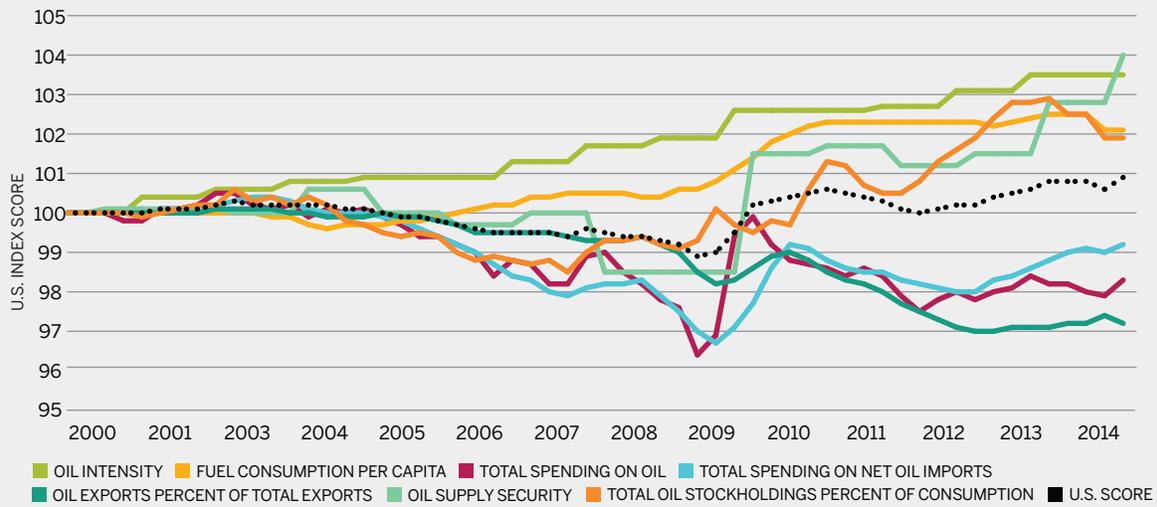
16 SAFE analysis based on data from: IEA; U.S. EIA; OECD; and IMF

17 SAFE analysis based on data from: BP

Oil Security in the United States

Rising domestic oil production continues to positively impact U.S. oil security by offsetting imports, but heavy oil use leaves the economy vulnerable to an increasingly unstable global oil system.

FIGURE 4
U.S. Index Score and All Metric Scores, Q1 2000 to Q2 2014



Source: SAFE/RGE analysis

Net U.S. liquid fuel imports have declined by roughly 6 mbd since 2008 to 5.5 mbd in Q2 2014.¹ Over the same period, domestic crude oil production has risen by more than 3 mbd.² This has helped facilitate a gradual—but increasingly substantial—strengthening in the Oil Supply Security metric result from 5.8 in 2008 to 6.7 in Q2 2014. This improvement comes through substituting oil imports from countries like Angola and Nigeria, where oil production is more at risk of disruption, with oil produced domestically or imported from Canada. Increasing domestic production has also helped reduce Total Spending on Net Oil Imports as a Percentage of GDP to 1.4% in Q2 2014 (from a maximum of 2.7% in Q4 2008 and more recent high of 2.0% in Q2 2012). This is its lowest level since Q4 2009, when average imported crude oil prices were just \$73 per barrel (/bbl) versus \$99/bbl in Q2 2014).³ This level was last observed during a period of economic expansion in 2005, when net

liquid fuel imports reached a historic high of 12.6 mbd, but average prices were less than \$50/bbl.⁴

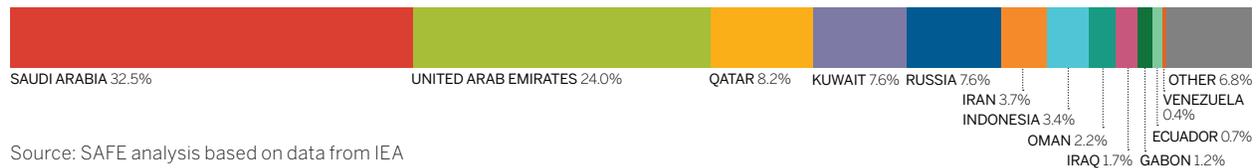
Although the effects of rising domestic oil production are unquestionably positive for the country's relative and absolute oil security, the United States remains the world's largest oil consumer—accounting for a share greater than China, Japan, and Russia combined.⁵ The country's Fuel Consumption per Capita metric is the second highest in the Index (1.75 gallons per person per day in Q2 2014, up from 1.70 in Q2 2013), and its Oil Intensity metric remains higher than many of its developed country peers including Germany, Japan, and the United Kingdom. Such levels of economy-wide consumption leave the United States far from being truly insulated from high and volatile oil prices. Moreover, since Q1 2013, U.S. oil demand has increased consistently y-o-y, and while it declined slightly in 2013, consumer spending on oil exceeded \$2,600 for the third consecutive year.⁶

1 U.S. EIA, STEO, August 2014
2 Id.
3 Id.

4 Id.; and SAFE/RGE analysis
5 SAFE analysis based on data from: IEA, OMR, August 2014
6 SAFE analysis based on data from: IEA, OMR, Archives; and Bureau of Labor Statistics, Consumer Expenditure Survey

FIGURE 5

Japan's Crude Oil Imports by Country of Origin, 2013



Source: SAFE analysis based on data from IEA

to a decline in the Japan's net trade in goods from +\$75 billion in 2010 to -\$43 billion in 2011 and -\$104 billion in 2012.¹⁸ August 2014 marked Japan's 25th consecutive monthly trade deficit.¹⁹

INTERNATIONAL ACTIVITY AND OIL STORAGE HUB

Japan's efforts to secure a stable supply of oil are comprised of two primary thrusts. First, Japanese companies are encouraged to participate in overseas exploration and production ventures. This includes projects in the Asia-Pacific region and the Middle East, where more than 80% of Japan's crude oil imports are sourced.²⁰ As a result, Japan scores relatively poorly on the Oil Supply Security metric (4.8, 10th). By 2030, the government hopes 40% of Japan's crude oil imports will originate from Japanese-owned concessions—versus 23% in 2010.²¹ Japan is also forging closer oil ties with Russia as it seeks to lower its reliance on the Middle East.²²

Second, Japan has extensive oil stockholdings of approximately 600 million barrels, equal to roughly 150 days of net imports.²³ Public stockholdings account for 55%

of the total and are almost exclusively crude oil (once private stockholdings are included, crude oil accounts for 70% of the total).²⁴ The country also has agreements to store crude oil for the United Arab Emirates (since 2009) and Saudi Arabia (since 2010).²⁵ Both countries plan to increase the size of their stores in the next few years. Japan receives priority for buying the stored oil in the event of an emergency and recently began counting half of it towards its secondary strategic petroleum reserves.²⁶ Japan also promotes cooperation amongst countries in East and Southeast Asia, including China, on oil stockpiling and the emergency response procedures required in the event of an oil supply disruption.²⁷

Finally, it is important to recognize that the global oil market is far more liquid today than in both the 1940s and 1970s when interruptions to Japan's oil supplies were so damaging. Today, if Saudi Arabia decided not sell to Japan, it would instead sell to another country, and surplus supplies previously meant for that buyer would be redirected to Japan. An outright reduction in Saudi output would affect the whole market equally, though Japan would fare better than most given its relatively high levels of efficiency.

18 The World Bank

19 See, e.g., ABC News, "Japan Trade Deficit Widens, Exports up Slightly," August 20, 2014

20 SAFE analysis based on data from: IEA, Oil Information 2014

21 EIA, Country Analysis Brief, Japan

22 See, e.g., Bloomberg, "Russia Sanctions Failing to Stanch Energy Deals With Japan," August 6, 2014

23 IEA, Energy Supply Security 2014

24 Id.

25 See, e.g., Bloomberg, "Japan Plans to Renew Agreement With Saudi Arabia for Storing Oil," December 13, 2013

26 See, e.g., Platts, "Japan to count half of Saudi, Abu Dhabi's crude oil stockpile as secondary SPR," July 24, 2014

27 See, e.g., Platts, "Japan to propose SPR cooperation framework for East Asia, Southeast Asia in May," April 28, 2014



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 enable policymakers and the general public to measure and compare the relative oil security of more than a dozen countries around the world.

Learn more at OilSecurityIndex.org



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