Achieving Oil Independence: United States Policy Options to Improve Energy Security

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Prepared for the Center for Strategic and International Studies

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Disclaimer: The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, the University, or any other agency.

Honor Pledge: On my honor as a student, I have neither given nor received unauthorized aid on this assignment.

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Acronyms and Abbreviations

1. ANWR – Alaska National Wildlife Refuge
2. Bbl – Price per barrel
3. BPD – Barrels per day
4. BLM – Bureau of Land Management
5. BOEM – Bureau of Ocean Energy Management
6. BSEE – Bureau of Safety and Environmental Enforcement
7. CAFE – Corporate Average Fuel Economy
8. CBO – Congressional Budget Office
9. CBP – Customs and Border Protection
10. CSIS – Center for Strategic and International Studies
11. DOI – Department of the Interior
12. EIA – Energy Information Administration
13. FSI – Fragile States Index
14. MMb/d – Million barrels per day
15. OPEC – Organization of Petroleum Exporting Countries
16. PHMSA – Pipeline and Hazardous Materials Safety Administration
17. SPR – Strategic Petroleum Reserve
18. WTI – West Texas Intermediate

Executive Summary

The United States is too dependent on oil from unstable countries. The US imports about a quarter of the oil it consumes. This is less than it has in the past 10 years, but it is still cause for concern when you look at where the oil is coming from. The Fragile States Index ranks countries on measures of stability, and almost 40% of US oil imports come from the top 100 most unstable countries in the world.

Dependency on oil from these countries brings additional costs that are not usually accounted for such as vulnerability to supply disruptions and economic shocks, defense and military expenditures for securing access, political and strategic limitations, and environmental costs. It is estimated that these costs add a premium to each barrel of oil we import of between $3 to $27. Assuming higher risk countries have higher oil premiums, I estimate that in 2017 the cost to the United States of dependency on foreign oil is around $43 billion. In theory, this is money that could be saved by no longer importing oil.

Thanks to new technology that is influencing both domestic production and consumption, coupled with rising oil prices, the US is becoming less dependent on oil imports. The Energy Information Administration's Annual Energy Outlook projects that the United States will become a net exporter of oil by 2028.

This applied policy project seeks to explore cost effective policy options that could accelerate this trend – making the US oil independent before 2028. I explore three alternatives to the status quo: imposing tariffs on oil from unstable countries, mandating a quota on oil from unstable countries, and holding federal land lease sales to allow for oil exploration and drilling. I evaluate each of these options on five criteria: cost effectiveness, political feasibility, ability to implement, environmental impact, and revenue generation.

My analysis shows that the best option for achieving US oil independence is to allow present trends to continue. Policies recently put in place by the Trump administration are likely to help America achieve the goal of oil independence by 2028. Other alternatives, such as a tariff or a quota, are less cost effective and could spark a trade war or other negative outcomes. Therefore, I offer the recommendation that policymakers who seek oil independence for America simply let present trends continue.

I also offer a secondary recommendation that policymakers could explore federal land lease sales as well as strengthening and restructuring the Strategic Petroleum Reserve in order to further improve oil security in America.

Problem

The United States is too dependent on sources of oil from unstable countries. In 2016, US net imports of petroleum from foreign countries were equal to about 25% of U.S. petroleum consumption. In 2016, the United States imported approximately 10.1 million barrels per day (MMb/d) of petroleum from about 70 countries. The top five source countries of US petroleum imports in 2016 were Canada, Saudi Arabia, Venezuela, Mexico, and Colombia.[1]

Access to adequate and secure sources of energy is one of the most basic foreign and national security mandates for any country. In the modern world, people and states are dependent on energy for their existences. For countries, energy is necessary to fuel economic activity and provide the vital materials to make modern military activity possible. At the individual level, energy and fuel is necessary for powering homes and making transportation possible.[2]

Snow (2016) writes that energy access and demands have steadily grown over time. As energy demands have increased worldwide, control over energy has become a major geopolitical imperative for those who rely on foreign sources of energy. Energy policy has both international and domestic aspects. For the United States, the international aspect has centered on secure access to the petroleum reserves of the Middle East and has been a leading driver of American policy in the region towards the world.[3]

Much of American foreign and national security policy over the past 35 years has been directed at Middle Eastern oil and has caused the United States to engage in policy actions to affect regional disagreements, even to the point of deploying troops and using military force.[4] Without a dependence on Middle Eastern sources of oil, perhaps the United States would not be as interested in conflicts in the tumultuous region. Perhaps the United States could reduce its footprint in the region, which could be fueling some of the conflict in the first place. Perhaps a drastic reduction of American presence in the region would be unwise, even if the United States is no longer dependent on Middle Eastern sources of oil. The point is that total American oil independence vastly widens the foreign policy options available to national leaders, not only in how the US engages with the Middle East but anywhere in the world.

[1] Energy Information Administration
[2] Snow, 2016
[3] Ibid.

Cost to Society

There are many different costs to society associated with dependence on foreign oil. Brown & Kennelly (2013) consider environmental externalities, OPEC market power and changes in the terms of trade for imported oil, economic losses associated with supply disruptions, fears that free markets cannot provide secure oil supplies, government expenditures (including defense spending), limits on U.S. foreign policy, the effects of oil dependence on political alignment, the effect of oil revenues to allow other countries to oppose U.S. interests, and the possibility that oil revenues will undermine local governance. For the purposes of my analysis, the most important factors deal with state stability. Less stable states are more likely to cause supply disruptions, require government and defense expenditures to secure supply, impose limits on US foreign policy, create unfavorable political alignments, and allow their oil revenues to undermine local governance.[5]

These factors are included in Brown & Kennelly's analysis. The researchers find the differential in social costs between the consumption of imported and domestic oil to be $2.08 per barrel when they use their most conservative estimates. However, when they use a more inclusive approach they find the difference to be $25.31 per barrel. Converting that to December 2017 dollars leaves a range of $2.23 to $27.10 per barrel.[6]

Cost Categories

Vulnerability to Supply Disruptions and Economic Shocks

International oil supply shocks have led to sharp price increases and US economic losses. These losses include transfers from the United States to foreign oil producers and reduced GDP. Oil supply disruptions result in higher oil prices and reduced economic activity. According to the EIA, unplanned global oil supply disruptions averaged more than 3.6 million barrels per day in May of 2016.[7] These supply disruptions have been caused by everything from wildfires in Canada to militant attacks in Nigeria to power outages in Iraq. Small supply disruptions like this can raise the price of oil temporarily but are not as devastating as the oil crises of 1973 and 1979. However, dependency on oil from countries that are either politically unstable or at odds with the U.S. subjects the American economy to occasional supply disruptions, price hikes, and loss of wealth, which, according to a study commissioned by the U.S. Department of Energy, have cost us more than $7 trillion present value dollars over the 30-year period of 1970-2000.[8]

Government Expenditures and Military Costs

Relying on sources of oil from unstable countries and regions has cost the United States significantly. A study from the Watson Institute of International and Public Affairs at Brown

[5] Brown & Kennelly, 2013
[6] Ibid.
[7] Energy Information Administration
[8] U.S. Department of Energy

University estimates that the US wars in Afghanistan, Iraq, Syria and Pakistan have cost $5.6 trillion dollars since they began in 2001. The Defense Department estimated that the total cost of the wars since 2001 was around $1.5 trillion. The estimates differ because the study by the Watson Institute incorporates additional expenses such as medical care for veterans and war costs incurred by the State Department and the Department of Veterans Affairs.[9] The 1990-91 Gulf War broke out as a result of an oil dispute between Iraq and Kuwait. According to Institute for Analysis of Global Security, the cost to the international community reached almost $80 billion.[10] Political instability in the countries the US imports oil from breeds wars and embroils the US in costly military actions to secure our access to oil, including the loss of American lives.

Political and Strategic Limits

There are many political and strategic costs to foreign oil dependence that have been identified as well. The Council on Foreign Relations (2006) named a few that I believe are significant. First, major interruptions in oil supply could have adverse political consequences in the United States. Second, control over oil revenues gives exporting countries the flexibility to adopt policies that oppose US interests and values. Third, oil dependence causes political realignments that constrain the ability of the United States to form alliances and partnerships to achieve a common objective. Fourth, revenues from oil and gas exports can undermine local governance – leading to instability and conflict that would likely have to be addressed by the United States. Many of the political and strategic costs resulting from dependence on foreign oil may be impossible to accurately quantify, but they still must be considered.[11]

Environmental Externalities

The consumption of both domestic and imported oil is likely to result in environmental externalities. Changing where the United States gets its oil from will not significantly reduce the environmental externalities associated with consuming it, although less stable countries have lower environmental standards for production. There will still be a need to transport oil even if America eventually becomes a net exporter. However, increased domestic production of oil and natural gas through fracking or other means could increase the environmental costs for the United States.

[9] Lubold, 2017

[10] Institute for Analysis of Global Security, 2006

[11] Victor, 2006

The Fragile State's Index

For my analysis, I will assign premium values to oil imported from different countries based on the country's Fragile States Index (FSI) rank. The Fragile States Index is an annual report published by the think tank Fund for Peace.[12] The index aims to assess a state's vulnerability to conflict or collapse by taking into account a number of factors and effectively ranks every country in the world on a scale of stability. I will place countries on this list into 3 categories: low, medium, and high risk. Low risk countries are those ranked higher in stability than the United States, high risk countries are those ranked in the bottom 100 countries, and medium risk are those in between the U.S. and the bottom 100. Figure 1 is a map depicting the 2017 Fragile States Index from Fund for Peace for reference.

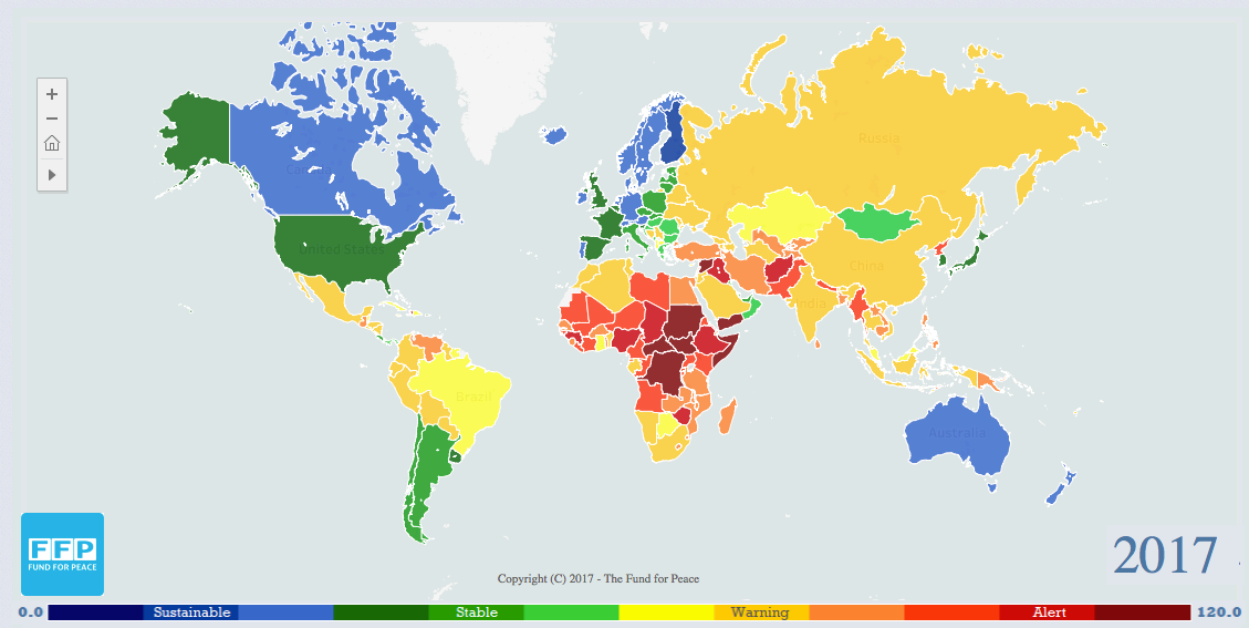

Figure 1

Total Cost Estimate

For simplicity, I will say low risk states have an oil premium of $5.00/barrel, medium risk states have a premium of $10.00/barrel, and high risk states have a premium of $20.00/barrel. So, based on these premiums and the total number of barrels imported from each country, I estimate the total cost of imported oil to the US was just under $43 billion in 2017. The average cost over the past 10 years has been around $53 billion.

[12] Fund for Peace, 2018

Background

In this section of the report I will discuss background information that is relevant to my analysis. First, I will briefly discuss the necessity of oil and energy security. Then, I will discuss dynamics of the world oil market such as the largest producers, consumers, and traders of oil, as well as how oil prices work. After that, I will discuss current trends with regard to production, consumption and prices. I will then discuss how new technologies are changing both the supply of and demand for oil. Lastly, I will touch on some of the environmental concerns with these new technologies.

Energy Security and the Necessity of Oil

People need "energy" in their daily lives. Modern life is difficult to imagine without reliable supplies of energy. Energy provides people with the necessities of life, such as power and transportation, as well as day-to-day conveniences and amenities. For much of human history, "energy" came from wood burning. However, both energy access and demands have steadily grown over time with technology, such that wood is no longer the primary source of energy for the world. It is helpful to think of the dynamics of energy use in cycles, where one form of energy is dominant over others for a period of time before its dominance wanes and another source becomes supreme. For a short period after wood, around the time of the Industrial Revolution, coal became the dominant source of energy. The next big energy cycle has been petroleum. There is much disagreement about where the world is on the petroleum energy cycle, but many estimates suggest the cycle is at its zenith or slightly beyond. Whether "peak oil" has been reached or not is a matter for debate, but our current dependence on the resource is not. It is not likely that that dependence will go away in the next decade.[13]

Today, we use oil for everything from transportation to creating plastic. Petroleum products include transportation fuels; fuel oils for heating and electricity generation; asphalt and road oil; and feedstocks for making the chemicals, plastics, and synthetics materials that are in nearly everything we use. Transportation is the largest use of oil though. In 2017, of the approximately 7.3 billion barrels of total US petroleum consumed, 47% was motor gasoline, 20% was distillate fuel (heating oil and diesel fuel), and 8% was jet fuel.[14]

So, achieving "energy security" simply means that the United States has safe, stable access to supplies of energy that are necessary to drive everyday life. If we are heavily dependent on oil from an unstable country and suddenly that country collapses, then the price of oil could skyrocket. This would affect the price of gasoline. If suddenly millions of Americans couldn't afford to buy gasoline to fuel their cars (or there simply isn't any available), then workers can't get to work, goods can't be transported, and the entire US economy could be devastated. US

[13] Snow, 2016
[14] Energy Information Administration

national security could be jeopardized as well, for example, the military could no longer fuel its cars, tanks, jets, ships, etc.

As I mentioned, the US currently imports roughly 25% of the oil we consume, which does not sound like heavy dependence, but that is roughly the same ratio of oil we imported in 1970. In 1973, the Arab Oil embargo reduced traded oil supplies by 14% internationally and gasoline prices in the United States shot up by 40%. Consumers panicked over oil shortages and hours-long lines at gas stations were common across America.[15] The same happened in 1979 with the Iranian revolution. Thanks to technology, diversified supplies and energy policies that resulted from these crises, such a shutdown might not have the same intense effect today, but it is difficult to tell since the US has not been tested since and the lesson remains striking.

World Oil Market

The market for crude oil is truly global in reach. Oil cargoes move with relative ease between countries and across oceans. It is misleading to think that only the small number of countries that make up the major producers of oil have an impact on oil prices in the United States. Because oil moves so freely from one area to another it is easier to think of the oil market as a pool, such that if one supplier shrinks the overall depth of the pool by withholding supply (or floods the pool by increasing production) then the effects are felt globally. Some of the largest producers of oil are Saudi Arabia, Russia, the United States, China, Canada, Iran, the United Arab Emirates, Iraq, Kuwait and Mexico.[16]

Pricing of oil is determined largely by a mix of supply factors, demand factors, and panic. How much one of these factors plays into any oil price move is unknown. Thus, day-to-day oil prices are largely unpredictable, much like the stock market. However, major events that deal with supply and demand and their effect on prices is fairly easy to explain and simple economic theory holds. When demand is high, prices are also high. Similarly, when accidents, political strife, or war keep supplies offline, replacements must be found and the price goes up. Panic in the oil market is not always rational, but it does happen like, as I mentioned previously, in the 1970s with the oil embargo and Iranian revolution. In cases of panic, public fears about oil availability or future high prices ultimately become self-fulfilling prophecies.

Oil is a heterogenous commodity, meaning not all oil is the same or costs the same. Some oil is easily extracted and flows like water, which is referred to as “light” oil. “Heavy” oil can be as thick as tar and much more difficult to extract. Light oils are generally valued higher. Sulfur content also matters. Oil with low sulfur content are referred to as “sweet”, while “sour” oils have a higher sulfur content. Pricing of heterogenous commodities involves using a benchmark price to track general price movements, then adjustments can be made for location and quality. The two most important global price markers are the West Texas Intermediate (WTI) and the Brent. In my analysis and discussion, I will use WTI prices.

[15] Council on Foreign Relations
[16] Blumsack, 2013

Current Trends and Future Projections

Domestic Production and Consumption

The US is one of the largest producers of oil in the world. It is also the second-largest producer of liquefied natural gas (LNG) and is expected to become the top producer within the next decade. As a result of increasing production rates driven by the technological advances in onshore horizontal drilling and high-volume hydraulic fracturing, the US now produces nearly 9,000,000 barrels per day (Bpd) of crude oil, up from just under 5,000,000 Bpd 10 years ago in 2008.[17] The economic downturn following the financial crisis of 2008, improvements in vehicle fuel economy, and changes in consumer behavior contributed to the decline in U.S. petroleum consumption. The oil and natural gas production sector is a staple of the US economy, employing approximately 180,000 people as of December 2017.[18] Growth in US oil production is projected to continue through 2050 mainly as a result of further development of tight oil resources.[19]

Only a small amount of crude oil is directly consumed in the United States. Nearly all of the crude oil that is produced in or imported into the United States is refined into petroleum products such as gasoline, diesel fuel, heating oil, and jet fuel, which are then consumed. Consumption has been declining since 2008. In 2016, the United States consumed a total of 7.21 billion barrels of petroleum products. The EIA projects that domestic consumption will continue to fall through 2050.[20] See Figure 2.

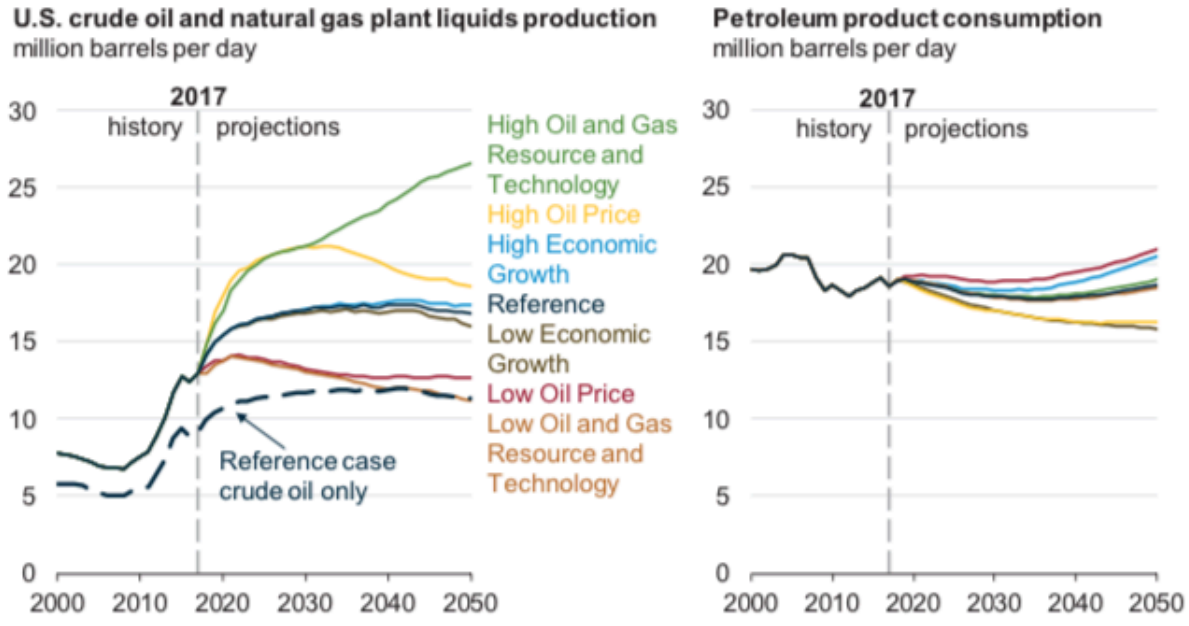

Figure 2

[17] Energy Information Administration
[18] Bureau of Labor Statistics
[19] Annual Energy Outlook, 2018
[20] Ibid.

Imports and Exports

The United States produces a large share of the petroleum it consumes, but it still relies on imports to help meet demand. The United States imported roughly 4.7 billion barrels of oil in 2008 and that number has declined to 3.7 billion in 2016. This trend was the result of many factors, including a decline in consumption, increased use of domestic biofuels, and increased domestic production of crude oil and hydrocarbon gas liquids.

Net imports of petroleum averaged 4.9 MMb/d, the equivalent of 25% of total US petroleum consumption in 2016, up slightly from 24% in 2015, which was the lowest level since 1970. In 2016, about 18% of US petroleum imports came from Persian Gulf countries. Saudi Arabia was the largest source of US imports from Persian Gulf countries. Canada is the largest source of US petroleum imports. Canada's share of US petroleum imports has increased significantly. Canada was the source of 15% of US petroleum imports in 1994 and 38% in 2016. Other major sources include Venezuela, Mexico, and Colombia.[21] In terms of the risk levels I have assigned to various countries, the US imports about 38% of its oil from high risk countries, 44% from low risk countries, and 18% from medium risk countries. By my standards Saudi Arabia is a "medium risk" country, as it is 101st on the FSI. I will discuss future projections in my analysis of Option 1.

Prices

The US benchmark West Texas Intermediate (WTI) crude oil prices have fallen in step with global crude oil prices by more than 70%, from over $100 per barrel (Bbl) in mid-2014 to a low of less than $30 Bbl before a slight recovery to $50 Bbl in 2017. Current prices are around $65 per barrel as of May 2018.[22] See Figure 3 for average annual price over the past 10 years.

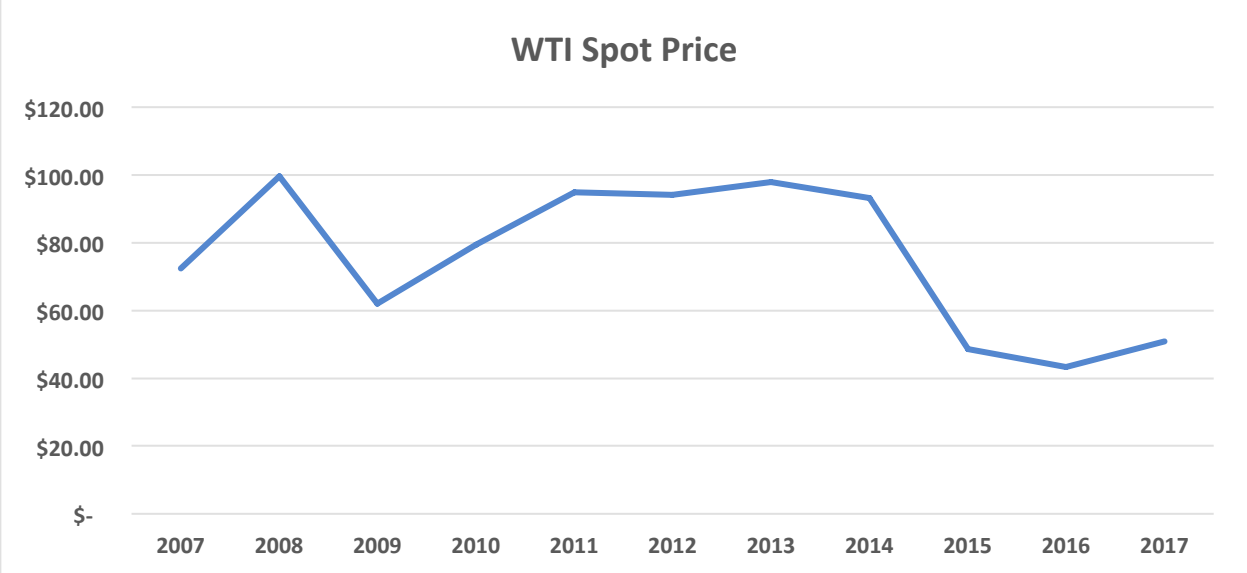

Figure 3

[21] Energy Information Administration
[22] Statista, 2017

Technology

Supply Side

New technologies in the oil and natural gas sectors have enabled the explosion of production growth in the United States known as the Shale Revolution. A combination of hydraulic fracturing and horizontal drilling allows producers to access reserves of oil and gas from low-permeability geological formations that were previously too expensive to extract. I will provide a short summary of the new production techniques and technologies that have contributed to the Shale Revolution.

Hydraulic Fracturing is a well stimulation technique that allows energy producers to tap into challenging geographic formations. There are over one million hydraulically fractured wells in North America, and the National Petroleum Council estimates that this technology will eventually account for 70% of natural gas production in the United States. To hydraulically fracture a well, producers inject a mixture of pressurized liquid containing water, chemicals, and a proppant inside a wellbore to create cracks in the rock formation, allowing oil and natural gas to flow more freely. Hydraulic fracturing has been controversial due to the nature of the technology and its environmental impact, including water depletion and contamination, increased surface pollution, and the potential for induced earthquakes.[23]

Horizontal Drilling has allowed producers to reach new depths, enabling the cost-effective exploitation of tight oil/gas formations. Typical wells for oil and gas production are vertical - drilled straight from the surface of the earth to reach hydrocarbon reserves below ground. Directional or horizontal drilling allows producers more flexibility and precision in reaching and extracting oil/gas compared to vertical drilling. Horizontal drilling allows oil and gas producers to minimize surface impacts of development, being able to drill multiple wells from a single pad. However, by the same token, horizontal drilling has been the subject of property/mineral rights disputes, as drillers have the ability to extract from neighboring parcels.[24]

Tar Sands which are also known as oil sands, are a combination of clay, sand, water and bitumen (a heavier form of oil). Tar sands are mined and processed to extract bitumen, which is then refined into oil. Two tons of tar sands are required to produce one barrel of oil. This process is more complex and capital-intensive than conventional oil extraction. It is estimated that over 2 trillion barrels of oil reserves exist in the form of tar sands, although not all of these resources are economically or technically recoverable. The majority of US tar sands resources are located in eastern Utah, with an estimated 12-19 billion barrels of reserves. The proposed Keystone XL pipeline would deliver Canadian tar sands from Alberta to refining facilities in the Gulf of Mexico. However, environmental opposition has caused significant delays in the project. The development of tar sands around the world could face a number of environmental and

[23] University of Texas at Austin, 2015
[24] Ibid.

technical challenges. However, if exploitation of this resource ramps up, the global oil market would become more diversified and resilient to price shocks from supply disruptions.[25]

Deepwater Drilling refers to deep offshore drilling primarily in the Atlantic Ocean. Deepwater drilling is generally regarded as any depth greater than 1,000 feet. There are two main technologies involved in offshore oil production; both are capital-intensive and require high levels of expertise to be used effectively: semi-submersive platforms and drillships. Since deepwater drilling requires a high level of technical expertise and substantial capital investment, only a handful of companies worldwide engage in deepwater drilling: BP, StatOil, PetroBras, Chevron, Exxon Mobil, and PEMEX. Globally, deepwater accounts for over 100 billion barrels of reserves, or about 10% of total reserves. There are 3,400 deepwater wells in the Gulf of Mexico alone. These wells present regular maintenance and repair challenges as well as environmental and security risks if not adequately protected and reinforced. However, if produced responsibly, the Gulf of Mexico represents the biggest deepwater drilling opportunity, with 30-40 billion barrels of reserves.[26]

Seismic Mapping and imaging technology have made exploration efforts for oil and gas more effective. Ultra-sensitive sound-emitting devices, called geophones, help seismologists bounce sound waves off underground rock formations to uncover hydrocarbon reservoirs. The resulting echoes are recorded and converted into three-dimensional maps that are then analyzed by supercomputers that help cut down on the time and money costs of exploration. Advances in digital imagery make the technology more precise than ever, allowing major companies to explore beyond conventional areas of production into shale, deepwater and tar sands. Because this technology is very capital-intensive and requires a high level of expertise, only a few of the world's major oil companies have the capability to use it.[27]

Big Data and Automation will continue to help bring down costs with companies expected to put more emphasis on digital solutions. Companies are using digital technologies to enhance field development, make the supply chain more efficient, and improve asset maintenance with robotic process automation. According to Deloitte, global oil and gas companies have the potential to save millions from their combined $2.4 trillion in operation costs.

Demand Side

Major technologies that are reducing demand for oil include electric cars and renewable energies. The falling cost of electric vehicles and solar technology will halt growth in demand for oil and coal from 2020. The Grantham Institute at Imperial College London and independent think tank Carbon Tracker Initiative analyzed cost forecasts for electric vehicles and solar panels, government policies, and the impact on road transport and power markets, which account for half of global fossil fuel consumption. The report said that electric vehicles could make up a third of the world's road transport market by 2035 and that solar PV could supply

[25] Ibid.
[26] Ibid.
[27] Ibid.

23% of global power generation by 2040, entirely phasing out coal and leaving natural gas with only a 1% market share. Growth in the number of electric vehicles could lead to 2 million barrels per day (bpd) of oil demand being displaced by 2025, the report estimates.[28] The International Energy Agency has said that 2 million bpd of oil could be displaced by electric vehicles by 2040. Bloomberg New Energy Finance has forecast that such displacement could occur as early as 2028.[29]

The Environment

Environmental Concerns with New Technologies

New oil and gas technologies have unlocked vast quantities of previously inaccessible resources that yield environmental benefits, consequences and controversy. While natural gas displaces coal as fuel for electricity, skeptics fear that hydraulic fracturing endangers communities living in close proximity to fracking operations. Environmentalists particularly deplore advanced fracking techniques that threaten water and air quality. The technique requires blasting huge amounts of water, sand and chemicals deep into underground rock formations and consumes vast amounts of water at a time when numerous regions are suffering from drought. A 2014 study published in the Annual Review of Environment and Resources, concluded that:

"Public concerns about the environmental impacts of hydraulic fracturing have accompanied the rapid growth in energy production. These concerns include the potential for groundwater and surface-water pollution, local air quality degradation, fugitive greenhouse gas (GHG) emissions, induced seismicity, ecosystem fragmentation, and various community impacts. Many of these issues are not unique to unconventional oil and gas production. However, the scale of hydraulic fracturing operations is much larger than conventional exploration onshore. Moreover, extensive industrial development and high-density drilling are occurring in areas with little or no previous oil and gas production, often literally in people's backyards."[30]

[28] Chestney, 2017
[29] Ibid.
[30] Jackson et al, 2014

Federal Oil and Gas Laws and Regulations

Overview

Joy & Dimitroff (2016) provide an excellent overview of current oil and gas laws and regulations in the United States. The regulation of oil and gas exploration, drilling, production, transportation, sale, and import and export are subject to myriad, often overlapping, local, state and federal laws, rules and regulations. In addition to regulatory changes, the body of common law changes from state to state and within the federal system as new disputes arise and are adjudicated. While the body of law and regulation is relatively stable at any given point in time across the entire US, rules and regulations in any given state, or concerning any given area of technical innovation, are always subject to change and modification to meet the competing demands of protecting health, safety and the environment while also encouraging the safe and responsible development of domestic US natural and energy resources.[31]

The US Government does not have a national energy policy. However, the oil and gas industry can be affected by tangential government energy and environmental policies, such as automotive fuel efficiency standards. Individual states within the US have developed specific policy objectives, most commonly stated as a policy to prevent waste and protect the environment while promoting the greatest ultimate recovery of indigenous oil and gas from within the state.[32]

The US has both federal and individual state agencies that regulate certain aspects of oil and gas production. Neither the US Federal Government nor the individual states have established a comprehensive energy policy to manage their energy resources. For example, domestic onshore oil and gas development is regulated by the individual states under mandates to prevent waste and protect human health and the environment, while encouraging the greatest ultimate use of domestic oil and gas production. Oil and gas production occurring offshore in the Gulf of Mexico or on federal land is managed by various US Federal Government agencies to ensure safe and environmentally responsible development, and the payment of production royalties and taxes for the public benefit.[33]

[31] Joy & Dimitroff, 2016
[32] Ibid.
[33] Ibid.

Federal Regulatory Bodies and Agencies

Trade Enforcement

US Customs and Border Protection (CBP)

US Customs and Border Protection is the agency tasked with enforcing trade laws such as tariffs and quotas. Employees at CBP appraise and classify all imported merchandise – including oil.

Leasing

Bureau of Land Management (BLM)

The BLM is a bureau of the Department of the Interior that manages vast stretches of public lands that have the potential to make significant contributions to the US's energy portfolio. The BLM also manages federal onshore oil, gas and coal operations that make significant contributions to the domestic energy supply.

Bureau of Ocean Energy Management (BOEM)

The BOEM manages the exploration and development of the nation's offshore resources. It seeks to appropriately balance economic development, energy independence, and environmental protection through oil and gas leases, renewable energy development and environmental reviews and studies.

Safety and the Environment

Environmental Protection Agency (EPA)

The EPA has primary responsibility for enforcing many of the environmental statutes and regulations of the US. The Environmental Protection Agency (EPA) does not have a direct role in the regulation of oil and gas extraction, but it does have regulatory jurisdiction over the release, or threatened release, of hazardous and toxic substances, such that once a release or threatened release occurs, EPA has remedial enforcement powers under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

Pipeline and Hazardous Materials Safety Administration (PHMSA)

PHMSA's mission is to protect people and the environment from the risks inherent in the transportation of hazardous materials, including oil and gas.

Bureau of Safety and Environmental Enforcement (BSEE)

BSEE works to promote safety, protect the environment, and conserve offshore resources through regulatory oversight and enforcement.

Trade

Oil Imports/Exports

The Energy Policy and Conservation Act of 1975 banned the export of crude oil produced from the US. Limited exceptions were granted by the Department of Commerce, resulting in between 50,000,000 and 100,000,000 barrels being exported annually. On 18 December 2015, amid an historic downturn in global oil prices, the US Congress finally lifted the crude oil ban, allowing US oil producers to sell in global oil markets.[34]

Tariffs

Tariffs on the import or export of oil and gas depend on the country of origin or export. Canada and Mexico are the largest importers and export destinations for gas, combining for 96% of all gas imports, and 100% of all gas exports. On 1 January 1994, the North American Free Trade agreement eliminated all fees and tariffs on oil and gas trade between the US, Canada and Mexico. Gas imported from Trinidad and Tobago, Algeria and other sources must still pay a small merchandise processing fee to the US Customs Service. Oil import tariffs range from $0.0525 to $0.525/Bbl depending on type and country of origin.[35] Trade agreements with the US also impact commodity tariffs. The Oil Pollution Act of 1990, as extended by the Energy Improvement and Extension Act of 2008, imposes a US$0.08/Bbl excise tax on all domestic and imported crude to fund the Oil Spill Liability Trust Fund.[36]

Oil tariffs and quotas would be legal under the World Trade Organization (WTO) and General Agreement on Tariffs and Trade (GATT) based both on my understanding of the agreements and what has been seen in practice. Although the rules of the multilateral trading system apply, in principle, to the international petroleum trade just like to any other product, in practice a number of factors, including exemption under Article XX of GATT, have combined to keep the petroleum sector largely outside the scope of the GATT/WTO system. The fact that oil and natural gas are exhaustible natural resources and, in a way, deal with national security means that in practice they are not subject to stringent WTO/GATT laws.[37]

Land Leasing and Production

Federal

The Department of the Interior's Bureau of Land Management (BLM) announces and holds public, competitive lease sales of public lands for oil and gas exploration and drilling. According to BLM's website, Oil and gas resources on the public lands are developed in a manner that considers other values and uses of the land and in an environmentally sound manner. The

[34] Ibid.
[35] Practical Law, 2016
[36] Joy & Dimitroff, 2016
[37] Desta, 2003

environmental review process for developing oil and gas resources is multi-faceted and includes input and coordination with other Federal and state agencies, as well as the public. Members of the public, typically industry representatives, nominate lands they wish to lease, but before they can be included in a sale, they are reviewed for compliance with the area's Resource Management Plan and other factors such as resource conflicts that might make the lands ineligible. In 2018, BLM will hold lease sales in Alaska, Colorado, New Mexico, Nevada, Montana, Utah, and Wyoming as well as some eastern states.[38]

State

Regulation of the exploration and development of oil and gas is governed state by state by administrative agencies (for example, the Texas Railroad Commission). Each state has its own regulations, and its agencies have the broad powers to, for example, issue citations, order remedial actions, or revoke permits for operations. Domestic onshore oil and gas development is regulated by the individual state in which the activity will take place. Each state has its own regulatory agency or agencies that control things such as: the distance between oil wells and property lines to protect the rights of adjacent landowners, prevention of waste, and health and safety issues. Individual states also have authority over the taxation of oil and gas production that occurs within the state. Oil and/or gas were produced in 33 of the 50 states within the US in 2014.[39]

Unconventional Gas and Oil Exploration

The US domestic gas (and oil) exploration and production sectors operate in a free market subject to government health, safety and environmental regulations. While domestic production is encouraged to meet US energy needs and enhance its national security, there are no specific government policies promoting unconventional oil or gas production. Capital investments are encouraged by market forces during a rise in commodity prices, and concurrently fall during commodity price slumps in the wake of excess supply. There are certain tax advantages associated with oil and gas exploration and production, such as the ability to deduct intangible drilling costs as a current business expense. The tax treatment of oil and gas production expenses is the same for conventional and unconventional development.[40]

Safety and the Environment

Environmental Impact Assessments

An Environmental Impact Assessment (EIA) is an environmental review and analysis of a proposed project. Largely creations of federal law under the National Environmental Policy Act 1970, EIAs have been adopted at the state level by numerous states as part of industry- or

[38] Joy & Dimitroff, 2016
[39] Ibid.
[40] Ibid.

project-specific regulations. EIAs are conducted to determine whether a proposed action could significantly affect the environment.[41]

The requirements to conduct EIAs vary between activities conducted on private property, local, state or federally owned property, Native American tribal lands, and offshore production in the Gulf of Mexico. Similarly, the scope of review varies between the type of pipeline and whether it is an exempt gathering system, intrastate or interstate pipeline.[42]

Drilling operations on private property conducted under privately negotiated contracts are subject to the lowest level of EIA scrutiny, typically based on a finding in a statewide generic environmental impact statement (EIS) that oil and gas exploration, drilling and production activities do not constitute a generally adverse environmental impact activity.[43]

Recent Environmental Policy Initiatives

The State of New York undertook a comprehensive multiyear (2008 to 2014) assessment of the potential impacts of high-volume hydraulic fracturing, and although its own studies did not find scientific evidence of adverse health or environmental consequences, the state banned high-volume hydraulic fracturing in response to citizen concerns.

The Bureau of Land Management is proposing to update its regulations associated with gas flaring, venting and leaks from oil and gas production operations on public and Native American lands predominantly located in the western US.[44]

The Environmental Protection Agency has been stepping up enforcement actions under the Clean Air Act 1963 by regulating, or attempting to establish regulatory jurisdiction over, oil and gas processing, treatment and transportation facilities by aggregating multiple facilities together to establish regulatory thresholds.[45]

Corporate Average Fuel Economy (CAFE)

Enacted by Congress in 1975, CAFE's purpose is to reduce energy consumption by increasing the fuel economy of cars and light trucks. National Highway Traffic Safety Administration (NHTSA) has set standards to increase CAFE levels rapidly over the next several years, which will improve our nation’s energy security and save consumers money at the pump. In 2009, President Obama proposed the current national fuel economy program that covered model years 2012 to 2016 vehicles. In 2011, he announced an agreement with automakers to increase fuel economy to 54.5 miles per gallon by 2025. In 2016, the EPA, NHTSA and the California Air Resources Board (CARB) released a technical paper assessing whether or not the auto industry will be able to reach the 2022 to 2025 mpg standards. The government groups found that the

[41] Ibid.
[42] Ibid.
[43] Ibid.
[44] Bureau of Land Management, 2017
[45] Environmental Protection Agency, 2016

auto industry has been doing a good job innovating and pushing towards lowering greenhouse gas emissions. The paper says the technology is cheaper or approximately what was expected in terms of cost, and that automakers are adopting new technologies quicker than expected. Still, the paper says that the 54.5 mpg goal is unrealistic and more realistic goals are 50 mpg to 52.6. The agencies estimate that the standards will save up to 2 billion barrels of oil and reduce carbon dioxide emissions by up to 1.1 billion metric tons over the lifetimes of MYs 2018-2029 vehicles, providing up to $230 billion in net social benefits.[46]

Taxes and Revenue

Taxes

Individual states choose to (or not to) place a tax on the extraction of oil and gas produced within the state. State taxes on production are most often levied as property taxes on the value of the oil or gas produced and sold from the property within the state. Companies profiting from the extraction and sale of oil and gas are also subject to local, state and federal income taxes on production revenue. The US does not have a national tax on the production of oil and gas.[47]

Revenues

The government's right to economic benefits is generally similar to that of individuals. In those instances where a US local, state or federal government entity is the owner of the oil or gas rights, and leases those rights for development, the lease conveying the rights to an operator will include a production royalty payable to the property owner entity. Local, state and federal government entities can therefore derive direct economic benefits from the ownership and development of the oil and gas estates through specific and general taxes, as well as royalties derived from production on government-owned lands.[48]

Government Expenditures

According to the Congressional Budget Office, the federal government provides financial support for the development, production, and use of fuels and energy technologies both through tax preferences and through spending programs administered by the Department of Energy (DOE). Policymakers have provided that support with several goals in mind, including increasing domestic energy production, reducing greenhouse gas emissions, and encouraging research that might benefit society but that would not be profitable for private firms to undertake without government funding.[49]

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[46] National Highway Traffic Safety Administration, 2016
[47] Joy & Dimitroff, 2016
[48] Ibid.
[49] Dinan, 2017

In fiscal year 2016, tax preferences provided the bulk of federal support for energy development, production, and use. Whereas tax preferences are estimated to have resulted in $18.4 billion in forgone revenues, lawmakers appropriated funds equal to about one-third of that amount—$5.9 billion—for DOE to fund the relevant spending programs.[50]

Strategic Petroleum Reserve

Another area of spending for the US Government is the Strategic Petroleum Reserve (SPR). The SPR is a government complex of four sites with deep underground storage caverns located in Texas and Louisiana. The SPR currently holds 713.5 million barrels and stores emergency supplies of crude oil owned by the US Government. The Department of Energy reports that the current investment to date in the SPR is around $25.7 billion ($5 billion for facilities, and $20.7 billion for crude oil).[51]

[50] Ibid.

[51] U.S. Department of Energy, 2017

Policy Options

Option 1: Let present trends continue

The United States is experiencing a boom in domestic oil and gas production. EIA's recently published Annual Energy Outlook 2018 projects that US net imports of crude oil and liquid fuels will fall between 2017 and 2035; making America a net exporter of oil by 2030 due to strong production growth and reduced domestic demand. However, EIA also projects that the US will return to being a net petroleum importer in 2045 in the reference case. Some scenarios, such as high oil price and high oil and gas resource and technology, suggest the US could become a net exporter of oil and natural gas as soon as 2020. However, under opposite conditions, low oil price and low oil and gas resource and technology, EIA projects that the US will remain a net importer of oil well beyond 2050. Policies have also recently been enacted that I believe will encourage this transition to becoming a net exporter of oil by 2030.

The recently passed tax reform bill will create a boom for American oil and gas producers. The cut in the corporate income tax rate from 35% to 21% will allow all American businesses to reap billions in savings. Barclay's equity analysts calculated that the cut will add $1 billion to the profits of the US oil and gas exploration and production firms, equivalent to a $1 per barrel increase in oil prices. However, these tax cuts are not targeted specifically at oil and gas production, the industry will just reap the benefits the same way all American businesses will.[52]

The tax reform bill also opened portions of the Arctic National Wildlife Refuge (ANWR) to oil exploration. The tax package instructs the Department of the Interior to hold two lease sales in the next 7 years. Proponents say exploration would provide needed oil and boost federal and state revenues. The Congressional Budget Office estimates that opening the refuge would generate roughly $1 billion over 10 years. These expanded exploration rights affect 1.6 million acres of the 19 million-acre refuge.[53]

Option 2: Tariffs on oil from unstable countries

This option proposes placing a higher tariff on oil imports from Saudi Arabia, Venezuela, Colombia, Iraq, Nigeria, Ecuador, Kuwait, Angola, Chad, Algeria, Russia, and other countries based on their FSI rank. Oil imports from these 11 countries make up around 53% of total US oil imports. Higher tariffs will discourage oil imports from these countries and allow for a stronger shift toward imports from more stable places like Canada and Brazil. Current tariffs on oil imports range from $0.0525 - $0.525 per barrel depending on the type of petroleum. This option proposes a 5% tariff on oil from low risk countries, a 10% tariff on oil from medium risk countries, and a 20% tariff on oil from high risk countries. The tariff will be based on the current OK WTI Spot Price. So, if the current price of oil is $60/barrel this would mean a $3/barrel tariff

[52] Grandoni, 2017
[53] Congressional Budget Office, 2017

from low risk countries, $6/barrel from medium risk countries, and $12/barrel from high risk countries.

Option 3: Quotas on oil from unstable countries

This option is similar to Option 2, but instead would impose a quota on oil imports from countries based on their rank on the Fragile States Index. Rather than discouraging imports from unstable regions, a quota would be an effective cap on the total number of barrels the US is dependent on from each country. The base year for this quota would be 2017 imports and would be structured similarly to the tariff, however the program would phase in to allow for markets to adjust. Phase 1 would impose a 5% reduction in imports from all countries. Phase 2 would impose a 5% reduction in imports from low risk countries, and a 10% reduction in imports from medium and high-risk countries. Phase 3 would impose a 5% reduction of imports from low risk countries, a 10% reduction from medium risk countries, and a 20% reduction from high risk countries.

Option 4: Federal land lease sales and expanded drilling rights

This option would instruct the Department of the Interior to hold more lease sales similar to the ANWR sales in the tax bill over the next 10 years in other national refuges to allow for more oil and gas exploration. Specifically, this option proposes opening and additional 3 million acres for oil exploration and drilling. An in-depth target analysis and environmental impact assessment would be conducted to identify the best opportunities and exactly where to hold the lease sales. If CBO's estimates of benefits from the ANWR lease sale program are accurate, then the possible benefits to more expanded drilling rights could be very significant.

Evaluative Criteria

For my analysis, I will assume a future projection time period of 10 years, with the EIA Annual Energy Outlook 2018 reference case serving as my status quo outcome. Success for each policy alternative will be measured by the reduction in total number of barrels of oil imported from unstable countries (or overall). This report will evaluate policy alternatives based on the following criteria and weights:

1. Cost-Effectiveness and Efficiency (40%) – the total cost of the program relative to the projected result. Measured as a ratio to estimate Net Present Value of each program. The outcome being total reduction in imports from unstable countries measured by assigning costs to barrels of oil from each country based on their risk level. Highest reduction in cost of imports for the lowest cost program would be the most cost-effective policy.

2. Political Feasibility (15%) – the ability of a program to be adopted through the political process. A measure of expected political opposition and support for the policy. Evaluated through the legislative vehicle of the policy, relevant stakeholders, and current political climate. Each policy will be rated on a scale of high to low based on an estimation of ease of adoption, high political feasibility being the policy that could be most easily adopted.

3. Ability to Implement (15%) – the ability of a program to be implemented efficiently. A measure of administrative, logistical, and other obstacles to creating and enforcing the policy. Each policy will be rated on a scale of high to low based on an evaluation of administrative and logistical hurdles including factors such as monitoring and enforcement capabilities of implementing agencies. High ability to implement would be a policy that would not be difficult to monitor, enforce, and maintain and that has historical precedent.

4. Environmental Impact (15%) – the negative or positive effects that a policy has on the environment. An estimate of pollution or reduction in pollution or other environmental externalities of a policy. Shifts in production location, pollution from transportation, and pollution from consumption are all factors that would be taken into account to evaluate environmental impact of each policy. Each policy will be rated on a scale of high to low in terms of environmental impact, high environmental impact being the policy that would most negatively affect the environment if adopted.

5. Revenue Generation (15%) – an estimate of the amount of government revenue a policy would generate as compared to the current status quo. Policy alternatives with the potential to generate a significant amount of revenue would be rated as “high” in revenue generation.

Policy Options Analysis

For this cost effectiveness analysis of my policy alternatives, the units of effectiveness will be the total reduction of imported barrels of oil from unstable countries. My definition of society is the United States. Citizens will benefit from reduced cost of imported oil through such things as lower price of gasoline at the pump, less fear of supply shocks, and new job creation. Domestic businesses will benefit from reduced competition and increased production. The US government will benefit through reduced defense expenditures to secure supply as well as revenues from some of the policy alternatives. The time period I will be considering for this analysis is the next 10 years, through 2028. First, I will go through my assumptions for the status quo and how it measures up on each of my criteria, then I will do the same for each of my policy alternatives.

Option 1: Let Present Trends Continue

Cost-Effectiveness

To project status quo outcomes, I will use the EIA's Annual Energy Outlook 2018 projections as a reference case. The reference case assumes trend improvement in known technologies along with a view of economic and demographic trends reflecting the current views of leading economic forecasters and demographers. The reference case assumes current laws and regulations affecting the energy sector are unchanged throughout the projection period. Potential impacts of proposed legislation are not included. With regard to petroleum, EIA's Annual Energy Outlook 2018 projects that growth in the US crude oil and natural gas plant liquids production generally continues through 2050 as a result of the further development of tight oil resources. Over the same period, domestic consumption falls making the United States a net exporter of liquid fuels in the reference case by 2029. See Figure 4 below.

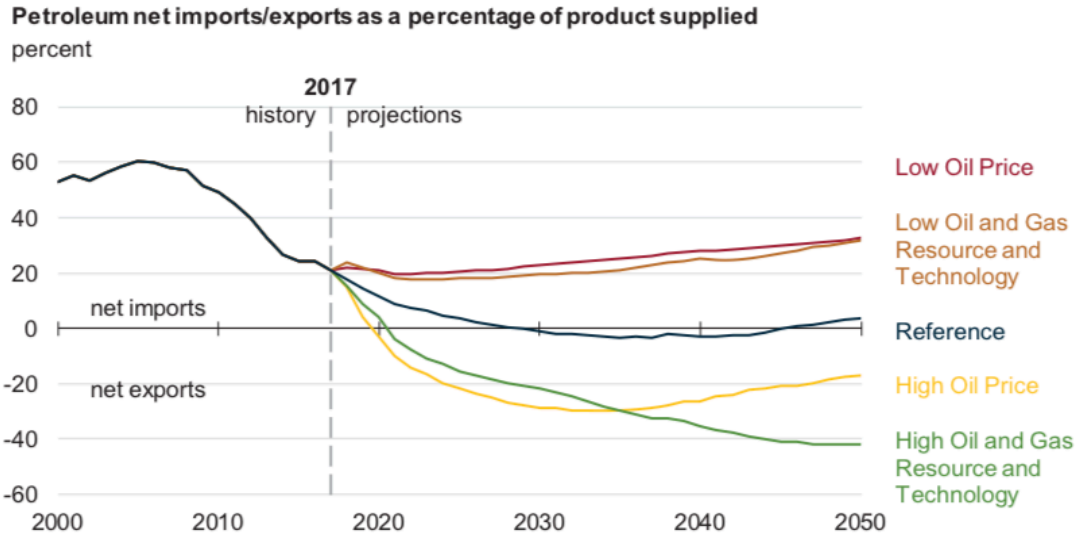

Figure 4

Alternative policies will be evaluated against this reference case, using the same assumptions as EIA's model.

For the purposes of my analysis, I have assigned a premium value to imports of oil from each country based on their risk level. In other words, oil imports from Yemen are "more expensive" than oil imports from Canada. So, using the range of oil premiums found by Brown & Kennely (2013), I have assigned low risk countries an oil premium of $5 per barrel, medium risk countries an oil premium of $10 per barrel, and high-risk countries a premium of $20 per barrel. This is so that I can capture more accurately the benefits of reducing imports on the whole, but also the additional benefits of reducing imports from high risk countries or countries that can cause other problems for the United States.

In 2017, imports cost an additional $42.7 billion based on my premiums. In 2017, 38% of imports came from countries I have deemed "high risk", 18% came from "medium risk" countries, and 44% came from "low risk" countries. Without policy change, I will assume this proportion will remain the same over the period of my analysis. Based on EIA's projections of reduced imports over the next 10 years I project oil imports will cost around $21.3 billion in 2022 and $10.7 billion in 2028. This suggests a savings of $32 billion over the next 10 years by allowing present trends to continue.

Political Feasibility
Maintaining the status quo is highly politically feasible because it requires no further policy interventions either from Congress or from the President.

Ability to Implement
Allowing present trends to continue is easily implemented because it does not require the creation of new government programs or require that resources be moved around. For that reason, the status quo is rated as "high" in ability to implement.

Environmental Impact
I have rated the status quo as "medium" on environmental impact. The rationale being that current US dependence on oil brings with it some negative environmental consequences that could be alleviated by new environmental policies such as increased fuel efficiency standards. However, the status quo also does not mean implementing a new program that would open additional preserved lands to drilling and oil exploration – a policy that would highly impact the environment. So, for those reasons, I believe letting present trends continue is a middle ground in environmental impact.

Revenue Generation
Although the government does currently generate significant revenue from current trends in the oil industry, when measured against the alternatives it is clear that the status quo would generate much less revenue than implementing a new tariff on oil.

Figure 5 depicts my cost effectiveness analysis for each of my options measured against the status quo. As you can see, each alternative reduces the total cost of imports at a faster rate than the status quo. However, as I will discuss later, these cost reductions may come at too high a price and the status quo may actually be the most favorable option.

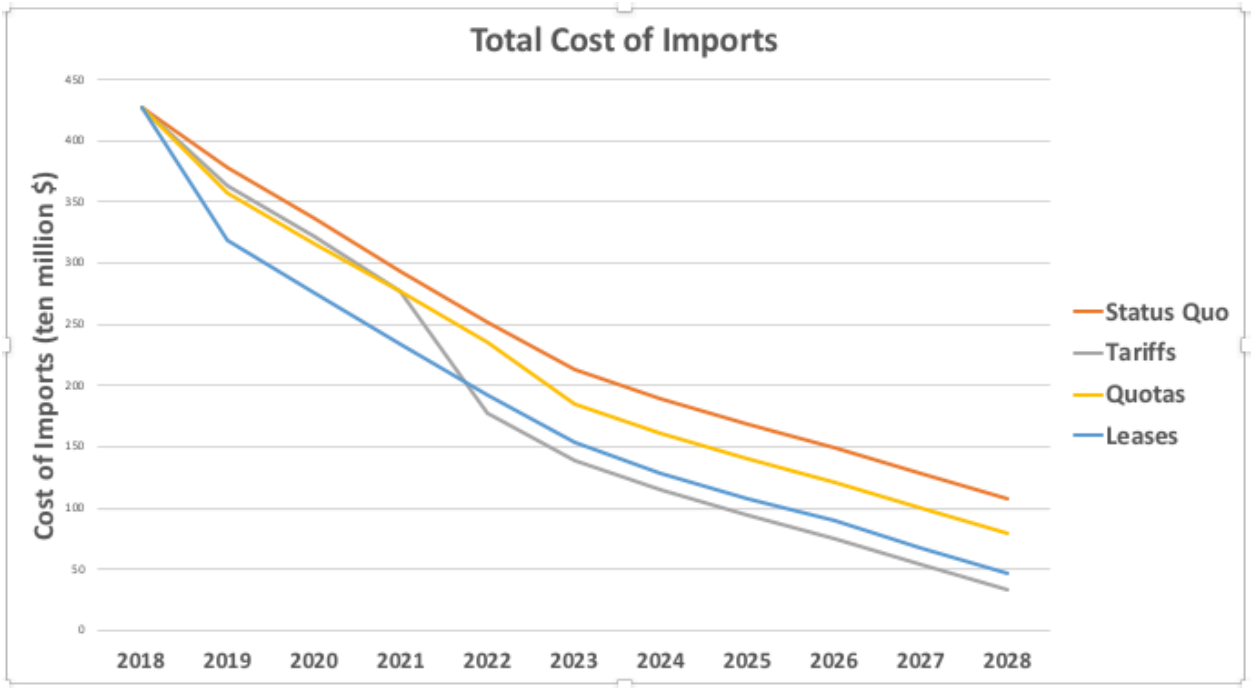

Figure 5

I will now discuss how I arrived at these calculations for each option as well as briefly discuss my rationale for how I have rated them against my other outcome criteria.

Option 2: Tariff on Unstable Countries

Cost Effectiveness

In order to evaluate the effect of a tariff on oil imports, I first calculated both the short run (past 3 years) and long run (past 10 years) price elasticity of demand for oil using total import quantities and yearly average WTI Spot prices. I found the elasticity to be (-)0.22, or inelastic, in the short run and (-)2.04, or elastic, in the long run. This means that in the short run, a tariff of 5% on imports would lead to a reduction in quantity imported of 1.1%. In the long run, a tariff of 5% would lead to a 10.2% reduction in imports. After assigning tariff levels to countries based on their risk level, I can project a reduction of total imports, with the largest reductions coming from the highest risk countries.

As I mentioned before, in 2017, the US imported around 3.7 billion barrels of oil costing $42.7 billion. In the short run, I project that number will decrease by about 84 million barrels per year and save $1.4 billion on average each year for the first 3 years of the tariff. After that period, I project long run elasticities will begin to take effect which will save $7.4 billion on average per

year for the next 7 years. Overall, I project that the tariff will lead to a total savings of $39.4 billion over the next 10 years.

The cost of such a program falls primarily on the implementing agency of US Customs and Border protection charged with enforcing, monitoring, and processing tariff fees. In 2016, $2.8 billion was the total reported cost of "securing and expediting trade" for Customs and Border Protection. Recently, Kevin McAleenan, Commissioner of US Customs and Border Protection, testified before the House Appropriations Subcommittee on Homeland Security and requested an additional $2.1 million for 26 new positions to support goals pursuant to the Trade Facilitation and Trade Enforcement Act of 2015. That amount averages out to $80,000 per position, so a conservative estimate that enforcement and processing of my tariff program would require 50 new positions suggests the cost of this program would be $4 million per year.

$4 million dollars per year for 10 years, this program, discounted at a rate of 3%, yields a net present value of around $37 million in costs. That number divided by the net present value of potential savings, $33.6 billion, leaves a cost effectiveness ration of 0.0011 units of effectiveness. This is the second most cost effective option out of my alternatives to the status quo, so I have rated it as "medium" in cost effectiveness.

Political Feasibility

This option would be achieved through an executive order. Looking at current trends in the Trump administration and their willingness to impose tariffs on good such as steel, suggests that the administration might be open to additional protectionary policy. That being said, the oil trade affects many more stakeholders than steel, all the way down to every consumer's price of gasoline at the pump. So, there could be significant political pushback from a policy that would impose major tariffs on oil imports. For these reasons, I have rated this option as "medium" in political feasibility.

Ability to Implement

I have also rated this option as "medium" on ability to implement. Customs and Border Protection already has the systems in place to enforce tariffs and collect duties, so it would not be an issue of creating an entirely new program. However, in order to enforce the policy effectively it would require increased monitoring efforts and likely a significant amount of additional manpower.

Environmental Impact

I have rated this option as "medium" in environmental impact because it really does nothing different from the status quo in regards to the environment. Shifting sources of production to more stable countries – also likely the countries with higher environmental standards for production and extraction – would have a small environmental benefit. However, the impact on the environment would not be very significant.

Revenue Generation
Imposing a substantial tariff on oil would generate the highest amount of revenue compared to all of my other options. In fact, if the tariff were to be implemented next year I can calculate that the government could see as much as $232 billion in revenue collected from duties. For that reason, this option is rated as "high" in revenue generation.

Option 3: Quota on Oil from Unstable Countries

Cost-effectiveness
To evaluate the effect of my proposed oil import quota, I assumed a quota based on 2017 import levels from each country. I then found the total barrels that would be imported for each phase of the program, and multiplied that number by the premiums in order to get the total cost for each year. In the first phase of the quota (2019 and 2020), I project an average savings of $2.1 billion each year. In the second phase (2021 and 2022), I project an average savings of $1.7 billion each year. In the third phase of the quota (2023 to 2028), I project an average savings of $2.8 billion each year. I project a total savings of $34.8 billion over the 10-year course of my analysis.

Similar to a tariff, the cost of a quota is borne by US Customs and Border Protection. Tracking the product, counting the barrels, and enforcing the policy all produce administrative costs. Again, I will use a conservative assumption that this program would cost $4 million per year for 10 years to create 50 new positions, a net present value of $37 million in costs. That amount, divided by the net present value of potential savings, $29.7 billion, leaves a cost effectiveness ratio of 0.0013. This is the least cost effective option, so I have rated it as "low" in cost effectiveness.

Political Feasibility
Similar to a tariff, imposing a quota on oil imports would be achieved through executive order. However, I have rated this option as "low" in political feasibility because it would be even more unpopular than a tariff. It also does not have the somewhat redeeming quality of the ability to generate government revenue, so it is likely that such a proposal would face fierce political pushback. It also is a mandated reduction in imports from all countries, rather than a tariff that would allow the market to adjust more naturally, meaning it would likely upset allies and major partners like Canada more so than a tariff.

Ability to Implement
This option is rated "medium" on ability to implement for the same reasons as the tariff. The systems to enforce the policy are in place, but effective enforcement would likely require additional resources and manpower.

Environmental Impact
This option is also rated "medium" in environmental impact for the same reasons as the tariff. Shifting sources of oil could have some environmental benefits, but likely not enough to make a significant impact on the status quo.

Revenue Generation
As this option is structured it is rated as "low" in revenue generation. A simple mandated quota would not generate any government revenue, and in fact would reduce the small amount of revenue the US currently collects from oil imports.

Option 4: Federal Land Lease Sales

Cost-effectiveness
This policy is structured exactly like the ANWR lease sales to be conducted by the Department of Interior, so cost and benefit estimates from that legislation will be scaled up in order to estimate cost effectiveness of my proposal. The ANWR lease sales opens 1.5 million acres of federal land in Alaska for oil exploration and drilling. My proposed policy would open 3 million acres of federal land, anywhere in the United States, for oil exploration and drilling. I will assume that doubling the size of the area opened will double both the costs and the benefits of the lease sales program.

The Congressional Budget Office estimates that opening 1.5 million acres in the ANWR could produce 2.6 billion barrels of oil from 2018 to 2028. So, I will assume that opening 3 million acres of federal land for oil exploration and drilling could produce 5.2 billion barrels of oil from 2018 to 2028. That's an average of 520 million barrels per year. I will assume the 520 million barrels of domestically produced oil per year will offset an equivalent amount of imports. I will assume we still import the same proportion of oil from each risk level (44% from low risk countries, 18% from medium risk countries, and 38% from high risk countries). Using these 520 million domestically produced barrels to offset imports creates savings of around $6 billion per year on average over 10 years. I project this policy would lead to a total savings of around $38 billion over the next decade.

CBO estimated the total cost of the lease sale program to be around $10 million over 5 years (roughly $2 million per year). So, I will estimate that my program would cost around $20 million over 5 years (roughly $4 million per year). At a discount rate of 3%, the net present value of costs of my program is around $21.7 million. Dividing that by the net present value of potential savings of $32.4 billion leaves a cost effectiveness ratio of 0.0007. I have rated this option as "high" in cost effectiveness, because this is the most cost effective option other than the status quo.

Political Feasibility
This option could be achieved either through executive order or legislation. I have rated it as "medium" in political feasibility because there is political precedent – ANWR expansion as part of the tax bill. However, doubling the amount of reduction in protected federal lands could be seen as going too far. Also, since I have structured the policy such that land can be taken from anywhere in the US, that means that more stakeholders will be involved than just Alaska, making the political process more complicated.

Ability to Implement
This option is rated as “medium” in ability to implement because, again, the system to carry out the policy is already in place in DOI. But significantly expanding the scope of current policy means that there will be a need for additional resources and manpower to carry it out.

Environmental Impact
This option would have the greatest negative impact on the environment. It would mean a major reduction in protected federal lands to allow for oil exploration and drilling. With this comes destruction of habitats, deforestation, and increased negative environmental externalities from higher domestic production of oil. For these reasons this option is rated as “high” in environmental impact.

Revenue Generation
This option is rated as “medium” in revenue generation because it would not generate as much revenue as a tariff, but it would generate more revenue than the status quo. Revenue for this policy would be generated through lease payments and royalties, but I do not have an exact estimate on the amount of revenue that could be generated over the course of the policy.

Outcomes Matrix

	Cost Effectiveness Ratio (40%)	Political Feasibility (15%)	Ability to Implement (15%)	Environmental Impact (15%)	Revenue Generation (15%)	Score
Status Quo	High (3)	High (3)	High (3)	Medium (2)	Low (1)	2.55
Option 2: Tariffs	0.11 Medium (2)	Medium (2)	Medium (2)	Medium (2)	High (3)	2.15
Option 3: Quotas	0.13 Low (1)	Low (1)	Medium (2)	Medium (2)	Low (1)	1.30
Option 4: Leases	0.07 High (3)	Medium (2)	Medium (2)	High (1)	Medium (2)	2.25

Recommendation: Let Present Trends Continue

Based on my analysis of each of the policy alternatives against the status quo (as can be seen in the outcomes matrix), allowing present trends to continue without making a significant policy intervention is the best option for improving US oil security.

Alternative policies do reduce the total cost of imports at a faster rate than the projected status quo, but they require additional resources that ultimately make them less cost effective. Additionally, there are major externalities that my analysis does not take into account for two of the options – the global political effects of imposing a tariff or a quota on oil imports from countries highly dependent on oil revenue. Even if those two options were the most cost effective, I would hesitate to recommend them because my analysis does not take into account the major effect on the US of starting a major trade war on many fronts. Retaliatory tariffs and quotas from the target countries could have serious negative economic impacts on the US that might outweigh the benefits of reduced dependence on oil.

Furthermore, tariffs and quotas imposed on highly unstable countries that are heavily dependent on oil revenue for their survival could ultimately lead to further instability and even state failure in some cases. There are moral considerations of harming citizens of another country be taken into account, but there are also considerations of long term costs to the US. If we allow states to fail by reducing the amount of oil we buy from them, then the costs saved from no longer protecting oil sources might be negated by increased military costs when we are

forced to intervene. In other words, is saving money on oil worth spending more money on state building and counterterrorism? Uncertainty makes me hesitant to recommend imposing a tariff or quota on oil imports from unstable countries.

So, I reiterate, that allowing present trends to continue and letting the US achieve oil independence naturally is the best option for policymakers concerned with oil security.

Secondary Recommendations: Land Leases and the Strategic Petroleum Reserve

If policymakers are still concerned that we are not doing enough to ensure US energy security, then I would make a secondary recommendation that they pursue increased domestic production by expanding oil exploration and drilling in federally protected lands. It is the second most cost effective option and the second best overall policy alternative. Though it has a very high negative impact on the environment, it could be reduced in scope from an expansion of three million acres to some smaller amount, such as one to two million acres, in order to have less environmental impacts. Furthermore, I cannot see that such a policy would lead to major global political consequences like trade wars the way that tariffs or quotas might.

Also, there has been debate recently about whether or not we still need the Strategic Petroleum Reserve. All of my policy alternatives assume that the Strategic Petroleum Reserve is still in place so changing that would change my calculated outcomes about the cost of US dependence on oil – likely increasing those costs because of increased vulnerability to supply shocks. So, I will weigh in on the debate by offering my two cents: the Strategic Petroleum Reserve should not only be maintained, but strengthened and perhaps restructured. The purpose of the reserve is to protect Americans against emergency oil supply disruptions and we are currently still heavily dependent on oil. Even though times seem good right now, the US should not be getting rid of its insurance policy. It is safer and less costly to have the SPR and not need it, than to than to need it and not have it.

If policymakers were concerned about the SPR not being useful, then I would recommend restructuring it to function more like the Federal Reserve. In other words, it would not be used only for emergencies, but regularly in order to promote oil price stability. Independently operated by a board of experts, the SPR would be buying barrels of oil when prices are low and selling off barrels when prices are high. Assessing the feasibility of this idea is outside the scope of this paper, but it is worth mentioning as a secondary recommendation for policymakers to explore.

Conclusion

The future for US energy security looks bright. If EIA's projections are correct and the United States becomes a net exporter of oil by 2030, then the entire global political dynamic could change. Dependence on foreign oil has been a constant for the United States for over half a century. It has embroiled us in unnecessary conflicts, tied us up with unsavory allies, and left us vulnerable to cartel manipulation. In the near future, all of that could change.

In the past, American interests in unstable countries have been overvalued due to dependence on oil from those countries. This is especially apparent when looking at how much the US has been involved in the affairs of the Middle East. The need for Middle Eastern oil will decline as we become more oil independent, and so will our national interest in protecting our access to that oil.

In an age of energy independence, the US will be allowed the opportunity to rethink its policy interventions and alliances throughout the globe. The original rationale for US presence in the Middle East, protecting the flow of oil to the United States, has and will continue to diminish. That is not to say that achieving energy independence would mean a total pullout of the region. The vacuum that US pullout would leave could easily be filled by China, which might not be a favorable outcome for either the US or the Middle East and may justify our continued presence in the region.

However, breaking our dependence on oil from the Middle East and other unstable countries means that our policy options to address issues significantly widen. In the next 10 years, the US will be able to consider geopolitical possibilities and foreign policy options that could not have been raised even a decade ago.

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