THE IMPACT OF INCREASING OIL AND NATURAL GAS PRODUCTION ON ECONOMIC AND DIPLOMATIC POWER

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ABSTRACT

THE IMPACT OF INCREASING OIL AND NATURAL GAS PRODUCTION ON ECONOMIC AND DIPLOMATIC POWER, by Christopher J. Herold 136 pages

The United States has rapidly increased production of oil and natural gas in the wake of the shale revolution. This increase occurs while renewable energy sources are rapidly expanding to put downward pressure on oil and natural gas demand. This thesis examines how this increase affects the global energy market and provides economic and diplomatic options to the United States. It applies a case study methodology to examine the increase in oil and natural gas production in the Soviet Union from 1956 to 1989 and Canada from 1981 to 2007. The results of this analysis show that a free market economy limits the Unites States from employing all the centralized methods employed by the Soviet Union. Despite this limitation, the United States should review the Strategic Petroleum Reserve and consider keeping some production capacity in reserve, expand the construction of liquid natural gas facilities to provide strategic options, and resume a leadership role in emissions restrictions to benefit growth.

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TABLE OF CONTENTS

Page

ACRONYMS

Btu	British Thermal Units
CCUS	Carbon Capture, Utilization and Storage
Comecon	Council for Mutual Economic Assistance
DIME	Diplomatic, Information, Military and Economic Instruments of Power
EIA	United States Energy Information Agency
GECF	Gas Exporting Countries Forum
IEA	International Energy Agency
IEF	International Energy Forum
IOC	International Oil Company
LNG	Liquified Natural Gas
Mtoe	Million tons of oil equivalent
NOC	National Oil Company
OPEC	Organization of the Petroleum Exporting Countries
OECD	Organization for Economic Cooperation and Development
PIIE	Peterson Institute for International Economics
WEC	World Economic Council

ILLUSTRATIONS

Page

CHAPTER 1

INTRODUCTION

Research Purpose

The purpose of this research is to understand how the United States can use their new role as the world leader in oil and natural gas production to influence economic and diplomatic power. The intent is to gain a deeper understanding of how changes in the energy market interact with the instruments of national power. This examination starts by assessing how increasing oil and natural gas production impacts the energy market and how that influence affects energy security. The analysis continues by determining how a greater share of the energy market provides diplomatic and economic options to foreign policy makers, and how energy security reduces the risk of diplomatic and economic pressure. The last part of the analysis considers how power is converted from resources using different instruments of power to establish a more complete understanding of the impact.

Issues

There are several issues surrounding the energy market and its interaction with the instruments of national power. First, the energy market is essential for modern society and is continuing to grow. With gains in energy efficiency, energy growth is slowing in developed countries, but is expected to substantially expand in developing countries.[1] Oil

[1] Organization of the Petroleum Exporting Countries (OPEC), *2018 World Oil Outlook 2040*, (Vienna: OPEC Secretariat, September 2018), 103-104, accessed 14 October 2018, http://www.opec.org.

and natural gas are two components of a complex energy market. They are popular fuel sources due to their energy density, meaning there is a large amount of potential energy in a small volume. This characteristic makes them ideal fuel sources for many applications and easier to transport across large distances. Oil is more stable and popular in dynamic environments, especially the transportation industry. Natural gas is cleaner burning and more efficient. It is used in electricity generation and as an industrial fuel source.[2] Oil is currently the leading fuel source and provides 190 quadrillion British Thermal Units (Btu) to the world market.[3] Natural gas is the third leading fuel source, after coal, and currently provides 130 quadrillion Btu to energy consumers.[4]

Oil and natural gas are strategic resources that provide benefits to those with large supplies. Energy is required as a fuel for a nation's economic engine to ensure security, prosperity and the nature of civilization.[5] Many disputes and crises have arisen to due to lack of an adequate energy supply, but the current environment has been largely stable since the creation of the International Energy Agency in 1974.[6] The largest producers of oil are the United States, Saudi Arabia and Russia; each of which produces more than ten percent of the world supply. The only countries that individually consume more than four

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[2] U.S. Energy Information Agency (EIA), *Annual Energy Outlook 2018* (Washington, DC: U.S. Department of Energy, 6 February 2018), 62.

[3] International Energy Agency (IEA), *World Energy Outlook 2017: Executive Summary* (Paris, France: IEA Publications, November 2017), 6.

[4] Ibid.

[5] Daniel Yergin, *The Prize: The Epic Quest for Oil, Money & Power* (New York: Free Press, 2009), xiv.

[6] Ibid., 773.

percent of the world's oil are the United States, China, India, Japan and Russia.[7] The United States and Russia lead the world in natural gas production and produce over three times as much as Iran.[8] The United States and Russia also lead consumption but China moves ahead of Iran.[9] The tension between energy producers and consumers provides the backdrop for understanding the larger context of the energy market.

Oil and natural gas represent only two examples of a vast array of energy sources. Coal is an older source of energy and more readily available in some countries. Momentum is gaining behind environmental movements to curtail the use of fossil fuels (coal, oil, and natural gas) in lieu of sources with fewer emissions. These sources include nuclear power and renewable sources such as solar, wind, geothermal and hydro power.[10] This movement is causing several shifts in the energy market. The overall trend is slowly moving away from fossil fuels toward renewable sources of energy.[11]

The transportation industry is the largest consumer of oil and faces the toughest challenge with shifting to renewable energy sources. The challenge in developing

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[7] U.S. Energy Information Agency (EIA), "What Countries are the Top Producers and Consumers of Oil?," 9 April 2018, accessed 14 October 2018, https://www.eia.gov/tools/faqs/faq.php?id=709&t=6.

[8] U.S. Energy Information Agency (EIA), "Dry Natural Gas Production, 2017," accessed 13 November 2018, https://www.eia.gov/beta/international/rankings/#?prodact=26-1&cy=2017.

[9] U.S. Energy Information Agency (EIA), "Dry Natural Gas Consumption, 2017," accessed 13 November 2018, https://www.eia.gov/beta/international/rankings/#?prodact=26-1&cy=2017&pid=26&aid=2&tl_id=2-A&tl_type=a.

[10] EIA, *Annual Energy Outlook 2018*, 94.

[11] Ibid., 20.

economical solutions on a mass scale means that the transportation industry will likely remain the largest consumer of oil in the short to mid-term.[12]

The United States recently became the leading producer of oil, to join its role as the leading natural gas producer. However other countries have their own view of oil and natural gas. For example, Russia is a large exporter of natural gas and receives a significant amount of revenue for its export to European countries. China, on the other hand, is a developing nation using a large amount of energy to grow its industrial capacity. These competing priorities contribute to the challenge of understanding the energy market. Despite the role of energy in our society, it is not the only influence on national power and must be considered in the context of external events that may also influence governmental policies.

Problem

The issues above provide the context from which the problem is defined. If current production increase trends hold, the United States will move from an oil and natural gas importer to an exporter thanks to increased production from horizontal drilling.[13] This would represent a drastic shift in the energy market over the last 10 years. Shifts in the energy market create threats and opportunities as they disrupt the strategic geopolitical balance. The problem for United States policy makers is to assess how to maximize returns and reduce risk as increased production of oil and natural gas affects the global balance of economic and diplomatic power.

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[12] EIA, *Annual Energy Outlook 2018*, 105.

[13] Ibid., 22.

Primary Research Question

This research attempts to provide a solution to the problem of the global balance of economic and diplomatic power through analyzing and answering the primary research question. This examination of the energy market will be focused on the oil and natural gas industries, specifically the high growth markets in the United Sates. This research seeks to understand how resources, especially oil and natural gas, impact a country's influence and role on the world stage. Key to this analysis is how states convert resources to national power. Therefore, the primary research question for this thesis is: how does increasing oil and natural gas production impact energy security and national power for the United States?

Secondary Research Questions

The secondary research questions support the primary research question to frame the research and analysis. The secondary research questions are:

1. How does increasing oil and natural gas production impact the energy market and energy security for the United States?
2. How does the United States derive economic and diplomatic power from the energy market and energy security?
3. What means convert national power generated from oil and natural gas between instruments of national power?
4. Should the United States actively pursue oil and natural gas policy as a means to gain national power?

Assumptions

Several assumptions aid the analysis of the oil market and interactions between countries. These assumptions help constrain the problem and make it possible to analyze it.

The first assumption is that the global change in hydro, nuclear and coal power production will remain near zero. Some countries will increase or decrease production, but the aggregate will change very little. This assumption is based on the consensus of government and energy company projections and allows for focus on other sources of energy, specifically oil and natural gas.

The next assumption is that global oil and natural gas reserves will not be depleted prior to supply from other sources meeting the demand at a more economical price. This assumption is based on known oil and natural gas reserves growing year by year despite a rise in production and is supported by all projections. This assumption covers extraction costs, which are likely to rise as lower-cost reserves are depleted first. If this assumption does not hold, any energy security from oil and natural gas would end with depletion of the reserves.

Third, the economic idea of the Efficient Market Hypothesis is valid for the global oil market. This hypothesis states that in the absence of outside inefficiencies, including production limits, taxes and embargos, there will be a universal price for oil after adjustment for transportation costs. This assumption allows for the analysis of economic alternatives. Without this assumption it is difficult to infer the impacts of alternative courses of action.

Fourth, all actors are rational and seek to improve their position. This means that all actors will make choices that are in their best interest. This is a baseline assumption of economic and international relations theories and allows for the analysis of economic tools.

Definition of Terms

Several unique definitions must be clarified to discuss the interaction of oil and national strategy. Most of these definitions are generally accepted throughout the international relations community or taken from government sources.

Energy Security – defined by the International Energy Agency (IEA) as the uninterrupted availability of energy sources at an affordable price.[14] While commonly associated with self-production, it also includes reliable trade deals. For the purpose of this thesis, sources of energy will be considered secure if they are domestically produced or come from an ally that has signed political, economic and military agreements.

Energy Independence – the most extreme case of energy security, in which a nation to produces all energy domestically.

Diplomatic Power – the ability to achieve one's purpose or goals, or to get the outcome one wants.[15]

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[14] International Energy Agency (IEA), "Energy Security," accessed 15 October 2018, https://www.iea.org/topics/energysecurity/.

[15] Joseph S. Nye Jr. and David A. Welch, *Understanding Global Conflict and Cooperation: An Introduction to Theory and History,* 10th ed. (Boston: Pearson, 2017), 46.

Economic Power – the ability to control or influence the behavior of others through the deliberate and politically motivated use of economic assets.[16]

Renewable Energy – energy from sources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Sources include biomass, hydropower, geothermal, wind and solar power.[17]

Limitations

Several external factors limit this research. Availability of information is the biggest limitation that will affect the research. Data collection will be kept to publicly available and unclassified sources to facilitate the widest dissemination upon completion. Additionally, only English-language sources are used to collect data. Time is also limited, as the researcher is a student in the Command and General Staff Officer Course. The time limitation of the duration of the course will affect the researcher's ability to process every addition to the body of knowledge. Lastly, the researcher's limited energy industry experience may restrict the depth of the technical analysis and will be mitigated through generalized assumptions.

[16] Ellen L. Frost, "What is Economic Power?" *Joint Force Quarterly*, no. 53 (April 2009): 9.

[17] U.S. Energy Information Agency (EIA), "What is Renewable Energy?" 13 July 2018, accessed 15 October 2018, https://www.eia.gov/energyexplained/index.php?page=renewable_home.

Scope and Delimitation

The scope of this thesis is limited to how oil and natural gas production impacts economic and diplomatic power. The analysis is confined to oil and natural gas as they are the most transferable sources of energy between nations. The market for these fuels is also changing rapidly due to new extraction techniques. Renewable energy sources, with the exception of hydropower, are also growing but their small share of the market and limited historical examples makes comparison difficult. The use of hydropower energy is not expected to grow in the near future. Coal is not considered as the market is shrinking amidst the global effort to reduce carbon emissions.

The analysis will also focus on the diplomatic and economic instruments of power as they are the most directly related to the oil and gas industry. The military and information instruments of power will not be expressly analyzed. However, the analysis of power conversion between the economic and diplomatic instruments can be extrapolated to the other instruments.

Significance of the Study

The significance is threefold. First, the study could provide national policy makers a basis upon which to understand how energy security and the energy market fit into the national strategic framework. This understanding could provide options for negotiation or influence. Second, it can provide an input for energy companies to understand the interaction between the energy market and national interests. This insight could inform long-term investment strategies. Third, from a military perspective, it helps with understanding the operational environment. Understanding how energy resources can be used and how they interact with other instruments of power can contribute to

understanding how adversaries may assess their strategic position. It can also inform geopolitical considerations.

Summary and Conclusions

Oil and natural gas provide fuel not only for engines and electricity, but for economies as well. The interactions between the energy market and instruments of national power drive the geopolitical environment in many parts of the world, for both producers and consumers. Understanding the interactions provides insight into motivation for actions. The purpose of this research is to better understand those interactions and make predictions about how the United States can benefit from increasing production of oil and natural gas. Using this information, it will be possible to provide recommendations for energy policy that supports economic and diplomatic policies.

CHAPTER 2

LITERATURE REVIEW

Introduction

The purpose of this thesis is to examine how the energy market influences national power. This examination specifically considers how the increase in oil and natural gas production impacts diplomatic and economic power through the energy market. Accordingly, this literature review provides a background of relevant topic areas regarding energy security through resources and national power models.

The literature review begins by examining energy security through energy independence or the energy market, specifically how increased oil and natural gas production provides energy security to the United States. Examining the fuels, sectors, and national players in the energy market explains connections and dependencies therein. These connections explain how the energy market can provide energy security for any nation to explain the relationship with economic and diplomatic power. This section of the review uses outlooks from government supported agencies, energy company forecasts, and analysts' predictions to explore the history, current policies and likely future of the world energy market. The extant literature delves into the impacts of the projected market on the United States and other relevant actors.

The literature review then turns to a review of theories of national power, especially international relations models from academic theorists and how they are applied in Joint Military Doctrine. The review also discusses the concepts of hard, soft, and smart power; balance of power; and power conversion. The review will shift focus to the instruments of national power—Diplomatic, Information, Military, Economic—to

discover their capabilities and how they interact together. The final part of the review of national power considers power conversion and how resources are converted into power.

Energy Security

Energy is the lifeblood that fuels civilizations and globalization.[18] Securing adequate energy supply has been essential for a growing economy since the dawn of the hydrocarbon age and industrialization, but has taken many forms. Most of the extant literature breaks energy security down into two areas of thought. First, some analysts, including John Hannah and Robert Rapier, define energy security as energy independence, meaning all energy is produced, processed and consumed domestically.[19] This definition became popular after President Richard Nixon used the term in a speech following the oil embargo Saudi Arabia emplaced in 1973.[20] The concept remained popular in succeeding presidential administrations, including that of President Carter, who claimed energy independence was the moral equivalent of war.[21] President George

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[18] Doug Stokes and Sam Raphael, *Global Energy Security and American Hegemony* (Baltimore: Johns Hopkins University Press, 2010), 215.

[19] John Hannah, "Energy Security is the Real Way to Put America First," *Foreign Policy,* 10 August 2018, accessed 15 October 2018, https://foreignpolicy.com/2018/08/10/energy-security-is-the-real-way-to-put-america-first-trump-iran-oil-sanctions/; Robert Rapier, "How Long Will Natural Gas Be a Bridge Fuel?" *Forbes*, 9 September 2018, accessed 14 October 2018, https://www.forbes.com/sites/rrapier/2018/09/09/how-long-will-natural-gas-be-a-bridge-fuel/#62126ec44579.

[20] Daniel Yergin, *The Quest: Energy, Security, and the Remaking of the Modern World* (New York: The Penguin Press, 2011), 268.

[21] Gary D. Chesley, "America's Energy Security Policy: Goals for 2025," (Master's thesis, U.S. Army War College, Carlisle Barracks, PA, 1 February 2007), 1.

W. Bush also advocated for energy independence.[22] The purpose of energy independence is to insulate the state from external factors, especially supply disruptions, while providing the energy for the state's economy to grow. While an idealistic goal, it is not likely or beneficial for most modern countries to be completely self-sufficient. The only two of the top ten world economies that have a realistic possibility of energy independence are Brazil and Canada based on energy reserves and current consumption.[23] According to the Robert Strauss Center for Security and Law at the University of Texas – Austin, most politicians have a much narrower view of energy independence as offering protection against extreme price shocks, acute supply crises, and electricity supply security.[24] This softer definition of energy independence gives way to energy security from the market.

Secondly, a large body of literature claims that energy independence is unrealistic and that energy security comes from the global energy market. This larger group sees an interconnected energy market as the key to providing security to all. The Strauss Center asserts that isolating one country is unrealistic, given the dynamics of global energy trade.[25] Other experts have slightly different definitions on how the energy market provides security. Daniel Yergin, a life-long oil analyst and energy expert, defines energy

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[22] Chesley, "America's Energy Security Policy: Goals for 2025," 2.

[23] Velichka Milina, "Energy Security: A Paradigm Shift," *Connections* 12, no. 4 (Fall 2013): 95, accessed 23 March 2019, https://www.jstor.org/stable/26326342.

[24] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies," accessed 14 October 2018, https://www.strausscenter.org/energy-and-security/.

[25] Ibid.

security as the availability of sufficient supplies at affordable prices. He expands this definition to encompass several dimensions: physical security, access to energy supplies, the energy system (national policies and international institutions), and investment to promote future supply.[26] He further explains that energy security has been an issue since the rise of industrial society, and several factors increase the focus on energy security, including a rise in imports, turmoil in producing nations, and market pressures.[27] Yergin also mentions that fuel efficiency is important to energy security, and physical infrastructure must be secured.[28] Joseph Nye, a noted social scientist, identifies three basic threats to energy security: the physical disruption of oil supplies, the economic and political damage from rapid increases in oil prices, and the foreign policy implications of our energy policy. He mentions policies in the United States focused on price and economic impact to the detriment of ensuring adequate supply.[29] The International Energy Agency was created in 1974 to promote energy security after the 1973 oil embargo and is primarily focused on secure access to supply. Member countries agree to maintain 90 days of supply in reserve and improve the transparency of international

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[26] Yergin, *The Quest*, 266-267.

[27] U.S. Congress, House, Committee on International Relations, *Oil Diplomacy: Facts and Myths Behind Foreign Oil Dependency*, statement of Dr. Daniel Yergin, Chairman, Cambridge Energy Research Associates, 107th Cong., 2nd sess., June 20, 2002, , 3.

[28] Yergin, *The Prize,* 773.

[29] David A. Deese and Joseph S. Nye, *Energy and Security* (Cambridge, MA: Ballinger Publishing Company, 1981), 392.

energy markets.[30] The World Energy Council measures energy security using the share of net imports in primary energy supply and the diversity of primary energy supply sources.[31]

These theories can be summed up by saying that energy security is having reliable access to sufficient quantities of energy at an affordable price. The main difference between energy independence and energy security is the source of the energy. Market-based philosophies claim energy security can come from relationships, while more restrictive views only trust that security comes from controlling the entire process. To better understand how these relationships can provide security we will examine the details of the energy market.

Energy is among the most important factors for human development and plays a key role in global economic development.[32] The energy market is also closely tied to economic growth.[33] The Russian Academy of Sciences notes that growth takes societies through three phases. The first phase is an agrarian society moving toward rapid population growth. The second phase is rapid growth of energy consumption during industrialization of the economy. Several regions of the world are still in this phase, most notably China, India and Africa. The third phase occurs after industrialization and is

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[30] IEA, *World Energy Outlook 2017*, i.

[31] World Energy Council (WEC), *World Energy Scenarios: Composing Energy Futures to 2050* (London: Regency House, 2013), 221.

[32] Central Statistics Office, *Energy Statistics* (New Delhi, India: Ministry of Statistics and Programme Implementation, 2018), 2.

[33] EIA, *Annual Energy Outlook 2018*, 12.

marked by the expansion of the service sector that is less energy intensive. This transition from an industrial to a service economy leads to an increase in GDP that outpaces the growth in energy consumption.[34]

Understanding these transitions helps to shed light on the total global energy demand. Developing countries in the second phase of development, including China and India, account for 80 percent of expansion of energy consumption to feed their growing industrial capacity.[35] India is the largest growing market to increase its low energy use per capita.[36] China is approaching the end of the growth phase as energy demand could decouple from economic growth in 2020.[37] This transition has the potential to cause a stutter in long-term growth.[38] Africa will also play an increasing role in the global energy market, but is starting from a low level of productivity and industrialization.[39] The growth of the services sector in developed countries reduces energy consumption. The transition from industrial-based economies has reduced the energy demand per capita in

[34] Energy Research Institute of the Russian Academy of Sciences and Analytical Centre for the Government of the Russian Federation (ERI RAS), *Global and Russian Energy Outlook 2016* (Moscow: Russian Federation, 2016), 36.

[35] BP Energy Economics (BP), *BP Energy Outlook: 2018 Edition* (London: BP p.l.c, 2018), 19.

[36] Ibid., 53.

[37] Xiaojie Xu, *China Energy Outlook (2015-2016)* (Beijing: Chinese Academy of Social Sciences, September 2015), 2.

[38] Gas Exporting Countries Forum (GECF), *GECF Global Gas Outlook 2017* (Doha, Qatar: GECF, December 2017), 9.

[39] BP, *BP Energy Outlook*, 53.

several regions, and Europe has already seen a decrease in total energy demand.[40] Despite the declining energy intensity in developed countries, the demand from developing societies drives global demand much higher and is expected to continue growth through 2050.[41] In addition to the changing demographics of energy demand, the fuels used to meet the demand are changing.

A mix of many fuels combines to meet the demands of the energy market. The fuels that comprise most of the market, and which are discussed in most of the energy market literature, are coal, oil, natural gas, nuclear and renewables, to include hydro, solar and wind power.[42] These are treated consistently among energy projections with small differences in accounting for renewables. The largest variance among fuel source reporting concerns biofuels, also called biomass or bioenergy. The EIA and BP place biofuels among the liquids derived from hydrocarbon. The IEA and Exxon created a separate category under other renewables. OPEC categorizes biofuels as a separate biomass category.[43] These sources of energy have characteristics that make them useful in a variety of applications. Reviewing these characteristics, the history of the fuel source

[40] ERI RAS, *Global and Russian Energy Outlook 2016*, 41.

[41] Institute of Energy Economics, Japan (IEEJ), *IEEJ Outlook 2018: Prospects and challenges until 2050* (Tokyo, Japan: IEEJ, October 2017), 1; IHS Markit, *Rivalry: The IHS Markit View of the Energy Future (2018-2050)* (Englewood, CO: IHS Markit, 12 July 2018), 14; BP, *BP Energy Outlook*, 21.

[42] BP, *BP Energy Outlook: 2018 Edition*, 67; EIA, *Annual Energy Outlook 2018*, 13; ERI RAS, *Global and Russian Energy Outlook 2016*, 157.

[43] Richard G. Newell and Stu Iler, *Global Energy Outlooks Comparison Methods* (Riyadh, Saudi Arabia: International Energy Forum, February 2017), 13.

and regional energy demand allows for energy companies to make predictions about the future of each fuel source.

Coal enabled the industrial revolution through the introduction of steam power to lead the transition from an agrarian economy to an industrialized one.[44] Coal was the first hydrocarbon fuel in most economies and is abundant many parts of the world. It was the leading source in the United States until 1950.[45] Coal is still crucial to development in China, while the use of coal and lignite continues to increase in India.[46] There are three types of coal used for energy: steam, coking and lignite.[47] 74 percent of coal reserves are found in the top five coal producing nations. The United States leads with 22 percent, followed by Russia (16 percent), Australia (14 percent), China (13 percent), and India (9 percent).[48]

Coal met 27% of global energy demand in 2016.[49] Coal provided 14 quadrillion British Thermal Units (BTU) of energy to the United States market, which accounts for

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[44] Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil*, (London: Verson, 2011), 8.

[45] Yergin, *The Prize*, 391.

[46] Xu, *China Energy Outlook (2015-2016)*, 3; Central Statistics Office, *Energy Statistics*, 22.

[47] IEEJ, *IEEJ Outlook 2018*, 7.

[48] U.S. Energy Information Agency (EIA), "How Much Coal is in the United States?" 15 November 2018, accessed 20 November 2018, https://www.eia.gov/energyexplained/index.php?page=coal_reserves.

[49] GECF, *GECF Global Gas Outlook 2017*, 45.

13% of energy demand in the country.[50] The current global coal reserves are projected to last 100 years.[51]

Coal is a cheap fuel source, but it has a large environmental impact from carbon emissions.[52] Coal produces the largest share of carbon emissions of all fuel sources and has garnered significant attention from legislators.[53] The coal industry has made advances in clean coal technology but has not yet gotten emissions to be lower than those generated by other sources of energy. The future of coal will be heavily reliant on improving emissions control technology.[54] Carbon Capture, Utilization, and Storage (CCUS) plays a role in most scenarios that limit climate change growth.[55]

The extant literature provides a mixed view of the future of coal energy. In the developed world, coal is being legislated away in some places.[56] In the developing world, led by China and India, coal use will likely increase due to its low cost to mine and its abundance. China sees coal as crucial to meeting their energy needs in the short term, but

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[50] EIA, *Annual Energy Outlook 2018*, 12-13.

[51] ERI RAS, *Global and Russian Energy Outlook 2016*, 137.

[52] IHS Markit, *Rivalry*, 22-23.

[53] OPEC, *2018 World Oil Outlook 2040*, 6, 9; Robert Rapier, "Natural Gas Is Already a Bridge Fuel," *Forbes*, 2 September 2018, accessed 14 October 2018, https://www.forbes.com/sites/rrapier/2018/09/02/natural-gas-is-already-a-bridge-fuel/#3994b089975f.

[54] IHS Markit, *Rivalry*, 23.

[55] Equinor, *Energy Perspectives 2018: Long-Term Macro and Market Outlook* (Stavangar, Norway: Equinor, 2018), 19.

[56] GECF, *GECF Global Gas Outlook 2017*, 19.

could see a peak in its use between 2019 and 2025.[57] Despite the global focus on environmental policies, demand for energy in developing nations will likely trump environmental concerns, causing an increase in coal consumption.[58] However, the Energy Information Agency (EIA) claims that even without strict environmental restrictions, the global demand for coal will decrease in favor of other sources.[59] Coal was the first hydrocarbon produced and could be the first source retired.

Oil was the next hydrocarbon fuel in the global market and began to replace coal after Edwin Drake discovered it in western Pennsylvania in 1859.[60] Oil was first refined to produce kerosene that replaced whale oil in lamps. Oil, and the kerosene it produced, quickly gained market share, and its use expanded across the Atlantic Ocean to Europe. Improved refining techniques led to the development of other oil products, including gasoline and diesel fuel, that would come to dominate the transportation industry.[61]

Oil is the currently the leading global energy source and the subject a significant amount of literature discussing its benefits. In 2015 the world consumed 95.36 million barrels of oil per day. The United States led all nations by consuming 20% of the world total, followed by China (13%), India (4%), Japan (4%) and Russia (4%).[62] Oil currently

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[57] Xu, *China Energy Outlook (2015-2016)*, 3.

[58] Central Statistics Office, *Energy Statistics*, 2.

[59] EIA, *Annual Energy Outlook 2018*, 87-88.

[60] Yergin, *The Prize*, 11.

[61] Ibid., 35.

[62] EIA, "What Countries are the Top Producers and Consumers of Oil?"

provides 37 quadrillion BTU to lead the United States energy market by satisfying 36 percent of the energy demand, the largest of any fuel source nine percent.[63]

One of the early decisions involving oil and energy security was Winston Churchill's, when he decided in 1911 that oil should fuel for ships of the Royal Navy in 1911. He chose to use oil from Persia rather than coal from Scotland due to the higher energy density of oil that allowed ships to move faster. The decision drew criticism as it reduced the energy security of the Royal Navy and risked the ships being cut off from their fuel supply.[64] The oil industry has since expanded to be one of the most strategic and integrated global industries.[65] Oil has the capacity to make or break nations and is now a foundation of industrial society. Oil looms as the largest of energy sources due to its strategic character, geographic distribution, and irresistible temptation to grasp for its rewards.[66]

The defining features of the oil markets since World War II include five oil supply crises stemming from producers in the Middle East disrupting or threatening to disrupt supply.[67] The most pronounced oil supply shortage occurred in 1973 when Saudi Arabia led OPEC to cut production by 25 percent and embargo oil to the United States and the Netherlands in the wake of their support of Israel during the Arab-Israeli War of

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[63] EIA, *Annual Energy Outlook 2018*, 13.

[64] Yergin, *The Quest*, 265.

[65] U.S. Congress, *Oil Diplomacy*, 4.

[66] Yergin, *The Prize*, 762.

[67] U.S. Congress, *Oil Diplomacy*, 2.

that year.[68] This disruption caused a shift in the organization of the global oil market and led to the creation of the International Energy Agency (IEA) in 1974.[69]

The process of conventional oil production started with drilling to oil reserves and extracting or pumping oil into barrels.[70] Innovation drove improvements in drilling technology, including rotary drilling applied from water-well contractors in 1893.[71] The latest improvements include horizontal drilling and hydraulic fracturing technologies that have revolutionized and disrupted the oil industry. Horizontal drilling is a method of extending wells horizontally to extend the production from each well. Hydraulic fracturing is a well stimulation technique that allows energy producers to tap into challenging geographic formations. These technologies, combined with high oil prices, provided the opportunity for development of shale oil to dramatically change the nature of oil supply.[72]

Before shale oil production began, the United States imported around 10 million barrels of oil per day.[73] The development of shale oil has grown to account for 36% of

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[68] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

[69] IEA, *World Energy Outlook 2017*, 2.

[70] Yergin, *The Prize*, 13.

[71] Ibid., 67.

[72] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

[73] EIA, *Annual Energy Outlook 2018*, 28.

total oil production in the United States as of 2018.[74] The increase from shale oil has made the US the global leader in oil production and could lead to the US becoming a net oil exporter for the first time since 1948.[75] The development of shale oil presents a potential opportunity for expansion in places such as Latin America and China.[76] Other countries, including Poland, have vast shale oil reserves, but need more advanced technology to extract the shale oil economically.[77]

The oil industry breaks the supply chain into three parts, including upstream, midstream and downstream, that are defined differently depending on the source. Chevron defines the upstream section as the work to explore, produce and transport oil and natural gas; the midstream as the refinement, marketing, and distribution of fuels and lubricants; and the downstream as the selling of retail fuel to consumers.[78] The Robert Strauss Center includes the transportation of oil to the refineries in the midstream, leaving only exploration and extraction as the upstream. The downstream then includes the refinement and transportation to commercial use.[79] The common factor between the two

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[74] Robert Strauss Center, "The U.S. Shale Revolution," accessed 14 October 2018, https://www.strausscenter.org/energy-and-security/the-u-s-shale-revolution.html.

[75] Milina, "Energy Security: A Paradigm Shift," 84; Yergin, *The Prize*, 392.

[76] John R. Deni, ed. *New Realities: Energy Security in the 2010s and Implications for the U.S. Military* (Carlisle Barracks, PA: United States War College Press, 2015), 5; Milina, "Energy Security: A Paradigm Shift," 87.

[77] Milina, "Energy Security: A Paradigm Shift," 81.

[78] Chevron Corporation, *2017 Annual Report: Human Energy* (San Ramon, CA: Chevron, 2017), 7.

[79] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

sources' characterizations is the terminology itself and the division of the supply chain into three segments. The exact definition is not as important as the conclusion that the two important elements for the oil market are the production capacity in the upstream and the refinement capacity in the midstream. The production capacity is determined from the number of reserves and development of pumping infrastructure. The upstream investments in oil and gas investment remain components of a secure energy system.[80] The refinement capacity is limited by the number and throughput of refineries. A country's ability to process oil into products contributes to energy security. It is not sufficient to have oil reserves. The country should have the ability to process the oil, as well.

In addition to understanding how oil moves to the market, it is useful to understand the nature of the product moving through the system. Oil is classified by production quality using two metrics. The density of crude oil is characterized as light, medium or heavy.[81] The lighter the crude oil, the cheaper and more productive it is to refine. The sulfur content is described as sweet or sour, with a high concentration being denoted as sour. The more sulfur in the crude oil, the more expensive it is to refine. Light sweet crude is the most desirable. It creates the benchmark for oil prices and is most plentiful in the Middle East.[82] The quality descriptions contribute to the fungibility of oil,

[80] IEA, *World Energy Outlook 2017*, 8.

[81] Eni, *World Oil Review 2018* (Rome, Italy: Eni, 2018), 46.

[82] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

meaning that oil from different places and grades are largely interchangeable.[83] Fungibility creates what the Robert Strauss Center refers to as "A Global Bathtub" of oil, where producers contribute to a single world supply from which consumers draw. The ability to easily transport oil further supports this concept.[84] There are several indexes that report the price and facilitate trade of oil within the context of the global market. The oldest and most common benchmark for oil prices is the Brent Crude Index that was named after the Brent Oil Platform in the North Sea. The index in North America is the West Texas Intermediate and the newest popular index is Dubai Crude.[85]

Oil satisfies energy demand from several sectors. Fifty-seven percent of oil is consumed in the transportation sector that has limited alternative fuels.[86] The transportation segment is further broken down into four modes. Of these, road vehicles consume 45 percent of oil, aviation consumes 6 percent, railroads consume 2 percent and sea vessels consume 4 percent. Eleven percent of oil is used for residential, commercial and agriculture and 5 percent of oil is used to generate electricity to meet consumer needs. Industrial uses make up 27 percent of oil demand, which includes 13.9 percent for petrochemicals, a raw material for industries such as production on plastics, instead of

[83] Robert Strauss Center, "The Fungibility of Oil," accessed 14 October 2018, https://www.strausscenter.org/energy-and-security/.

[84] Robert Strauss Center, "The Oil Market: A Global Bathtub," accessed 14 October 2018, https://www.strausscenter.org/energy-and-security/.

[85] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

[86] OPEC, *2018 World Oil Outlook 2040*, 288.

combustible uses.[87] Oil is a flexible fuel that meets demand for a number of sectors of the economy, especially transportation, and is projected to meet a significant portion of energy demand through 2050.[88] Oil production created what many saw as a worthless byproduct that is turning into one of the most important fuels in the energy market: natural gas.

Natural gas is an important and growing segment of the energy market. The first natural gas well was drilled in Fredonia, New York in 1821.[89] Despite this early production, technology did not exist to extract or transport the fuel efficiently. Oil production quickly surpassed that of natural gas after its discovery several decades later. As oil production increased, natural gas was considered a byproduct and burned off at the well rather than captured for distribution and sale. J.N. Pew and a partner started to capture natural gas in Pennsylvania in 1876 to distribute as a fuel source for the oil fields. They expanded to distribute in Pittsburgh in 1883.[90] Technology has greatly improved since then, and natural gas is expanding to play an important role in the energy market.

Three primary drivers shape the global gas market: demand, supply and infrastructure.[91] The United States and Russia are the global leaders in natural gas production by a wide margin. They produce over three times as much as Iran, Qatar, and

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[87] OPEC, *2018 World Oil Outlook 2040*, 125.

[88] BP, *BP Energy Outlook*, 105.

[89] Yergin, *The Quest*, 326.

[90] Ibid., 76, 200.

[91] GECF, *GECF Global Gas Outlook 2017*, 4.

Canada, which round out the top five producers.[92] The United States and Russia are also the top consumers, followed by China and Iran.[93]

Global natural gas production is expected to rise by 80 percent by 2050.[94] Russia is the largest exporter of natural gas, with many of their customers in Western Europe. Natural gas currently provides 28 quadrillion BTU to the American energy market to meet 27 percent of total demand for energy and is projected to account for 39 percent of US energy production.[95]

Production of natural gas in the United States is increasing, especially from horizontal drilling and hydraulic fracturing that now accounts for 40 percent of production.[96] Natural gas from shale sources transformed the market in the United States, to the point that it can now export excess capacity.[97] Unlike oil, natural gas does not operate in a single global market. Instead there are regional markets that operate somewhat independently, as 80 percent of natural gas is consumed in the region it was

[92] EIA, "Dry Natural Gas Production, 2017."

[93] EIA, "Dry Natural Gas Consumption, 2017."

[94] IEEJ, *IEEJ Outlook 2018*, 6.

[95] EIA, *Annual Energy Outlook 2018*, 17-18.

[96] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

[97] Yergin, *The Quest*, 329-330.

produced.[98] The ability to economically transport natural gas is the greatest challenge to developing a globally integrated market because it is not as transportable as oil.[99]

The Global Exporting Countries Forum (GECF) outlines two trade models for natural gas, free trade or obligated trade through contracts. They also identify the two sources of natural gas for the market as pipeline gas and liquified natural gas (LNG).[100] Yergin expands on this idea to pair trade models with sources, in that LNG is freely available at spot prices, while pipeline gas is sold in 20-year contracts that are indexed off oil.[101] For the first source, natural gas traditionally depended on fixed pipelines for transportation.[102] Some of the most geopolitically significant pipelines run from Russia to Western Europe. Russia started to meet Europe's natural gas demand through pipelines in the 1970s, causing alarm for the United States due to the potential for increasing Russian influence.[103] The United States becoming a major exporter of natural gas potentially undercuts Russia's ability to exercise influence in Europe.[104]

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[98] IHS Markit, *Rivalry,* 22.

[99] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

[100] GECF, *GECF Global Gas Outlook 2017*, 79,

[101] Yergin, *The Quest,* 333.

[102] Joseph S. Nye Jr., *The Future of Power* (New York: Public Affairs, 2011), 69.

[103] Yergin, *The Quest*, 333.

[104] Clifford Krauss, "Oil Boom Gives the U.S. a New Edge in Energy and Diplomacy," *New York Times*, 28 January 2018, accessed 14 October 2018. https://www.nytimes.com/2018/01/28/business/energy-environment/oil-boom.html.

LNG emerged as a second source of transporting natural gas in 2016. The United States started the development of a global natural gas market by exporting LNG.[105] Yergin claims that LNG contributes to making natural gas a global fuel.[106] Despite this investment, the GECF expects the market to remain fragmented by region because it currently takes five to six dollars per MMBtu to overcome the cost of transportation.[107] The Energy Information Agency reiterates that LNG infrastructure is important to enable global exports.[108]

The spread of LNG requires significant investment in infrastructure. Natural gas can be volatile and risky to transport in its gaseous state. Condensing the gas to a liquid by supercooling to 260 degrees below zero Fahrenheit allows for its transport over long distances by truck, rail and ship.[109] This process also requires specialized infrastructure to perform liquefaction, transportation and regasification of natural gas. There are 240 liquefication plants as exit infrastructure and 400 regasification plants to import natural gas in the GECF infrastructure database.[110] According to the IEA, the number of liquefication sites is expected to double by 2040.[111] The United States continues to invest

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[105] IHS Markit, *Rivalry*, 13.

[106] Yergin, *The Quest*, 266.

[107] GECF, *GECF Global Gas Outlook 2017*, 13.

[108] EIA, *Annual Energy Outlook 2018*, 74.

[109] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

[110] GECF, *GECF Global Gas Outlook 2017*, 4.

[111] IEA, *World Energy Outlook 2017*, 6.

in exit infrastructure for LNG.[112] Russia acknowledges that this infrastructure investment sets the lower limit of arbitrage price, as the United States would rapidly increase supply if the price exceeds the delivered cost.[113]

Demand for natural gas is also expanding due to environmental considerations. Robert Rapier, an oil analyst, wrote about natural gas as a bridge fuel between demand for higher carbon sources, such as coal and oil, and non-carbon sources such as hydro, wind and solar power.[114] Rapier expects natural gas to serve this role for at least 15 years, until the supply of non-carbon energy can meet demand.[115] According to the Natural Gas Solution, natural gas can cut emissions as a bridge fuel in the short term.[116] Natural gas plays a large role in all projections to reduce carbon emissions, but is even expected to grow without emissions regulations.[117]

Several sources project the volume of natural gas to dramatically increase thanks to the combination of supply, demand and environmental sustainability. Natural gas currently accounts for 22 percent of global energy demand, but that could rise as high as

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[112] Equinor, *Energy Perspectives 2018*, 45.

[113] ERI RAS, *Global and Russian Energy Outlook 2016*, 124.

[114] Rapier, "Natural Gas Is Already a Bridge Fuel."

[115] Rapier, "How Long Will Natural Gas Be a Bridge Fuel?"

[116] The Natural Gas Solution, "Increasing America's Energy Security," 2018, accessed 24 December 2018, http://naturalgassolution.org/increasing-americas-energy-security/.

[117] EIA, *Annual Energy Outlook 2018*, 14; GECF, *GECF Global Gas Outlook 2017*, 23; IHS Markit, *Rivalry*, 20-22.

27 percent by 2050 to surpass oil and coal as the leading source of energy.[118] The Institute of Energy Economics in Japan projects that natural gas will add 2,250 Million tons of oil equivalent (Mtoe) to the energy market to remain slightly behind oil in total energy production.[119]

Electric power generation and the industrial sector are the leading consumers of natural gas, accounting for over half of its use.[120] There has been a large shift to natural gas as a fuel source for electric power to reduce carbon emissions, resulting projected 40 percent growth of natural gas consumption by 2040.[121] This will likely continue as tax credits for renewables expire in the mid 2020s.[122] The industrial sector accounts for additional growth of natural gas consumption for chemical applications and heat generation.[123] In Europe, 28 percent of natural gas supply goes toward industrial heating and chemicals. Meanwhile, residential consumers use 30 percent of supply for heat and an additional 30 percent for electric power.[124]

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[118] IHS Markit, *Rivalry*, 5.

[119] IEEJ, *IEEJ Outlook 2018*, 3.

[120] EIA, *Annual Energy Outlook 2018*, 69-70.

[121] ExxonMobil, *2018 Outlook for Energy: A View to 2040* (Irving, TX: ExxonMobil Corporate Headquarters, 2018), 33.

[122] EIA, *Annual Energy Outlook 2018*, 14.

[123] Ibid.

[124] F. Stephen Larrabee, Stephanie Pezard, Andrew Radin, Nathan Chandler, Keith Crane, and Thomas S. Szayna, *Russia and the West After the Ukrainian Crisis: European Vulnerabilities to Russian Pressures* (Santa Monica, CA: RAND Corporation, 2017), 38-39.

Nuclear energy was thought to be able to render all other energy sources obsolete during the 1960s and 1970s. However, the IEA reports that the use of nuclear energy has flatlined, and even seen a decline in the developed world.[125] Nuclear energy supplies 5 percent of all energy consumed worldwide and currently provides 13 quadrillion BTU to the US energy market to meet 13 percent of demand.[126] According to the EIA, this rate is likely to drop as nuclear power plants reach the end of their useful life and there are no plans to replace them.[127] The global apprehension about adding nuclear power rests on two main causes. First, safety concerns as a result of nuclear reactor failures in Chernobyl and Fukushima have shifted public confidence in their safety.[128] The second issue is the risk imposed by the large capital investment required to build a nuclear reactor, especially in the face of dropping fuel prices that will decrease nuclear demand.[129] Despite the reluctance in developed countries leading to a slow decline, developing countries are striving to acquire energy by any means possible. This has led to additional building projects for nuclear power plants in the developing world.[130] The Chinese Academy of Social Science describes China's ambition to increase nuclear energy and become the

[125] IEA, *World Energy Outlook 2017*, 2.

[126] ERI RAS, *Global and Russian Energy Outlook 2016*, 56; EIA, *Annual Energy Outlook 2018*, 12-13.

[127] Linda Capuano, *International Energy Outlook 2018* (Washington, DC: U.S. Energy Information Agency, U.S. Department of Energy, 24 July 2018), 85-86.

[128] Equinor, *Energy Perspectives 2018*, 54.

[129] Yergin, *The Quest*, 329-330.

[130] ERI RAS, *Global and Russian Energy Outlook 2016*, 56.

world leader in nuclear energy by 2030.[131] ERI RAS mentions other countries planning on increasing nuclear energy China, India, Lithuania, Poland, and Turkey.[132] IHS Markit is less decisive in their projection, saying that the growth of nuclear energy depends on government policy.[133] Overall, the majority of projections assess that nuclear energy is not a game changer and will remain stagnant.[134]

The previous fuels are all non-renewable, meaning there is a finite amount available for consumption. The energy market has placed an emphasis on developing renewable energy to ensure a sufficient supply in the long term. The most common renewable fuels in the energy market are hydro, wind, solar and biomass.[135] Renewable sources provide 7 quadrillion BTU to the United States energy market to account for 7 percent of demand. Hydropower is the largest renewable source and provides 3 quadrillion BTU to the United States energy market to account for 3 percent of demand.[136] Hydropower is attractive because it can deliver some of the most cost-efficient power from a renewable source at a cost of 5 cents per kilowatt-hour.[137]

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[131] Xu, *China Energy Outlook (2015-2016)*, 6.

[132] ERI RAS, *Global and Russian Energy Outlook 2016*, 57.

[133] IHS Markit, *Rivalry*, 26.

[134] WEC, *World Energy Scenarios*, 237.

[135] BP, *BP Energy Outlook*, 96; EIA, *Annual Energy Outlook 2018*, 93; ERI RAS, *Global and Russian Energy Outlook 2016*, 60-61.

[136] EIA, *Annual Energy Outlook 2018*, 12, 18.

[137] ERI RAS, *Global and Russian Energy Outlook 2016*, 63.

Despite the positive aspects, hydropower is unlikely to grow substantially for three reasons. First, the best sources to develop hydropower close to urban clusters have already been developed. This means additional capacity would be further away and cost more. Secondly, hydropower is a more mature technology and costs are not declining at the same rate as other renewable sources. Lastly, social and environmental impacts of stopping river flow make it difficult for large scale hydropower projects to get approved by local governments. One outlier from slow hydropower growth is China, whose production is increasing at a rate of 9 percent per year. Despite slow growth, hydropower is not likely to decline as current sites continue to produce power and gain efficiency from upgrades.[138]

Other sources of renewable energy are growing much faster than hydropower. Wind power is growing at a rapid rate due to government support and decreased cost.[139] Wind capacity is expected to increase in the United States through 2024 when tax credits are scheduled to expire.[140] Wind energy can be divided into two broad categories: onshore and offshore. The price of onshore wind is $0.06 per kWh, but has the potential to drop by 7 percent as installations double. This decrease will likely exhaust the potential for cost minimization for onshore wind.[141] However, offshore wind is less

[138] Equinor, *Energy Perspectives 2018*, 47.

[139] Ibid., 48.

[140] Capuano, *International Energy Outlook 2018*, 91.

[141] ERI RAS, *Global and Russian Energy Outlook 2016*, 63.

developed and shows greater promise for cost reductions.[142] The most important development in wind energy has been the horizontal axis turbine to efficiently produce electricity.[143]

Solar energy is another promising renewable energy source. The cost of solar energy is dropping and could rival the cost of oil sources.[144] Solar capacity, especially from photovoltaic cells, is expected to increase through 2050 due to tax credits and decreased capital costs.[145] Several sources in the extant literature consider wind and solar power together instead of breaking them apart. Predictions for the growth of wind and solar vary from two and a half times by 2030 to four times by 2040.[146] Other sources predict that 64 percent of energy growth through 2050 will come from wind and solar energy.[147] Accurately reporting energy production from wind and solar is a challenge because not all systems are on the power grid.[148] Another challenge with wind and solar energy is timing the supply and demand of energy. Increased battery storage will be essential to enable these energy sources to meet demand. Lithium-ion batteries are the

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[142] Equinor, *Energy Perspectives 2018*, 49.

[143] Varun Sivaram, John O. Dabiri, and David M. Hart, "The Need for Continued Innovation in Solar, Wind and Energy Storage," *Joule* 2, no. 9 (September 2018): 1.

[144] ERI RAS, *Global and Russian Energy Outlook 2016*, 64

[145] EIA, *Annual Energy Outlook 2018*, 94; Capuano, *International Energy Outlook 2018*, 20.

[146] IEEJ, *IEEJ Outlook 2018*, 7; ExxonMobil, *2018 Outlook for Energy*, 3.

[147] EIA, *Annual Energy Outlook 2018*, 20

[148] Equinor, *Energy Perspectives 2018*, 16.

leading method for battery storage, but their adoption could retard the development of other sources.[149]

Biomass is the last major fuel source discussed in the extant literature, but it is not characterized consistently among different sources.[150] Some define biomass as wood and plant matter, such as that used in cooking fires. This is especially popular in the developing world.[151] Other sources include biofuels, such as ethanol, that are used in the transportation industry. The potential for growth of these sources is unclear, but the airlines present a possible opportunity.[152] All the aforementioned fuel sources combine to form the supply side of the energy market.

The demand side of the energy market can be represented two ways, by sector and region. Energy companies and energy analysts divide the energy market into sectors to understand trends within the market. The Royal Dutch Shell Company breaks energy end-users into the most detailed list of 14 sectors: heavy industry, agriculture, services, passenger transport (ship, rail, road, and air), freight transport (ship, rail, road, and air), residential (heating & cooling and lighting & appliances), and non-energy use.[153] EIA is more general in their analysis by grouping only five sectors: electric power, industrial,

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[149] Sivaram et al., "The Need for Continued Innovation in Solar, Wind and Energy Storage," 1.

[150] Newell and Iler, *Global Energy Outlooks Comparison Methods*, 2.

[151] Equinor, *Energy Perspectives 2018*, 49.

[152] Ibid., 50.

[153] Shell, *World Energy Model: A View to 2100*, Shell International BV, 2017, 12, accessed 14 October 2018, http://www.shell.com/scenarios.

transportation, commercial, and residential.[154] BP is even more restrictive with only transport, industry, non-combusted, and buildings.[155] Exxon also has four sectors with transportation, residential/commercial, industrial, and electrical generation.[156] OPEC divides the market into three main sectors with sub-sectors: transportation (road, aviation, rail and marine bunkers), industry (petrochemicals and other industry), and other uses (residential/commercial/agricultural and electricity generation).[157] This thesis will analyze the trends across the transportation, commercial and industrial sectors while acknowledging that it is difficult to reconcile the way some sources categorize the sectors.

The transportation sector includes the energy to move anything by land, sea, or air. This includes cars and trucks on the road, train cars, ships and airplanes. The EIA projects that global energy consumption for transportation peaked in 2017 as fuel efficiency improved faster than the increase in travel through 2035.[158] Most other sources see the transportation sector growing slightly, but slower than other sectors. ERIAS

[154] EIA, *Annual Energy Outlook 2018*, 69.

[155] BP, *BP Energy Outlook*, 23.

[156] ExxonMobil, *2018 Outlook for Energy*, 12.

[157] OPEC, *2018 World Oil Outlook 2040*, 125.

[158] EIA, *Annual Energy Outlook 2018*, 105.

predicts that transportation demand will increase by 500 Mtoe by 2040 despite the increase in efficiency.[159] BP predicts a leveling of demand from the sector by 2040.[160]

According to Exxon, the transportation sector consumes 105 qBtu or roughly 20 percent of global energy in 2016 and this ratio will remain consistent through 2040.[161] The EIA expects that gasoline will dominate the transportation sector through 2050.[162] The transportation sector consumed 55.8 million barrels of oil per day in 2017 to account for 57 percent of oil demand.[163] However, the GECF sees transportation as the largest sector for growth of natural gas.[164] According to OPEC, road transportation accounts for over three quarters of oil demand in the transportation sector. The remaining quarter is distributed between aviation at 11 percent, marine bunkers at 7 percent and rail at 3 percent. OPEC projects the ratio to remain the same, with only a slight decline for road transport as its growth slows and aviation growth rises.[165]

The burning of so much oil causes the transportation sector to produce the most carbon emissions and receive the most attention from environmentalists. Even OPEC acknowledges that road transportation is under increased scrutiny.[166] The most feasible

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[159] ERI RAS, *Global and Russian Energy Outlook 2016*, 71.

[160] BP, *BP Energy Outlook*, 25.

[161] ExxonMobil, *2018 Outlook for Energy*, 12.

[162] EIA, *Annual Energy Outlook 2018*, 105.

[163] OPEC, *2018 World Oil Outlook 2040*, 125.

[164] GECF, *GECF Global Gas Outlook 2017*, 61.

[165] OPEC, *2018 World Oil Outlook 2040*, 125.

[166] Ibid., 6.

way to reduce carbon emissions is to electrify the vehicle fleet.[167] Another possible solution is the expansion of natural gas propulsion, as transportation is the fastest growing sector for natural gas.[168] IHS Markit predicts oil will lose dominance in the sector as it falls from providing 92 percent of the energy to 79 percent, mostly due to electric vehicles.[169] The transportation sector will continue to play a large role in the fortunes of the oil and natural gas industries, even though the United Kingdom and France look to phase out gas and diesel vehicles by 2040.[170] The transportation sector drives much of the conversation of the energy market, but it is not the largest source of demand.

Exxon identifies the electricity sector as the leading source of energy demand with 220 quadrillion BTU or 40 percent of the market. Exxon projects this will grow to 270 quadrillion BTU in 2040 to remain at a 40 percent share of the market.[171] The Institute of Energy Economics in Japan projects a similar assessment with global energy production growing from 34 percent in 2000 to 41 percent by 2050.[172] ERI RAS assumes that demand will grow slightly more than 50 percent by 2050.[173]

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[167] Equinor, *Energy Perspectives 2018*, 25.

[168] GECF, *GECF Global Gas Outlook 2017*, 61

[169] IHS Markit, *Rivalry*, 10.

[170] IEA, *World Energy Outlook 2017*, 3.

[171] ExxonMobil, *2018 Outlook for Energy*, 12.

[172] IEEJ, *IEEJ Outlook 2018*, 4.

[173] ERI RAS, *Global and Russian Energy Outlook 2016*, 44.

Electricity is a means to transfer energy to other end-use sectors, and in the United States its consumption is evenly distributed between residential, commercial and industrial uses. Transportation made up an insignificant share of electricity use in 2017 but will grow even further by 2050 due to electrical cars. Despite this growth it will still make up a small portion of market demand.[174] The greatest advantage of electricity is that sources of fuel are highly substitutable to provide cost efficiency to the market.[175]

The industrial sector comprised 30 percent of the energy market in 2016 and will maintain the same ratio through 2040.[176] The sector is divided into two primary uses, combusted and non-combusted. Combusted energy is used in manufacturing processes and non-combusted sources are used to produce petrochemicals. The industrial sector consumed a quarter of total demand, which was evenly split between petrochemicals and other uses in 2017.[177] Petrochemicals are expected to grow at three times the rate of other uses by 2040.[178]

The residential and commercial sectors consume the least amount of energy at roughly 12 percent in 2016. The amount of energy used by these sectors is not expected to grow as efficiency increases with population growth. The share of demand from these

[174] EIA, *Annual Energy Outlook 2018*, 83-84.

[175] Ibid.

[176] ExxonMobil, *2018 Outlook for Energy*, 12.

[177] OPEC, *2018 World Oil Outlook 2040*, 125.

[178] Ibid.

sectors will fall to 10 percent by 2040.[179] Most of this demand is for heating, cooling and electrical appliances at home and in the work place.[180] Natural gas provides a significant portion of energy to these sectors.[181]

Newell and Iler summarize how the extant literature categorizes demand by the country or regional considerations that are largely classified as producers or consumers, importers or exporters and developed or developing. Countries produce energy from reserves of the sources previously discussed. Producers create more energy than they consume and export the excess to countries that consume more than they produce. Even countries, such as the United States with large energy reserves and production volume can be importers. The available literature focuses on the most important countries and regions for the global energy market including the United States, European Union, Russia, China, India, the Middle East, and Africa.[182]

The United States leads in total energy consumption.[183] The United States has had an alternating role as a net producer and net consumer. However, energy demand has outpaced supply since the 1940s. The global oil industry began in the United States and it produces the largest share of its energy by source. Natural gas contributes the second largest and growing share. Both of these sources benefit from hydraulic fracturing

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[179] ExxonMobil, *2018 Outlook for Energy*, 12.

[180] BP, *BP Energy Outlook*, 30-31.

[181] Larrabee et al., "Russia and the West After the Ukrainian Crisis: European Vulnerabilities to Russian Pressures," 39.

[182] Newell and Iler, *Global Energy Outlooks Comparison Methods*, 23.

[183] Eni, *World Oil Review 2018*, 19.

revolution taking place primarily in the United States. Despite being among the largest producers of oil and natural gas, demand is so high that it was also one of the largest importers. The use of coal is declining under the pressure to reduce emissions and growth of renewables. The high consumption of energy encouraged the industrial revolution and economic growth. The overall energy market in the United States is expected to remain roughly the same size through 2040 as population growth is tempered with improved efficiency and a continued shift to a service economy.[184]

The European Union does not have the same energy reserves as much of the developed world. Europe is dependent on Russia for natural gas, and Russia faced limited competition in the European market.[185] However, competition is increasing and the Rand Corporation believes that Europe is less susceptible than many believe to Russian energy.[186] Europe also leads the global effort to expand renewable energy, having already passed peak energy demand.[187] Europe is the only region where total energy demand decreases.[188]

The developing world faces a much different energy profile than the United States and Europe. China and India are expecting a large economic revolution through the rest

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[184] BP, *BP Energy Outlook*, 121

[185] Milina, "Energy Security: A Paradigm Shift," 86.

[186] Milina, "Energy Security: A Paradigm Shift," 86; Larrabee et al., "Russia and the West After the Ukrainian Crisis: European Vulnerabilities to Russian Pressures," 69-71.

[187] ERI RAS, *Global and Russian Energy Outlook 2016*, 61.

[188] BP, *BP Energy Outlook*, 65.

of the first half of the century. China is expected to lead global GDP growth and is the leading country in global energy consumption.[189] China's rise will contribute to the fragmentation of the established global energy market.[190]

Coal produces over half of China's energy and results in China also producing the most carbon emissions in the world, but it is working to reduce emissions.[191] China is working to switch from coal to natural gas to reduce emission and increase air quality.[192] Equinor sees China as the lynchpin in the global gas trade due to large imports by 2040.[193]

While already the leading country, China will also be a leader in energy demand growth through 2040 according to several estimates.[194] China's GDP and energy are currently correlated.[195] However, China's own view sees a potential energy peak in 2020 as the growth of energy decouples from the growth of the economy.[196] China is looking to grow energy consumption and see clean and efficient coal as essential to meeting growing demand.[197] Coal is crucial and developing emission reduction technologies are

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[189] ExxonMobil, *2018 Outlook for Energy*, 8.

[190] IHS Markit, *Rivalry*, 5-6.

[191] Xu, *China Energy Outlook (2015-2016)*, 3-4.

[192] Equinor, *Energy Perspectives 2018*, 43.

[193] IEA, *World Energy Outlook 2017*, 4.

[194] BP, *BP Energy Outlook*, 55, 113.

[195] Capuano, *International Energy Outlook 2018*, 10.

[196] Xu, *China Energy Outlook (2015-2016)*, 2.

[197] Ibid., 3-4.

essential as peak coal is not expected in China until the early 2020s.[198] The energy reduction focus through structural optimization, technological innovation, and economical deployment of CCUS creates an emissions peak in 2020.[199] China will also greatly increase its use of renewable energy, and will lead the world in total production.[200] China is transitioning from an industrial to a service economy while experiencing economic growth at the same time.[201] As the world's largest consumer economy, China must switch fuels to manage sustainable growth.[202] China predicts that slowing economic growth is necessary to manage such a transition, which would help correct the relationship between energy saving and emission reduction.[203] Taking all this information together, China's energy demand will greatly increase as both their population and energy consumption per capita increase.[204] China has the largest consumption in the energy market and it is growing quickly, but is not the fastest growing player in the energy market.

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[198] Xu, *China Energy Outlook (2015-2016)*, 8.

[199] Ibid., 10.

[200] BP, *BP Energy Outlook*, 55; ERI RAS, *Global and Russian Energy Outlook 2016*, 62.

[201] IEA, *World Energy Outlook 2017*, 3.

[202] BP, *BP Energy Outlook*, 57.

[203] Xu, *China Energy Outlook (2015-2016)*, 11.

[204] Capuano, *International Energy Outlook 2018*, 14.

India has a smaller share of the energy market but is growing the fastest.[205] Together with China, the two make up half of global growth through 2040.[206] This growth comes from low per capita energy increasing as the Indian economy improves.[207] India is predicted to take the global lead in liquid fuels by 2040.[208] India sees energy as a key factor in economic development.[209] The growth of energy will coincide with a growth of GDP from $6,000 to $20,000 per capita in 2040.[210] India was the third leading consumer of oil in 2015 at 4.14 million barrels per day.[211] Coal is the leading energy source and provides 71 percent of India's energy. Petroleum and natural gas make up 11 and 9 percent respectively and renewables make up 6 percent.[212] The coal that India produces domestically is low quality and India must import higher quality coal for its steel industry.[213] India has set ambitious goals to increase penetration of natural gas.[214]

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[205] BP, *BP Energy Outlook*, 113, 121.

[206] Ibid., 7.

[207] Capuano, *International Energy Outlook 2018*, 14.

[208] ERI RAS, *Global and Russian Energy Outlook 2016*, 67.

[209] Central Statistics Office, *Energy Statistics*, 74.

[210] ERI RAS, *Global and Russian Energy Outlook 2016*, 37.

[211] EIA, "What Countries are the Top Producers and Consumers of Oil?"

[212] Central Statistics Office, *Energy Statistics*, 22.

[213] Ibid., 30.

[214] GECF, *GECF Global Gas Outlook 2017*, 24.

India's power and influence are projected to grow as their population and economy grow.[215]

The Middle East has long been a large producer and exporter of energy. Iran, then Persia, became vital on the international scene in 1911 when Winston Churchill made the decision to switch the primary fuel source from domestic coal to imported oil.[216] Since then, the Middle Eastern countries, led by Iran and Saudi Arabia, continue to export vast quantities of oil to the global market. Saudi Arabia and Iran rank second and fifth in global oil production with 13 and 5 percent share respectively. Saudi Arabia is the only Middle Eastern country to rank in the top ten consumers at sixth with three percent of global oil consumption.[217] Saudi Arabia remains the largest oil exporter, mostly due to low extraction costs, a large resource base, and relative political stability.[218] Saudi Arabia suffers somewhat from the abundance curse that deters the development of other economic sectors. They are working to balance rectify this by diversification from oil and balancing their budget by 2020, but have pushed the goal to 2023.[219] Saudi Arabia plays a large role in determining the global price of oil as they modify their output to achieve a

[215] IHS Markit, *Rivalry*, 6.

[216] Yergin, *The Prize*, xiii-xiv; Yergin, *The Quest*, 264-265.

[217] EIA, "What Countries are the Top Producers and Consumers of Oil?"

[218] ERI RAS, *Global and Russian Energy Outlook 2016*, 88.

[219] Equinor, *Energy Perspectives 2018*, 37.

desired price. This manipulation is effective because they have excess pumping capacity and are willing to change their production.[220]

Russia is a polarizing force within the global energy market. Energy is important to Russia's economy and contributes 31 percent to their GDP, and 16 percent of their GDP comes from energy exports.[221] Russia predicts difficult economic times ahead as renewable energy and increased efficiency drive down the cost of hydrocarbon fuels.[222] Russia's energy intensity, a measure of energy consumption per unit of GDP, is twice as high as Europe and time and a half of the United States.[223] Russia is rich in natural resources but also executes an aggressive foreign policy.[224] Russia is also a large exporter to Europe and is expanding the flow of natural gas through pipelines to feed Europe's growth of electricity.[225] The Caspian region of Russia serves as the "Saudi Arabia of Natural Gas."[226] Russia's influence is tempered by the growth of liquid natural gas production in the United States.[227] The increased geopolitical tension between Russia

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[220] Keith Johnson, "Why American Oil Hasn't Been a Total Game-Changer," *Foreign Policy,* 14 November 2018, accessed 15 December 2018, https://foreignpolicy.com/2018/11/14/why-american-oil-hasnt-been-a-total-game-changer/.

[221] ERI RAS, *Global and Russian Energy Outlook 2016*, 172.

[222] Ibid., 173.

[223] Ibid., 154.

[224] IHS Markit, *Rivalry*, 6.

[225] Equinor, *Energy Perspectives 2018*, 43.

[226] U.S. Congress, *Oil Diplomacy*, 8.

[227] Johnson, "Why American Oil Hasn't Been a Total Game-Changer."

and the west provides incentives for energy importing countries to develop independence.[228]

Russia markets most of its oil and natural gas through the national oil company Gazprom, but is transitioning to an independent industry.[229] Russia was the second country to enter the global oil market as Caspian oil pushed out American kerosene.[230] Russia is the third largest contributor to the global oil market with 12 percent, but only consumes 4 percent of the world total.[231] Russia trails only the United States in the production and consumption of natural gas.[232] Russia frames this as the United States and Russia as the only two super producers.[233]

Another distinguishing factor for some countries is the structure of the energy industry within the country and the rise of international oil companies (IOC) and national oil companies (NOC). IOCs grew from free market economies to supply energy to consumers. They seek to consolidate the value chain from a diverse portfolio of energy sources and provide energy on a large scale. NOCs are more commonly associated with centralized economies and consolidate decision making power with the central

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[228] ERI RAS, *Global and Russian Energy Outlook 2016*, 5.

[229] U.S. Congress, *Oil Diplomacy*, 7-8.

[230] Yergin, *The Prize*, 42.

[231] EIA, "What Countries are the Top Producers and Consumers of Oil?"

[232] EIA, "Dry Natural Gas Production, 2017."

[233] ERI RAS, *Global and Russian Energy Outlook 2016*, 131.

government. NOCs usually represent countries that are energy exporters and allow the government to optimize the output for national objectives.

International organizations have evolved to influence the global energy market. Nations with mutually supporting interests have joined to create organizations that further their national interest. The most prominent organization to the global energy market is the Organization of Petroleum Exporting Countries (OPEC), comprised of some of the largest oil exporting countries. OPEC was established on 14 September 1960 by Saudi Arabia, Venezuela, Kuwait, Iraq and Iran to protect against price cuts by international oil companies.[234] The founding members accounted for 80 percent of global exports in 1960.[235] OPEC recently expanded to 25 countries in 2018 with the addition of the Congo.[236]

One way that OPEC influences the global energy market is through the application of the Oil Weapon. The Robert Strauss Center describes the oil weapon as manipulation of the oil price through embargoes, production cutbacks, and discounts.[237] Roy Licklider only lists the negative aspects of embargoes and production cutbacks as

[234] Yergin, *The Prize*, 504-505.

[235] Ibid., 505.

[236] OPEC, *2018 World Oil Outlook 2040*, 1.

[237] Robert Strauss Center, "The Oil Weapon," accessed October 14, 2018, https://www.strausscenter.org/energy-and-security/.

components of the Oil Weapon.[238] Yergin describes the Oil Weapon as being wielded in the form of an embargo through production cutbacks and export restrictions.[239]

OPEC applied the most successful oil embargo in 1973 in the wake of the United States supporting Israel during the Fourth Arab Israeli War.[240] Arab oil producers embargoed shipments to the United States and the Netherlands and cut production by five percent per month to prevent other nations transiting oil to them. The cut in production led to the price of oil increasing fourfold.[241] The price increase caused the government to emplace austerity measures that led to long lines at gas stations, although some impacts were later seen as self-inflicted.[242] In regards to production, one of OPEC's main purposes is to coordinate production levels for the benefit of their members. However, they struggle to enforce production quotas due to the incentive to cheat created by higher prices.[243] According to Equinor, OPEC must balance the price of oil so that it is low enough to discourage shale investors and high enough to produce adequate revenue for

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[238] Roy Licklider, "The Power of Oil: The Arab Oil Weapon and the Netherlands, the United Kingdom, Canada, Japan and the United States," *International Studies Quarterly* 32, no. 2 (June 1988): 206, accessed 23 March 2019, https://www.jstor.org/stable/2600627?seq=1#metadata_info_tab_contents.

[239] Yergin, *The Prize*, 570.

[240] Robert Strauss Center, "The Oil Weapon."

[241] Licklider, "The Power of Oil," 206.

[242] Yergin, *The Prize*, 598-600.

[243] Robert Strauss Center, "The National Security Implications of New Oil and Gas Technologies."

their members.[244] Saudi Arabia and OPEC keeps a floor of 50 dollars per barrel.[245] Recently, OPEC and Russia made an agreement in 2016 to cut production in response to increased shale production in the United States.[246] When this production cut failed, OPEC increased production to drop prices in an attempt to disrupt shale producers that relied on extraction methods with higher costs. The shale industry was forced to consolidate and restructure but remained resilient. The oil industry has been brought back to equilibrium as OPEC concedes that shale oil will impact the market. OPEC predicts that shale oil will peak in the late 2020s and OPEC will be the more important source in the long term.[247]

Japan predicts that OPEC will provide 80 percent of new oil growth, and rise from 42 percent of global share to 47 percent.[248] OPECs exports will shift from OECD countries, where supply will likely be provided by the United States, to Asia.[249]

The International Energy Agency (IEA) was created in 1974 to counter OPEC's influence in the wake of the oil embargo in 1973. The main aim of IEA is coordination among oil importers to handle supply disruptions.[250] The IEA promotes energy security

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[244] Equinor, *Energy Perspectives 2018*, 32.

[245] Krauss, "Oil Boom Gives the U.S. a New Edge in Energy and Diplomacy."

[246] Equinor, *Energy Perspectives 2018*, 31.

[247] OPEC, *2018 World Oil Outlook 2040*, 2.

[248] IEEJ, *IEEJ Outlook 2018*, 4.

[249] Ibid., 5.

[250] Yergin, *The Quest*, 270.

among member countries through collective response of the oil supply. All member countries must hold 90 days of net oil imports in reserve to mitigate supply disruptions.[251] The stockpiles have been triggered three times: during the Gulf crisis (1990-1991), Hurricane Katrina and Rita (Summer 2005), and the Libyan Civil War (2011).[252]

The International Energy Forum (IEF) brings OPEC and the IEA together to have oil producers and consumers discuss common issues.[253] The IEF aims to foster mutual understanding of energy interests among members. The members comprise 90 percent of global supply and demand, and serves as a neutral facilitator of informal and open dialogue.[254]

Understanding the forces that influence the energy market is important but does not provide energy security in itself. David Deese and Joseph Nye described several pitfalls in designing an energy security policy in 1981. The first pitfall they mentioned was thinking of the United States in isolation.[255] It is difficult to insulate a country form the effects of the global market. Even if the United States could internally meet all of its energy demand, there could still be spikes in local prices caused by changes in external demand. John Hannah add that United States production does not insulate the country

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[251] IEA, *World Energy Outlook 2017*, 2.

[252] Yergin, *The Quest*, 273.

[253] Ibid., 274-275.

[254] Newell and Iler, *Global Energy Outlooks Comparison Methods*, 3.

[255] Deese and Nye, *Energy and Security*, 12.

from the global market, especially given their market-based approach and lack of government control.[256] The second major pitfall that Nye explores is equating imports with vulnerability.[257] The volume of imports is important, but not the only measure. Other factors, such as maintaining reserves and multiple origins for imports, impact the reliability of maintaining a steady source to meet demand.[258] The European Commission further supports this by claiming that diversification of sources of supply are necessary for the security of the European Union.[259] The third major pitfall is confusing the time scale and the disputes that arise from evaluating different time horizons.[260] Helpful time scales include defining the short term as less than two years, the mid-term as two to ten years, and the long term as longer than ten years. The short term is focused on coping with supply disruptions. The medium term on reducing dependence on Persian Gulf oil. The long term was focused on adjusting to higher priced alternatives.[261] The fourth pitfall is not considering the security of supply. The policies then only focused on keeping prices low to keep consumers happy. This ignored the use of rising prices to reduce demand. If prices remain low, there is not incentive for consumers to reduce their usage,

[256] Hannah, "Energy Security is the Real Way to Put America First."

[257] Deese and Nye, *Energy and Security*, 12.

[258] Ibid., 12-13.

[259] Directorate-General for Energy (DGE), European Commission, *Energy 2020: A Strategy for Competitive, Sustainable and Secure Energy* (Luxembourg: Publications Office of the European Union, 10 November 2010), Chapter 5.

[260] Deese and Nye, *Energy and Security*, 13.

[261] Ibid., 14.

which only exacerbates the problem. The fifth pitfall is thinking that energy security is a quick fix with a single solution. Nye believed energy security would be an issue for at least a decade.[262]

Daniel Yergin outlined his eight principles of energy security most clearly during his Congressional testimony in 2002 and they build on the framework outlined by Deese and Nye. Yergin's first principle is that there is one global energy market and security resides in the stability of the overall market.[263] This principle emphasizes long term relationships to provide stability and predictability for investors. The second principle is ensuring a diverse energy supply. This principle is especially important if the country does not produce all required energy domestically. The energy market should diversify its fuel sources and points of origin to maintain flexibility. Diverse fuel sources ensure that the market can respond the advancing technology for a new fuel source, while diversity of origin prevents oversized influence from another party. The third principle is that emergency stocks are the frontline defense against supply disruption. The Strategic Petroleum Reserve fills the role for the United States and all members of the IEA are required to maintain stocks equivalent to a 90-day import supply.[264] Yergin cautions that emergency stocks should not be devalued by turning them into market management schemes. It is enticing for the emergency stocks to temper the volatility of the market by buying during times of surplus and low prices and selling during a tight market as prices

[262] Deese and Nye, *Energy and Security*, 15.

[263] U.S. Congress, *Oil Diplomacy*, 5-6.

[264] Ibid., 5.

rise. The drawback to this method is that the market misses the signal to decrease consumption and causes the emergency stocks to be prematurely exhausted. The fourth principle is that the oil market is flexible. The flexibility of the market is a great asset and intervention and controls can be counter-productive. The fifth principle is that the United States should pursue cooperative energy relations with other importing nations, multilaterally or bilaterally.[265] An example of this principle is the IEA. The sixth principle outlined by Yergin is that the government can allay panic through quality information and making rapid adjustments.[266] The EIA provides the necessary information for national policy makers to make rapid and accurate decisions. The seventh principle is that most oil exporting countries recognize the mutuality of interest to establish "security of demand." This principle means that energy exporters need to secure sources of demand to sell their products just as much as consumers need to secure sources of demand. The eighth energy security principle is that a healthy, technologically driven, domestic energy industry is part of energy security. A robust and competitive energy industry seeks to develop new technologies and improve efficiency for the benefit of the industry and consumers. Yergin outlined these principles 15 years ago but they remain important today, despite a changing landscape in the energy market.

Even more recently the World Economic Council (WEC) places energy security in context using the Energy Trilemma in 2013. The Trilemma includes energy security, energy equity, and environmental stability, and seeks to deliver a balanced, predictable,

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[265] U.S. Congress, *Oil Diplomacy*, 5.

[266] Ibid., 6.

and stable energy framework. WEC includes several criteria for each factor. The first aspect of energy security is the effective management of the primary energy supply from domestic and external sources. This means managing resources so that energy sources are not depleted before other sources can replace its demands. The second consideration for energy security is the reliability of energy infrastructure. The infrastructure is important to transport fuel and convert raw fuel to a usable product. This means the oil derricks, pipelines, refineries, natural gas liquefaction and regassification plants must be maintained and protected to ensure that sufficient fuel meets the demand of consumers. The third consideration is the ability for energy companies to meet current and future demand. Part of this means developing sufficient primary resources to meet demand, but is balanced with increasing technological innovation to reduce demand. The final aspect that WEC uses for energy security is that exporters must maintain revenues from external markets.[267] If energy exporters lose their markets for selling fuel it will update the balance of power in an already unstable country. WEC measures energy security in two ways. First, through the share of imports in the primary energy supply. Lower values are better and mean that a country is more energy secure. The second measurement uses the Simpson Index to evaluate the diversity of primary energy supply.

The WEC defines energy equity as the accessibility and affordability of the energy supply across the population.[268] The WEC measures energy equity through final

[267] WEC, *World Energy Scenarios*, 220.

[268] Ibid., 221.

energy and electricity per capita and examining the population without access to electricity.

Environmental sustainability comprises the third component of the WEC's framework and they define it as the efficiency gain and development of energy supply from renewable and other low-carbon sources.[269] The sustainability is concerned with CO2 emissions and the depletion of hydrocarbon resources. WEC measures energy sustainability through CO2 intensity of primary energy, total CO2 emissions and the reserves of resources.[270]

Energy security is a complex issue that concerns many political decision makers. Most of the literature agrees that energy security comes from the energy market and any solutions to increase security must be placed in that context. The market is flexible but benefits greatly from a predictable and stable environment. Even countries who have a surplus of energy stocks are concerned about energy security. It is possible for energy producers and consumers to work together for their mutual benefit through existing organizations and creating bilateral agreements. Increasing energy security can impact national power.

National Power

World leaders and statesmen have long been concerned with power. National power is the ability of one nation to make or resist change or the ability to get what it

[269] WEC, *World Energy Scenarios*, 220.

[270] Ibid., 222.

wants.[271] The study of power traces its roots through realism back to Thucydides and Machiavelli.[272] Many analysts are tempted to discard the notion of power because it is vague and imprecise, making it easier to experience than to define or measure.[273] Despite these challenges, the concept of power has been difficult to replace.[274] Joseph Nye, a former dean of the John F. Kennedy School of government and leading expert on national power, writes that political leaders often associate resources with power. These resources include population, territory, natural resources, economic size, military forces and political stability.[275] It is tempting to simply equate resources as a measure of power because they are easy to quantify. Resources do an adequate job of explaining potential, but states must also be able to convert the resource to power.[276] Power conversion is a basic problem of using resources to determine power since not all countries have the same ability to convert power.[277]

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[271] Nye, *The Future of Power*, 5.

[272] Nye, *The Future of Power*, 18-19.

[273] Joseph S. Nye Jr., "The Changing Nature of World Power," *Political Science Quarterly* 105, no. 2 (Summer 1990): 177, accessed 29 April 2019, https://www.jstor.org/stable/2151022.

[274] Nye, *The Future of Power*, 3.

[275] Nye, "The Changing Nature of World Power," 178.

[276] Nye, *The Future of Power*, 8.

[277] Nye, "The Changing Nature of World Power," 178.

Power conversion is the process of turning resources into behavioral outcomes through national processes.[278] The efficiency of the conversion process determines how effective an actor is at employing power. Defining power in terms of resources that could produce outcomes faces the paradox that actors with the most resources do not always achieve their goals.[279] Japan was able to secure power with few resources, while many countries have resources but cannot translate them to power.[280] An example of not being able to translate power beyond resources is the oil curse that prevents states from developing other areas of their economy. The lack of a broad-based economy limits the power the state can employ.[281] Measuring power through resources is further complicated by resources providing power in one instance but not another.[282] The alternative to measuring resources is to evaluate behavioral outcomes after power conversion. The behavioral definition is useful to analysts who can spend considerable time understanding all relevant factors. However, it is not likely practical for leaders and politicians who lack the time to devote to such inquiry.[283]

Nye also discusses the balance of power concept as a starting point for realist discussions of international politics. The theory states that the natural order prevents any

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[278] Gregory F. Treverton and Seth G. Jones, *Measuring National Power* (Santa Monica, CA: RAND Corporation, 2005), ix.

[279] Nye, *The Future of Power*, 8.

[280] Ibid., 62.

[281] Ibid.

[282] Ibid., 3-4.

[283] Nye, "The Changing Nature of World Power," 178.

one state from developing a preponderance of power and is built on two assumptions. First, states exist in an anarchic system with no higher government. Secondly, political leaders will act first to reduce risk to independence of their states. Balance of power is used to predict how a state will behave in a given situation, not to describe the current state. This theory helps to explain why a large state cannot grow forever as smaller states seek alliances to counter threats to their independence.[284]

Nye describes the application of power as hard, soft or smart. Hard and soft power utilize the same resources to form a continuum of behaviors. On one end, hard power implements threats and coercion to command, while soft power applies persuasion to attract and co-opt. The middle ground applies payments, sanctions and framing. Hard power is coercive in nature and most commonly associated with force and money, or the military and economic instruments of national power. Hard power flows from the realist tradition that assumes there is no authority above the nation state. Soft power is the ability to affect others through framing the agenda, persuading and eliciting positive attraction to obtain preferred outcomes.[285] Soft power is an academic concept more popular in China, Indonesia, and Europe that is more influential in nature.[286] Soft power rests on three basic resources: culture, political values, and foreign policies.[287] The perception of the target is important, as not all soft power looks soft to outside critics.

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[284] Nye, "The Changing Nature of World Power," 183-185.

[285] Nye, *The Future of Power*, 19-21.

[286] Ibid., 81.

[287] Ibid., 84.

Another way to look at the difference between the two is that hard power is a push while soft power is a pull.[288] Nye developed the theory of smart power to combine hard and soft power using liberal realism to counter the notion that soft power alone is enough for foreign policy. Smart power is the ability to combine hard and soft power resources into effective strategies and goes to the heart of the power conversion problem.[289] Hard and soft power form the continuum and smart power is the decision of where to be on the spectrum at a given time.

Joint military doctrine, especially Joint Publication 1 (JP 1) that blends policy with doctrine, builds on international relations theory to provide fundamental principles that guide the employment of military forces is support of the national security strategy.[290] JP 1 specifies that the operational level of war links strategy to tactics by integrating ends, ways, and means.[291] The National War College published a National Security Strategy Primer in 2017 that clarifies several of the concepts associated with joint military doctrine. The primer explains that ends entail the political aim and specific objectives and the ways are how to proceed toward achieving the aim.[292] The means are

[288] Ibid., 20-21.

[289] Nye, *The Future of Power*, 22-24.

[290] Joint Chiefs of Staff (JCS), Joint Publication (JP) 1, *Doctrine of the Army Forces of the United States* (Washington, DC: Government Printing Office, 12 July 2017), I-1.

[291] Ibid., I-8.

[292] The National War College (NWC), *A National Security Strategy Primer* (Washington, DC: National Defense University, 2017), 7.

the tools, resources, and capabilities to achieve the end and is most closely related to national power.[293]

The primer later describes the three components to the means of the national security strategy as the elements of power, institutions and actors, and the instruments of national power.[294] The elements of power are the tangible and intangible factors that enable the achievement of political aims and closely mirror the resource list discussed by Nye.[295] There are a range of institutions and actors that produce outcomes, including government agencies, quasi-governmental organizations, and non-governmental organization. Lastly, the instruments of national power are delineated using the DIME model. The four instruments are Diplomatic, Information, Military and Economic, each of which can comprise a set of fundamental capabilities.[296]

The diplomatic instrument of national power relates to engaging other states and foreign groups to advance the values, interests, and objectives of the United States.[297] It is the principle means of organizing coalitions and alliances, and the Department of State is the lead agency.[298] The diplomatic instrument can also be expressed as the outward expression of foreign policy that coordinates the other instruments through

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[293] Ibid.

[294] NWC, *A National Security Strategy Primer*, 12.

[295] Ibid.

[296] Ibid., 13.

[297] JCS, JP 1, I-12.

[298] Ibid.

engagement.[299] The capabilities of the diplomatic instrument can be decomposed into representation, negotiation, and implementation. Representation builds relationships and engages foreign counterparts to describe, defend, or advocate a position. Negotiation is the give and take necessary to reach an agreement that resolves a problem. Implementations involves the follow up activities to manage the resulting environment.[300] These elements combine together through the diplomatic instrument of power that pushes the nation's agenda on the international stage.

The information instrument of national power coordinates communication, public affairs and information operations for the country.[301] There is no single entity that coordinates this instrument at the national level. The informational instrument of national power revolves around perception and distribution and control of knowledge. The perception refers to accurately understanding the world as it is. Distribution is informing an audience of choice through a persuasive transmission of knowledge. Control of knowledge is accomplished through manipulation and restriction of information to produce a desired effect.[302]

The military instrument of national power led by the Department of Defense and is coercive in nature to apply force.[303] The capabilities of the military instrument are an

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[299] NWC, *A National Security Strategy Primer*, 14.

[300] NWC, *A National Security Strategy Primer*, 14.

[301] JCS, JP 1, I-12.

[302] NWC, *A National Security Strategy Primer*, 15-16.

[303] JCS, JP 1, I-13.

actor applying, threatening to apply, or enabling other parties to apply force in furtherance of its political aims. The use of force is defined as the application of violence to coerce or subdue and enemy. The threat of force modifies behavior of shapes future actions coercively and enabling other forces improves the capacity or capability of international partners.[304]

The Department of Treasury leads the economic instrument of power by promoting a strong economy with free access to markets and resources.[305] The economic instrument of power serves as the foundation to empower the other instruments by furthering or constraining the targets prosperity or influencing key groups and decision makers.[306] The capabilities of the economic instrument of power can be categorized as assistance, trade and finance. Assistance refers to giving money, goods, materiel, or services to another actor to improve capability or capacity, develop goodwill or induce short term actions. Trade is the positive or negative exchange of goods and services that have the potential to increase wealth of trading partners. Positive inducements include trade agreements and tariff reductions that result in a desirable foreign policy, while sanctions and tariffs act as negative limits on trade.[307] Financing another actor provides access to capital markets to invest and increase productive capacity through lending,

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[304] NWC, *A National Security Strategy Primer*, 16-17.

[305] JCS, JP 1, I-13-I_14.

[306] NWC, *A National Security Strategy Primer*, 17.

[307] Ibid., 18.

investment and capital flows. Of note, the more a country relies on the free market, the less control the government has.[308]

Nye elaborates on several important considerations for economic power. He makes the case that economic power is now more important than military power, but political observers still debate which is more fundamental. It used to be cheaper to seize enemy territory than create the complex system required for trading goods effectively. With the rise of exchange markets, economic power holds the key to success in world politics.[309] Economic power can produce hard or soft power as a successful economy produces resources for hard power and the pull of attraction develops soft power. A key point is that economic growth produces a bigger pie but relative power between actors determines who gets the biggest piece of that pie.[310]

The elements of national power, or resources, are the raw material for a nation to create institutions that allow for the transfer of power through the instruments. It is the activity, not the actor, that produces an effect and institutions develop to protect and conserve the instruments of national power.[311] These four instruments of national power provide a framework to instruct military officers at the strategic level, but differ slightly from more traditional international relations teaching.

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[308] Ibid.

[309] Nye, *The Future of Power*, 51.

[310] Ibid., 53.

[311] NWC, *A National Security Strategy Primer*, 18.

This literature review summarized some of the extant literature on energy security and national power. The discussion focused on energy security based on access to energy at a reasonable price through the energy market. The topic of national power focused on how to measure national power. The DIME model provides a framework to understand how instruments of national power interact to convert resources to outcomes. This thesis will build on these two areas to draw inferences regarding the connection between energy security resulting from increased oil and natural gas production and a state's diplomatic and economic power. To this researcher's knowledge, such a study is not available in the extant literature. Therefore, this thesis will contribute to filling a gap in the scholarship.

CHAPTER 3

RESEARCH METHODOLOGY

Introduction

Chapter 3 covers the methodology for collecting and analyzing data to determine if an increase in oil and natural gas production leads to an increase in diplomatic and economic power. This chapter covers an overview of the case method, the selection of cases and the data required to conduct the analysis. This information provides the basis for the analysis in Chapter 4 that will answer the primary research question, how does increasing oil and natural gas production impact energy security and national power for the United States?

Case Methodology

This thesis applies the instrumental case study method to extract themes from specific cases and apply them to a current situation. This methodology is popular with social science research, especially when there are few cases from which to draw comparison. This method requires deep analysis of multiple sources to interpret how the facts come together to form themes within and between the underlying cases. The use of multiple cases strengthens the conclusions as themes can be drawn from across different cases. The case study methodology provides the ability draw inferences across multiple cases to develop a broad conclusion. John Creswell describes several defining features and procedures for conducting an instrumental case study.[312]

[312] John W. Creswell, *Qualitative Inquiry & Research Design: Choosing Among Five Approaches* (Los Angeles: Sage, 2013), 98-101.

Creswell outlines five procedures that provide structure to the instrumental case study method. The first procedure is to determine if any cases can be found and bound. The boundaries are essential to provide the framework that defines the case for analysis. The second procedure is to select relevant cases that show different perspectives of the issue. While all cases provide additional data to consider, it is important to highlight cases that reveal different factors or conditions that can impact the results. The third procedure is to collect data from numerous sources in support of establishing an in-depth understanding of each case. Common sources include observations, interviews, documents and audio-visual materials. The fourth procedure is to analyze the data to thoroughly inform the context of the case. Thorough understanding helps to mitigate the risk of using a small number of cases. The analysis leads to themes within each case and themes that connect cases. The fifth procedure is to report on the meaning of the cases. This report represents the conclusions drawn from the analysis. This structured procedural approach enables a coherent method to systematically analyze and answer the research question.[313]

Creswell further describes seven defining features that separate case study from other methodologies. The first is the definition of cases so they can be bounded for examination. Bounding the cases allows for efficient analysis. The second feature is a description of the intent of the case study, and is divided into intrinsic cases, that are unique or unusual cases, and instrumental cases, which seek understanding of specific issues. The third feature is to demonstrate in-depth understanding to identify themes. A

[313] Creswell, *Qualitative Inquiry & Research Design*, 100-101.

cursory examination of the cases will not provide the rich understanding necessary to determine the unifying themes in each case and between cases. Synthesizing multiple sources to confirm data creates in-depth understanding and draw conclusions. The fourth feature is selecting how to analyze the data. The fifth feature is a detailed description of the cases to explain how they are bounded and explain the themes found within them. The case descriptions identify the specific situations in which the case applies as well as the issues and themes. The sixth feature is the presentation of analysis to articulate the themes and issues from the case. Cases are analyzed for similarities among all cases to present as a theoretical model to be applied to other cases. In this thesis, two cases will be considered to limit the scope while ensuring consideration of multiple views. The last feature is a summary of the general lessons from the cases.[314] These features explain how the instrumental case study methodology differs from other methods and how to apply the procedures to ensure a constructive outcome. These features and procedures will provide structure to the analysis of how an increase in oil and natural gas production impacts economic and diplomatic power.

Case Definition

Following Creswell's method, the first procedure identifies potential cases and the boundaries required to evaluate them. The cases are determined by the energy market and the growth of oil and natural gas production. Identification of the potential cases considered production rates since the discovery of oil in 1859. The initial screening criterion for potential cases was nations that consistently increased oil and natural gas

[314] Creswell, *Qualitative Inquiry & Research Design*, 98-99.

production over any 20-year period. While this criterion restricts the number of cases, it supports the evaluation of the long-term impacts of increased production. A shorter time period makes it difficult to separate the impact of oil and natural gas production from other factors that may influence national power. This definition also allows for a clear delineation of the beginning and end of each case to satisfy Creswell's feature of bounding the case. There are 66 instances of oil and 66 instances of natural gas production increasing consistently for any 20-year period. However, these populations only overlap in 40 instances in which countries increased oil and natural gas production over 20 years since 1900.[315] These cases are then evaluated in terms of their share of the oil and natural gas market, as growth in market share may play an important role in a state's economic power. The increase in market share allows for different considerations than just an increase in overall production. Four cases in which the market share of oil or natural gas decreased despite an increase in output, were eliminated from consideration. An additional 27 cases display less than a 2 percent share of the global market for oil or natural gas at the end of their growth. These cases were eliminated because countries with such a small share cannot impact the energy market in the same way as a country that commands a larger share. These screening criteria aim to leave only the cases that best approximate the issues facing the current situation for the United States. The cases to be selected for study will come from the remaining nine cases, in order to provide the necessary perspectives to draw reasonable conclusions.

[315] Hannah Ritchie and Max Roser, "Fossil Fuels," Our World in Data, accessed 22 April 2019, https://ourworldindata.org/fossil-fuels.

Case Selection

The second procedure according to Creswell's method is to select the most relevant cases for analysis using evaluation criteria. The remaining nine cases are evaluated to determine homogeneity to the current situation of the United States in terms of governmental and economic structure, economic size, and diplomatic reach. The purpose of this study is to apply broad generalizations to the United States, so the relevant cases should most closely approximate the current situation in the United States.

The remaining cases include Canada from 1946 to 1973 and 1981 to 2007, China from 1955 to 2014, Iran from 1986 to 2011, Norway from 1974 to 2004, Qatar from 1985 to 2014, Russia from 1922 to 1944 and 1946 to 1989, and Saudi Arabia from 1984 to 2014. The cases were evaluated by their type of government and economy. The political and economic structure is an important factor as it greatly influences how resources are converted to behaviors. It also has a significant role in how power transfers between instruments of national power. The four governmental types represented in these cases are constitutional monarchy (Canada, Norway), socialist state (Russia, China), theocracy (Iran), and absolute monarchy (Qatar, Saudi Arabia). The three economic types are market-based (Canada, Norway), centralized (China, Russia) and oil based (Iran, Qatar, Saudi Arabia).[316]

The case that best approximates the simultaneous growth of oil and natural gas production from a moderate start point to global leader is Russia from 1945 to 1989. This case is instrumental to understand the effect on the energy market but may not be suitable

[316] Central Intelligence Agency (CIA), "The World Factbook," accessed 15 March 2019, https://www.cia.gov/library/publications/the-world-factbook/.

to explain conversion techniques as the government and economic types are different from those of the United States. The second case should consider a closer economic and government relationship. Of the three cases that demonstrate similar governmental and economic structure, Canada from 1981 to 2007 has the largest share of the energy market and will serve as the second instrumental case study. Case selection is important as it influences the outcome of the recommendations.

Data Collection

Using these two cases, data is collected to enable analysis in support of Creswell's third procedure to answer the research questions. Data is gathered to draw conclusions on the resources oil and natural gas production and its impact on the behaviors of economic power and diplomatic power. The data is analyzed to support or not support the hypothesis that an increase in oil and natural gas production leads to an increase in economic and diplomatic power.

Quantitative data on oil and natural gas production comes from published records. Most sources report oil in terms of barrels per day or per year and natural gas production by volume. The oil and natural gas production data used to screen the cases carry over to understand the energy side of the analysis. These are adjusted to the common unit of terawatt-hours to allow effective comparison between energy sources.

The data for economic and diplomatic power is qualitative and follows the capabilities listed in the National Security Strategy Primer. Economic power data corresponds to the three capabilities of economic power: assistance, trade, and finance.[317]

[317] NWC, *A National Security Strategy Primer*, 17-18.

First, assistance will be measured using foreign aid data. Second, information regarding trade balance will includes imports, exports and trade balance. The third capability, finance, will be measured through the evaluation of economic sanctions to observe the impact of coercive techniques. These data points are taken holistically to determine the change in economic power over time and change in energy production.

Similar methods will be applied to the three capabilities of the diplomatic instrument of power: representation, negotiation, and implementation.[318] First, representation is measured based on the number of diplomatic relationships for each country. The second capability of negotiation is measured through the number and strength of treaties. Implementation, the last capability, is measured through the number or strength of membership in multilateral organizations. Guiding a multilateral organization carries more weight than simply being a member. These data points will be taken to evaluate the change in diplomatic power.

The data collected is taken in context of external events, including change in leadership and emerging conflicts, in an attempt to isolate the connection to oil and natural gas. Instances that tie directly to oil and natural gas will be examined more closely and given more weight than other circumstances. The energy market is only a small part of a much larger system and cannot be completely isolated for analysis. Considering context and potential confounding variables allows for effective analysis in the absence of statistical control measures.

[318] NWC, *A National Security Strategy Primer*, 14.

The energy, economic and diplomatic data will then be combined to make a qualitative assessment in order to answer the primary research question. This will allow for general conclusions on the relationship between resources and national power to incrementally add to the body of knowledge.

Isolating the connection to oil and natural gas is the key consideration in this research. There is a risk of correlation not establishing causation. The researcher considers three factors to prevent simple correlation being interpreted as causation. First, the increase in oil and natural gas production must coincide with the increase in economic and diplomatic power. Secondly, the increase in energy production must come before the increase in national power. Lastly, and most difficult to assess, no other causes reasonably explain the increase in economic and diplomatic power as well as the increase in energy production. The focus of the research will be to answer the research questions while remaining faithful to these considerations.

Conclusion

The methodology uses case studies to collect data in preparation for analysis. Cases are selected based on their applicability to inform the current situation for the United States and similar data is collected for all the cases. The data is analyzed to determine the changes in national power compared to the changes in energy output. This covers Creswell's first three procedures. Later chapters cover the fourth procedure of analysis (Chapter 4) and recommendations on the connecting themes (Chapter 5).

CHAPTER 4

ANALYSIS

Overview

The purpose of the analysis is to apply the methodology from chapter 3 to understand the relationship between energy security and national power using two cases. The methodology creates a frame for understanding how energy security affects economic and diplomatic influence on the geopolitical stage. The two cases are the Soviet Union from 1956 to 1989 and Canada from 1981 to 2007. The general format of the analysis will be a brief overview of each case to understand the general situation as energy productions increased, followed by a deeper dive into the energy policy at the time. This will then flow into a qualitative assessment of the economic and diplomatic instruments of power. This deep understanding of each case will provide the foundation to synthesize data across the cases as part of the conclusions in the following chapter.

Soviet Union (1956 – 1989)

The case of the Soviet Union from 1956 to 1989 provides an important view to understand the relationship of energy security to national power. The case starts in 1956, shortly after the death of Josef Stalin and rise of Nikita Khrushchev as the leader of the communist party. The end of the case is two years before the fall of the Soviet Union, another significant period of transition. The Cold War was a significant factor during this period that drove many decisions at the national level. Acknowledging the competition between the two superpowers ensures that data collected is placed in the context of the time period.

Despite the Soviet Union's size and complexity, there are still some challenges regarding collection of accurate information. First, the limitation of using only English-language sources reduces the amount of available data. Second, some data that would be useful has not yet been declassified by the Russian government (as the successor to the Soviet Union) or the United States. Lastly, the utility of some of the Soviet government data is not useful due to variances in their reporting methods.[319] Notwithstanding these challenges, there is enough information available to understand the relationship of energy to national power.

The Soviet Union drastically changed policies after Stalin's death as it looked to expand globally and is categorized into three time periods during the case. During the first phase, from the 1950s to the 1970s, the Soviet Union focused on extensive accumulation of capital through growth of output and per capita GDP.[320] This change in policy marks the beginning of increased oil and natural gas production for the case. The Sixth Five-Year plan of the Communist Party of the Soviet Union was abandoned in 1957 in favor of a Seven-Year Plan that focused on coal and oil production. National income increased 58 percent as industrial production grew by 84 percent. However, the agriculture sector grew at a disappointing pace.[321] The second phase from the 1970s to

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[319] Raymond E. Zickel, ed. *Soviet Union: A Country Study*, Federal Research Division, Library of Congress, 2nd ed. (Washington, DC: The Division, 1991), 452, accessed 30 March 2019, https://archive.org/details/sovietunioncount00zick/page/n7.

[320] Numa Mazat and Franklin Serrano, "An Analysis of the Soviet Economic Growth from the 1950s to the Collapse of the USSR" (Centro di Ricerche e Documentazione "Piero Sraffa", Rome, Italy, 2012), 15.

[321] Zickel, *Soviet Union*, 476.

the mid 1980s was marked by economic slowdown and intensive accumulation, with a focus on minimizing costs and maximizing efficiency.[322] The slowdown affected all economic sectors in the early 1970s as problems with agriculture increased. The latter half of the decade was even more disappointing with only two percent growth in Gross National Product (GNP). This lack of growth led to modest goals for the Eleventh Five Year Plan that covered 1981 to 1985. The Soviet Union did not even reach these modest goals.[323] The third phase was marked by a recession that started after the reforms Mikhail Gorbachev initiated in 1985 and lasted until 1991.[324] The Twelfth Five Year Plan (1986-1990) set out to improve the standard of living for the soviet people while accelerating scientific and technical progress. The plan also anticipated a growth in energy production of 3.6 percent, a rise over the actual 2.6 growth over the preceding five years.[325] Oil production in the Soviet Union rose from 975 terawatt-hours in 1956 to 7090 terawatt-hours in 1989. Simultaneously, natural gas production increased from 125 terawatt-hours to 8453 terawatt-hours. The combined production rose from 1100 terawatt-hours to 15,543 terawatt hours.[326] (Figure 1.) This background provides the foundation to evaluate

[322] Mazat and Serrano, "An Analysis of the Soviet Economic Growth from the 1950s to the Collapse of the USSR," 5.

[323] Zickel, *Soviet Union*, 478.

[324] Mazat and Serrano, "An Analysis of the Soviet Economic Growth from the 1950s to the Collapse of the USSR," 24.

[325] Zickel, *Soviet Union*, 478.

[326] Ritchie and Roser, "Fossil Fuels."

the effect of energy production on the economic and diplomatic instruments of national power.

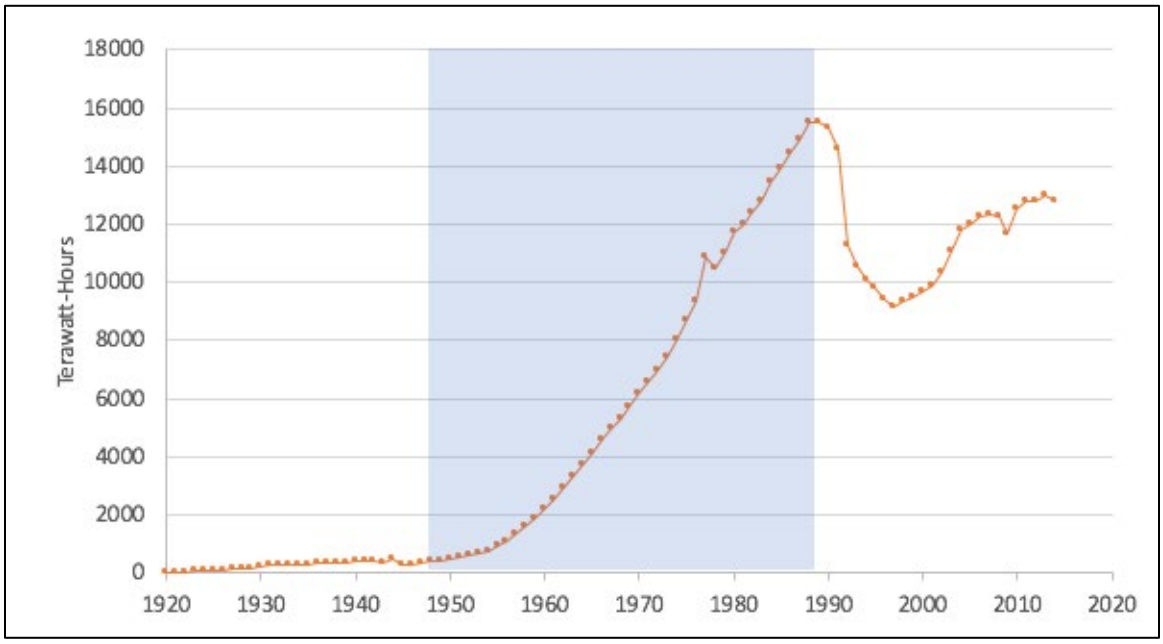

Figure 1. USSR Oil and Natural Gas Production

Source: Hannah Ritchie and Max Roser, "Fossil Fuels," Our World in Data, accessed 22 April 2019, https://ourworldindata.org/fossil-fuels.

The analysis of the case of the Soviet Union starts with the economic instrument of power, which has three components: assistance, trade and sanctions. Assistance, the first component of economic power, is measured through the number of countries and amount of foreign aid provided to Third World countries during the case period. The Soviet aid and trade program began in 1953 and peaked at $1 billion in 1960.[327] The

[327] Gerda Asmus, Andreas Fuchs, and Angelika Muller, "BRICS and Foreign Aid," (Aid Data: A Research Lab at William & Mary, August 2017), 10.

Soviet Union adopted a policy that favored underdeveloped countries and those other states that supported Moscow in world affairs.[328] This policy was in direct competition with the United States, who was forced to spend more for fewer security concessions.[329] The Soviet Union aimed to provide 40 percent of the aid a target country received in an attempt to persuade them to convert to communism.[330] The Soviet foreign aid program was reassessed in the 1980s as they focused more on the economic payback rather than the influence that it bought.[331]

Foreign aid from the Soviet Union was divided into two categories: support of communist countries and those that could be swayed to become communist. It is difficult to find specific data on Soviet development aid within the communist bloc as a complete account has yet to be released.[332] The best source of data was written in 1983 using data available before 1980.[333] (Figure 2.) The available data does not cover the entire case but the 25-year period provides an adequate sample from which to draw conclusions.

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[328] David K. Shipler, "Soviet Explains Aim of Its Foreign Aid," *New York Times*. 6 October 1976, accessed 30 March 2019, https://www.nytimes.com/1976/10/06/archives/soviet-explains-aim-of-its-foreign-aid-with-unusual-candor-moscow.html.

[329] Asmus, Fuchs, and Muller, "BRICS and Foreign Aid," 11.

[330] Gu Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," *Soviet Studies* 35, no. 1 (1983): 71, accessed 11 April 2019, http://www.jstor.org/stable/151493.

[331] Zickel, *Soviet Union*, 589.

[332] Asmus, Fuchs, and Muller, "BRICS and Foreign Aid," 13.e

[333] Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," 75-80.

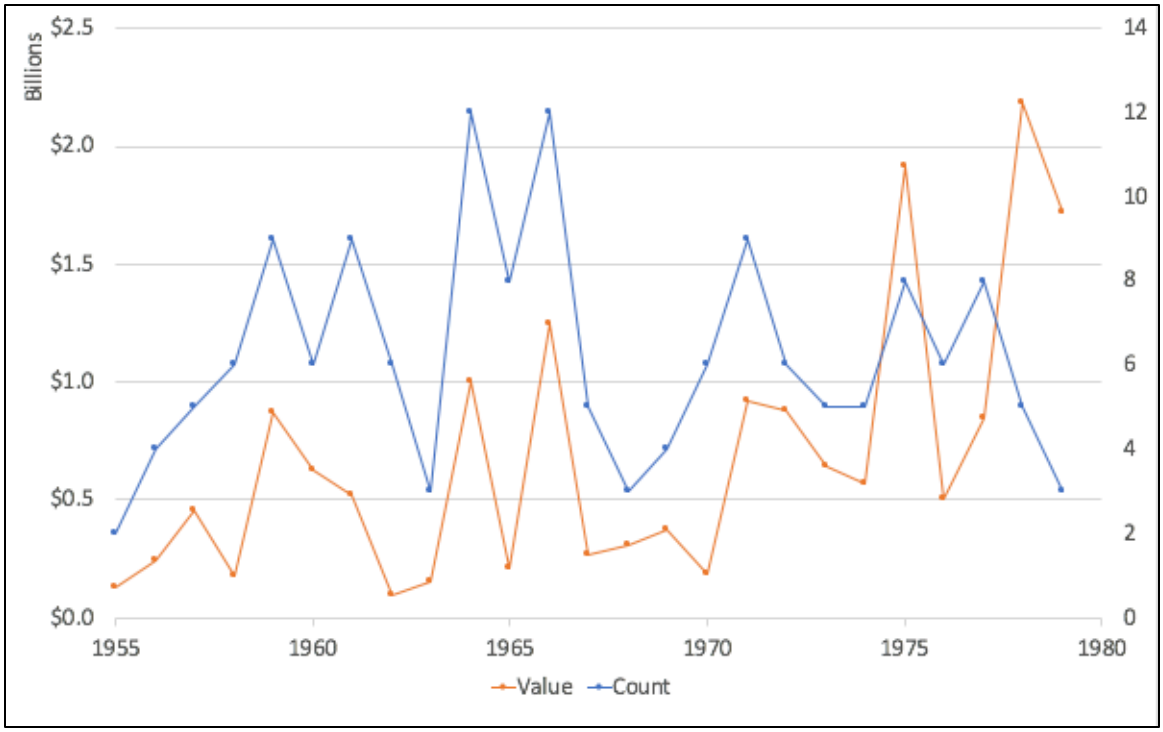

Figure 2. USSR Foreign Aid

Source: Gu Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," *Soviet Studies* 35, no. 1 (1983): 75-80, accessed 11 April 2019, http://www.jstor.org/stable/151493.

The Soviet Union started their foray into foreign aid with $128 million to India and Afghanistan in 1955. Both values increased in 1956, the first year of the case, to $238 million to four countries.[334] The number of countries increased for the remainder of the decade before oscillating between three and 12 countries through 1979. The high of 12 countries occurred in 1964 and 1966. In 1964, the Soviet Union distributed aid to four countries in south Asia, six in Africa and two in the Middle East. The numbers in 1966 were similar, except for adding a country in Latin America in exchange for one of the

[334] Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," 75-80.

African countries.[335] The general trend was to provide aid to countries located near the USSR before expanding outward. Aid initially went to South Asia before shifting to the Middle East. Aid to Africa increased greatly during decolonialization in the early 1960s. Aid to Latin America started in 1965 and increased in the 1970s. The value of foreign aid oscillated but showed a generally upward trend with a peak of $2.1 billion in 1978.[336] The Soviet entry in the Third World achieved its political objectives of removing the domination of Western influence, but the varying degrees of support after Khrushchev show that government priorities are important in evaluating aid.[337] Both the increase in foreign aid value and number of countries suggest a possible correlation between the increase in energy production and an increase in foreign aid. The effectiveness is demonstrated by the increasing reach as the flow of aid moved from Asia to Africa and finally Latin America.

Trade is the second component of economic power. The Soviet Union conducted trade in three broad categories. First, between established communist countries through the Council for Mutual Economic Assistance (Comecon) to create efficiencies of scale and production among members. Trade with the Eastern European members of Comecon accounted for 67 percent of the Soviet Union's trade. Their major exports were petroleum, natural gas, metals and wood, while their imports were grain and other

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[335] Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," 75-80.

[336] Ibid., 78.

[337] Robbin F. Laird and Erik P. Hoffman, eds., *Soviet Foreign Policy in a Changing World* (New York: Aldine de Gruyter, 1986), 733.

agricultural goods.[338] Goods were traded bilaterally so that imports matched exports without the need for hard currency.[339] The structure and growth of Comecon will be examined further as a component of diplomatic relations. Second, the Soviet Union traded with communist states in the Third World to expand influence. Trade with the Third World comprised 10 to 15 percent of total trade from 1965 to 1988.[340] Usually the trade involved exchanging machinery and arms for tropical foodstuffs.[341] Third, the Soviet Union traded with western industrialized countries to import technology and obtain hard currency. The amount varied based on political relationships but was usually around 22 percent of total trade.[342]

The available trade data suffers similar reliability issues as the foreign aid data, especially after 1975, with reports having a variance between 10 and 15 percent.[343] However, despite the unreliable information, it is still possible to form a qualitative assessment based on growth rather than a more detailed assessment of specific values. The relevant metrics to evaluate trade data for this case are the total imports, total exports and trade balance, defined as exports minus imports. The available data covers 1966,

[338] Zickel, *Soviet Union*, l.

[339] Ibid., 601.

[340] Ibid., 589.

[341] Ibid.

[342] Ibid., l.

[343] Lavigne, "The Soviet Union inside Comecon," 137.

1972 and 1975-1990, and the authors normalized the data to reduce the impact of different reporting methods.[344] (Figure 3.)

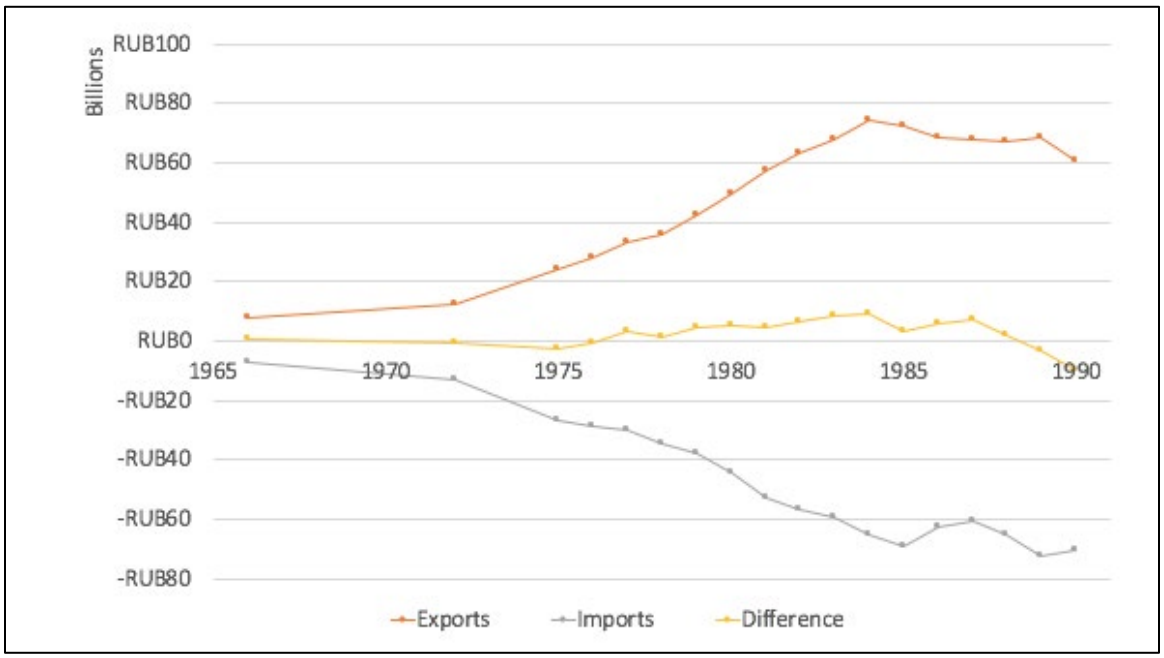

Figure 3. USSR Imports and Exports

Source: Masaaki Kuboniwa, Shinichiro Tabata, and Yasushi Nakamura, "Soviet Foreign Trade Earnings Revisited" (Russian Research Center, Institute of Economic Research, (Hitotsubashi University, Tokyo, Japan, October 2016), 22.

Imports measured 7.96 billion rubles in 1966 compared to 7.12 billion rubles in exports. This spread resulted in a net export of 840 million rubles. These metrics grew steadily to a peak in 1984 with 74.39 billion rubles of exports and imports of 65.37 billion rubles. This difference led to a peak trade balance of 9.01 billion rubles. Despite

[344] Masaaki Kuboniwa, Shinichiro Tabata, and Yasushi Nakamura, "Soviet Foreign Trade Earnings Revisited" (Russian Research Center, Institute of Economic Research, (Hitotsubashi University, Tokyo, Japan, October 2016), 22.

energy production continuing to increase through 1989, imports and exports began to decrease. Imports ranged from 72.66 billion rubles in 1985 to 68.74 billion rubles in 1989 before collapsing to 60.76 billion rubles in 1990. Imports rose to 69.43 billion rubles in 1985 then trended downward to 60.74 billion rubles in 1987. The imports rose again to 72.14 billion rubles in 1989. The trade balance also descended over the same time period from 1984 to 1990. 1988 was the last year of a positive trade balance and reached a low in 1990 with net exports of 9.97 billion rubles.[345] The general increase from 1966 to 1984 strongly supports the assertion of growing economic power with increasing influence on the global trade market and a growing trade balance. The correlation begins to falter in the last five years of the case, suggesting that other factors may affect trade, including the strength of the economy.

The third component of economic power is economic sanctions, measured by their number and effectiveness. The best available data for economic sanctions for this time period comes from the Peterson Institute for International Economics (PIIE). They categorize sanctions in terms of the sender, target, success score and cost to the target in terms of GDP. The success score is derived from multiplying a value for the result by the contribution sanctions had on the outcome. Both are given a score between 1 and 4 for a potential range of 1 to 16. Any success score above a 9 is considered successful.[346]

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[345] Kuboniwa, Tabata, and Nakamura, "Soviet Foreign Trade Earnings Revisited," 22.

[346] Gary Clyde Hufbauer, Jeffrey J. Schott, Kimberly Ann Elliott, and Barbara Oegg. "Summary of Economic Sanctions Episodes, 1914-2006," Peterson Institute of International Economics, May 2008, accessed 14 April 2019, https://piie.com/summary-economic-sanctions-episodes-1914-2006.

The Soviet Union imposed four sanctions during this time period, against Finland (1958-1959), China (1960-1970), Albania (1961-1965), and Romania (1962-1963). The most effective was imposed to force Finland to adopt pro-Soviet policies. The sanction impacted 1.1 percent of GDP and received a score of 16. (Figure 4.) The other scores ranged from 1 to 4 and impacted small portions of GDP. The Soviet Union also had five sanctions imposed on them during this time period, all from the United States. The first was imposed in 1948 to impair military potential and lasted until the fall of the Soviet Union. This scored a 4 on sanction success. The most effective sanction against the Soviet Union was imposed from 1975 until the fall of the Soviet Union. The sanction received a score of 8 and impacted .2 percent of GDP. This sanction was imposed to allow free emigration and had a .01 percent impact to the Soviet Union GDP. The other three sanctions all received a score of 2 and lasted a shorter time.[347]

[347] Hufbauer et al., "Summary of Economic Sanctions Episodes, 1914-2006."

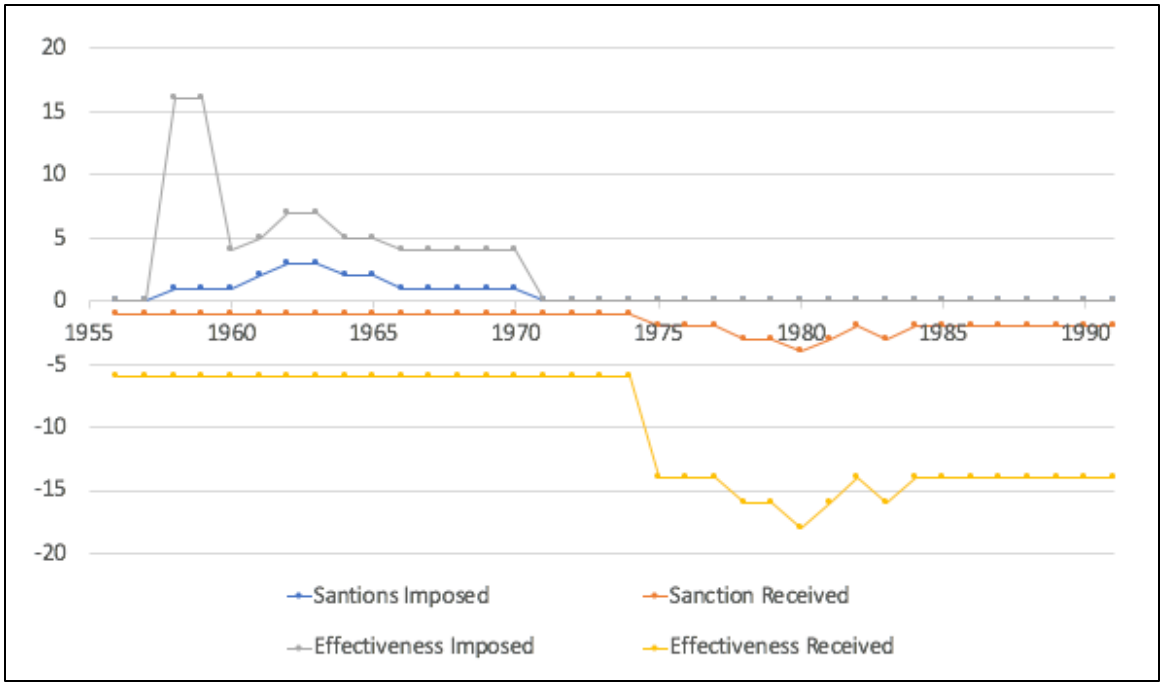

Figure 4. Sanctions Related to USSR

Source: Gary Clyde Hufbauer, Jeffrey J. Schott, Kimberly Ann Elliott, and Barbara Oegg. "Summary of Economic Sanctions Episodes, 1914-2006," Peterson Institute of International Economics, May 2008, accessed 14 April 2019, https://piie.com/summary-economic-sanctions-episodes-1914-2006.

These sanctions and effectiveness scores are summed to evaluate their change over time with respect to energy production. The Soviet Union imposed sanctions from 1956 to 1971. Effectiveness peaked with the sanctions on Finland from 1957 to 1958. The number of sanctions peaked in 1962 to 1963. Other than a sanction against the military, sanctions imposed on the Soviet Union began in 1975 and peaked in amount and effectiveness in 1980. This trend demonstrates a strong negative correlation between energy production and the application of sanctions that do not support the thesis.

Overall the data regarding the three measures of the economic instrument of power infer a mixed record or correlation with energy production by the USSR. Foreign

assistance seemed to increase with the increase in energy production. Trade increased until the Soviet economy began to falter. Sanctions showed a significant downward trend as energy increased. With regard to each component, the possible effects of other variables on the relationship must be borne in mind. The next section of this analysis examines how the diplomatic instrument of power was affected by the increase in energy production.

Diplomatic power is divided into the three components: representation, negotiation and implementation. Raymond Zickel explains that the Soviet Union pursued two forms of diplomacy. The first is the bourgeois diplomacy of state to state relations made popular by European states. The second is communist diplomacy that emphasized equality within the regime. This form of diplomacy later expanded to include peaceful coexistence with capitalist countries. The Soviet Union sought diplomatic recognition after 1922, soon after the overthrow of the Russian empire. This was especially focused on the United Kingdom and United States after their success in World War I.[348]

The first component of representation is measured through diplomatic reach and quantified by the number of countries with which the Soviet Union maintained diplomatic relations. Relations grew rapidly from the creation of the Soviet Union in the early 1920s as they established their foreign policy. While several sources discuss the aims of foreign policy, there are few that articulate the timeline for the establishment of diplomatic relations or embassies. The leaders of the Soviet Union focused on

[348] Zickel, *Soviet Union*, 410.

international relations from the moment they came to power.[349] The Soviet Union established 144 embassies and consulates by 1971.[350] This increased to about 120 embassies and scores of consulates by the late 1980s.[351] (Figure 5.)The Soviet Union placed a concerted effort into expanding diplomatic relations and communism through militant means to compete with the capitalist West from 1957 to 1962, that coincided with the increase in energy production.[352] Some of this growth paralleled the growing number of independent countries, but diplomatic reach is made more obvious by examining the regional trends. Most diplomatic relations prior to 1955 were maintained with countries located close to the Soviet Union, but the focus shifted to the Middle East, Africa, and Latin America.[353] This period coincided with decolonialization in Africa that could also explain the number of growing relations. Additionally, the pace of establishing diplomatic relations did not change much from before the case. The combination of these trends demonstrate that diplomatic relations increased in number and distance as energy production increased; however, other factors likely play a large role.

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[349] Jon Jacobson, *When the Soviet Union Entered World Politics* (Berkeley: University of California Press, 1994), 12.

[350] A. M. Prokhorov, ed., *Great Soviet Encyclopedia: A Translation of the Third Edition,* vol. 8 (New York: Macmillan, Inc., 1975), 276.

[351] Zickel, *Soviet Union*, 412.

[352] Adam B. Ulam, *Expansion and Coexistence: Soviet Foreign Policy 1917-1973*, 2nd ed. (New York: Praeger Publishers, 1974), 606.

[353] Ibid.

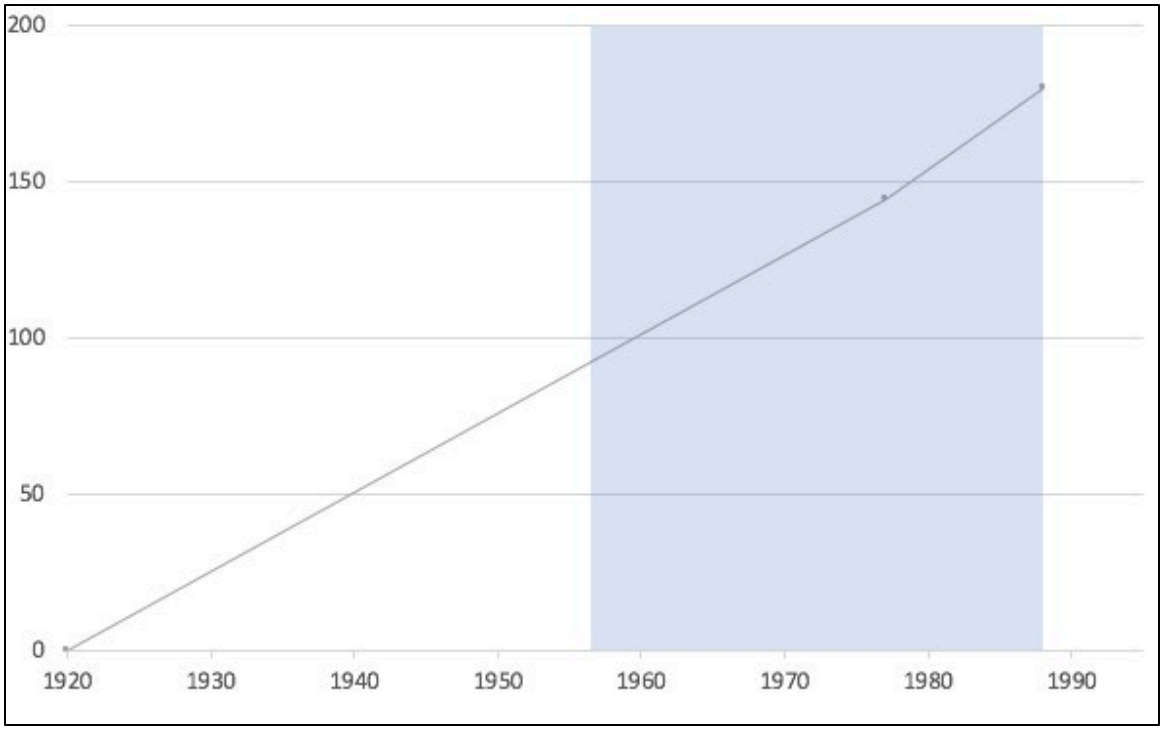

Figure 5. Soviet Diplomatic Relations

Source: A. M. Prokhorov, ed., *Great Soviet Encyclopedia: A Translation of the Third Edition,* vol. 8 (New York: Macmillan, Inc., 1975), 276; Raymond E. Zickel, ed., *Soviet Union: A Country Study,* Federal Research Division, Library of Congress, 2nd ed. (Washington, DC: The Division, 1991), accessed 30 March 2019, https://archive.org/details/sovietunioncount00zick/page/n7, 412.

The second component of diplomatic power is negotiation, measured by the number of active treaties involving the Soviet Union. The data surrounding treaties with the Soviet Union is sparse, making it difficult to draw a conclusive finding. The two sources available detailed high-level treaties and treaties of friendship and cooperation over a portion of the case.[354] The high-level treaties discuss several topics. The Soviet

[354] Zickel, *Soviet Union*, xxxiii-xliii; Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," 74.

Union signed the Brest-Litovsk Treaty with Germany in 1918 but it was cancelled in 1919. They only signed three treaties between 1921 and 1935. During the case, the Soviet Union signed four treaties with the United States regarding nuclear weapons, including the Limited Test Ban (1963), Nonproliferation of Nuclear Weapons Treaty (1968), Anti-Ballistic Missile Treaty (SALT I) (1972), Second SALT Agreement (1979), and the Intermediate-Range Nuclear Forces Treaty (1987).[355] Secondly, the Soviet Union signed a series 11 friendship and cooperation treaties between 1971 and 1981 with African and Middle Eastern countries.[356] (Figure 6.) This window is defined by a change in government policy in 1970 that advocated increases agreements and is based on a source published in 1983 that covered data to 1981. The limited data suggests a potential relationship between increased energy production and treaties, but it is not possible to develop a more definitive deduction without more detailed data from the entire case.

[355] Zickel, *Soviet Union*, xxxiii-xliii.

[356] Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," 74.

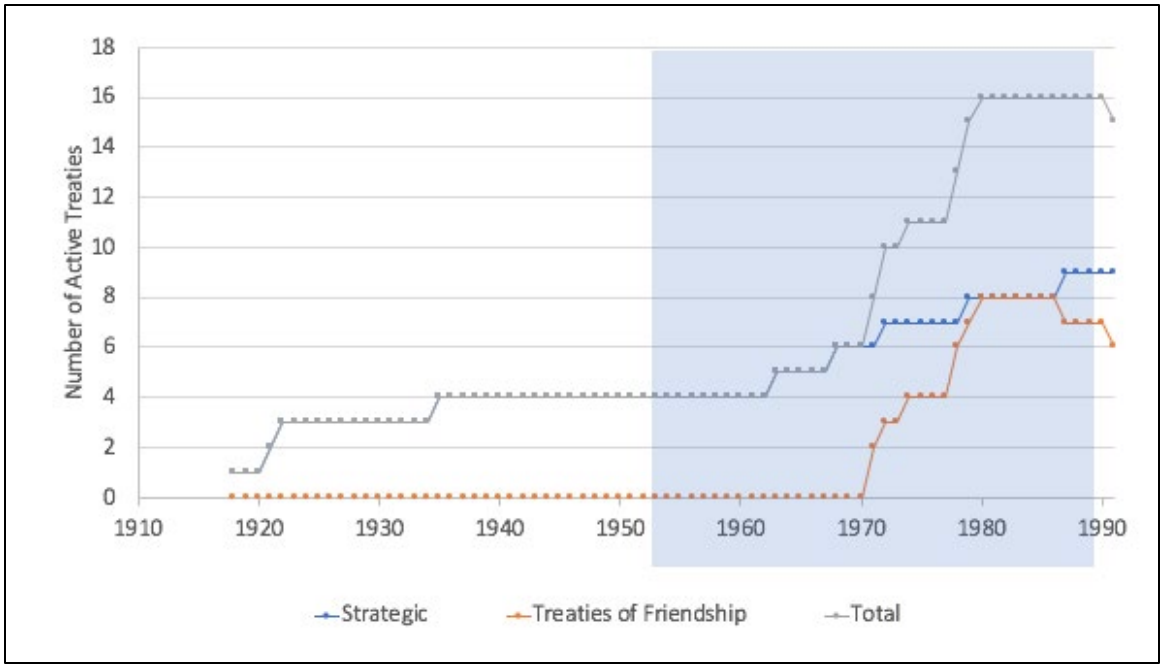

Figure 6. USSR Treaties

Source: Raymond E. Zickel, ed., *Soviet Union: A Country Study,* Federal Research Division, Library of Congress, 2nd ed. (Washington, DC: The Division, 1991), accessed 30 March 2019, https://archive.org/details/sovietunioncount00zick/page/n7, xxxiii-xliii; Gu Guan-Fu, "Soviet Aid to the Third World an Analysis of Its Strategy," *Soviet Studies* 35, no. 1 (1983): 74, accessed 11 April 2019, http://www.jstor.org/stable/151493.

The third component of the diplomatic instrument of power, implementation, is measured by participation in multilateral organizations. Instead of the number of organizations, it is more useful to examine the leadership roles of the Soviet Union in the two main organizations in which they participated, the Warsaw Pact and Comecon. This is measured by the number of countries participating in the organization and the control the Soviet Union had to influence the organizational policy.

First, the Soviet Union was instrumental to the creation of Comecon in 1949 to discourage Eastern European countries from joining the Marshall Plan and counteract

trade boycotts imposed by World War II. Comecon's main purpose was to coordinate economic and technical cooperation among its members. The seven founding members included Albania, Bulgaria, Czechoslovakia, Hungary, Poland, Romania, and the Soviet Union. East German joined a year later in 1950. Additionally, Yugoslavia was given preferred status in 1964 without becoming a full member.[357] The original members benefitted economically from economies of scale and integration of communist ideals. It created a beneficial relationship between the Soviets and Eastern European countries. Eastern Europe needed energy, especially in light of low energy efficiency that required 40 percent more fuel than their western counterparts. It provided the Soviet Union with a market for their energy production and bought them political and military support.[358] These were the eight members at the beginning of the case before adding Mongolia (1962), Cuba (1972), Vietnam (1978).[359] (Figure 7.) These countries were added more for diplomatic reasons than economic ones. The Soviet Union supported them joining the organization at the expense of some other members. The new countries did not have robust economies and imported higher quantity and quality of goods.[360] The ability for the Soviet Union to influence the activities demonstrated its ability to employ economic, political, and military power. This was further demonstrated as the Soviet Union could

[357] Zickel, *Soviet Union*, 601.

[358] Ibid., 870.

[359] Ibid., 601.

[360] Ibid., 870.

command above market prices from members for oil in 1985.[361] The ability for the Soviet Union to influence Comecon to their benefit and add additional members demonstrates a significant amount of diplomatic power through implementation.

The second important organization for the Soviet Union was the Warsaw Pact. that Moscow formed in 1955 in response to NATO's inclusion of West Germany. The organization ostensibly formed to allow collective decisions for its eight members, but the Soviet Union used the organization for political domination and military intervention.[362] The eight active members of Comecon in 1955 formed the original members. All members remained in the Warsaw Pact until the dissolution of the Soviet Union, except for Albania who left in 1968.[363] The Soviet Union was the dominant member of the Warsaw Pact and set its agenda. Their influence is significant, although it is not as clear an example of diplomatic power as Comecon.

[361] Zickel, *Soviet Union*, 601.

[362] Ibid., 875.

[363] Ibid.

Figure 7. USSR Organizations

Source: Matt Rosenberg, "The Warsaw Pact History and Members," ThoughtCo., 30 September 2018, accessed 29 April 2019, https://www.thoughtco.com/warsaw-pact-countries-1435177; Marie Lavigne, "The Soviet Union inside Comecon," *Soviet Studies* 35, no. 2 (April 1983): 135-153, accessed 23 March 2019, https://www.jstor.org/stable/151775.

In summary, the Soviet Union demonstrated a significant increase in diplomatic power as their energy production increased. The representation grew faster than independent countries and expanded global reach. Negotiation was not a significant aspect of Soviet aims. However, implementation through leadership of multilateral organizations increased.

The Soviet Union case demonstrates that positive economic power, through foreign aid and trade, can increase through an increase in energy production. However, the negative use of economic power of sanctions is not effective. Secondly, the increase

in energy production came from shifting national policies that also included a renewed emphasis on diplomatic power. Lastly, the centralized Soviet government was able to effectively convert this excess capacity into the application of their policy.

Canada (1981 – 2007)

The second case is Canada from 1981 to 2007. The boundaries of the case coincide with Canada's political independence from the United Kingdom in 1982 and the Financial Crisis in 2008. Britain gave Canada the right to self-govern in 1867 but Canada did not have full legal autonomy until the passing of the Statute of Westminster in December 1931. This statute created the Commonwealth of Nations as former colonies transitioned to dominions that retained allegiance to the British Crown. Each dominion had full autonomy; however, the British Parliament retained the ability to amend the Canadian constitution until 1982. Despite the separation from the United Kingdom, Canada continued to play an integral part in the Commonwealth.[364]

Under the Canadian constitution, the provinces have control over many governmental functions, including the ownership of natural resources and developing energy policies. The Federal government sees itself as an arbiter for the nation and sought to consolidate a national level energy policy after the 1973 oil crisis. The most important and comprehensive effort was the National Energy Policy implemented in 1980 that

[364] Emily Cuggy, "Canada's Declaration of Independence," Canada's History, accessed 15 April 2019, https://www.canadashistory.ca/explore/politics-law/canada-s-declaration-of-independence.

planned to save $214 billion over its first five years.[365] The National Energy Policy was somewhat controversial and highlighted tensions between energy producers in the west, especially Alberta, and energy consumers in the east from Ontario and Quebec. The plan sought to expand the natural gas pipeline network but pass the costs onto the producers rather than consumers. It also expanded the federal government's share at the expense of the provincial governments. During the tenure of the plan, Alberta was the only province that was a net contributor.[366] Those for the plan, including federal politicians, saw it as a bold initiative to assert Canadian economic rights and to stop the drain on national wealth to foreign investors. However, there was a large group that opposed the plan. The United States government saw it an interference with the free market and placing foreign investors at a disadvantage. Producing provinces felt the taxes reduced demand and profits. Industry felt that it was an unwarranted intervention that threatened self-sufficiency by muting signals to reduce consumption.[367] The federal government had to create agreements with each province to finalize policies after the creation of the National Energy Program. The first, and most difficult, agreement was with Alberta and resulted in an agreement on Energy Pricing and Taxation. The major features of the agreement focused on the price of oil and natural gas, and fiscal policy. The agreement then because

[365] John Foster, "Energy Policies in Canada," in *Relations Between Mexico and Canada*, ed. Omar Martinez (Mexico: Colegio de Mexico, 1990), 148, accessed 14 April 2019, https://www.jstor.org/stable/j.ctv3dnrxk.12.

[366] Jordan Michael Smith, "Northern Promises: Will Canada Make It as an Energy Superpower?" *World Affairs* 176, no 2 (July/August 2013): 76, accessed 23 March 2019,

[367] Foster, "Energy Policies in Canada," 173-174.

the example for deals with other provinces. Despite the effort required to reach a deal, it had to be reworked in 1983 as the global oil market dampened.[368]

Another major debate regarding Canadian energy policy centered around a Free Trade Agreement with the United States. The agreement created tension between the idea of self-sufficiency based on nationalistic polices and free trade that benefitted all consumers. The transportation costs required to move coal, oil and natural gas from Alberta to eastern Canada meant consumers paid higher prices than if it was imported duty free from sources in the eastern United States. Increased exports to the large market in the United States lowered domestic prices by spreading fixed costs over a larger quantity.[369]

The debate on how to manage Canadian energy resources continued and in 2006 Prime Minister Stephen Harper declared that Canada was an emerging energy superpower. His assessment was based on being one of the largest funders of energy research and development and one of the few places that had the reserves to securely support long-term sources of supply. The resources included the second largest proven oil reserves, third largest uranium reserves and fourth largest capacity of exploitable hydropower. He acknowledged that Canada had failed to convert this bounty into

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[368] Foster, "Energy Policies in Canada," 150.

[369] John N. McDougall, "The Canada-US Free Trade Agreement and Canada's Energy Trade," *Canadian Public Policy* 17, no. 1 (March 1991): 3, accessed 23 March 2019, https://www.jstor.org/stable/3551187.

international power, but saw the Keystone XL pipeline as a means to begin the conversion.[370]

The case specifically examines the time period from 1981 to 2007. Prior to 1981, Canada did not break the 100 terawatt-hour barrier for combined oil and natural gas production until 1951. This level increased to 1971 terawatt-hours by 1971 before wavering for the next decade. Canada produced 980 terawatt-hours of oil and 792 terawatt-hours of gas for a combined total of 1772 terawatt-hours in 1981. (Figure 8.) This placed them 9th and 4th in the global market for oil and gas respectively, while their combined total ranked 5th. By 2007, Canada produced 3966 terawatt-hours of energy, 2033 terawatt-hours from oil and 1933 terawatt-hours from natural gas. This combined output moved them up one place to 4th globally as they ranked 7th in oil production and 3rd in natural gas production.[371]

[370] Smith, "Northern Promises," 74.

[371] Ritchie and Roser, "Fossil Fuels."

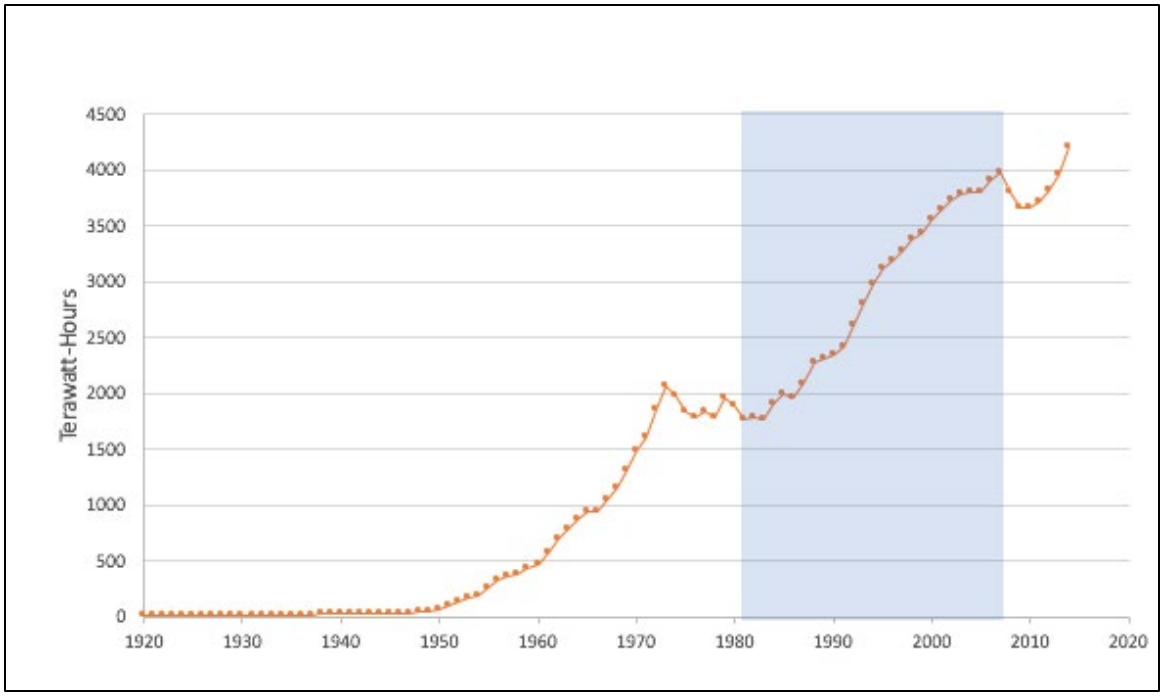

Figure 8. Canada Oil and Natural Gas Production

Source: Hannah Ritchie and Max Roser, "Fossil Fuels," Our World in Data, accessed 22 April 2019, https://ourworldindata.org/fossil-fuels.

This case of Canada from 1981 to 2007 is evaluated along the same instruments of national power using the same components and methods, but the metrics vary slightly given the difference in information available from the Soviet Union case. For example, the PIIE did not evaluate any sanctions imposed by or on Canada, so no effectiveness scores are found. Additionally, there is less data surrounding the strength of Canada's leadership roles in multinational organizations. Instead, the number of organizations will serve as the measure of diplomatic implementation.

The assessment begins with the same components of assistance, trade and finance. The first component of the diplomatic instrument of power is assistance. In this case it is measured through the total foreign aid disbursed and the number of countries receiving

aid. The data provided by the World Bank covers Canadian foreign aid back to 1960. Foreign aid in the two decades prior to the start of the case increased from $470 million per year to $5.9 billion per year. Simultaneously, the global reach increased from 65 to 133 countries. After the start of the case, total contribution increased from $7.1 billion in 1981 to $14.0 billion by 1991, while the number of countries receiving aid increased from 145 to 166. Over the next nine years the number of countries receiving aid continued to increase while the amount decreased to a low of $7.5 billion in 2000. The amount of disbursed foreign aid rebounded thereafter to end the case with $28.6 billion in 2007.[372] (Figure 9.) Foreign aid in Canada does not support the notion that an increase in energy production increases assistance provided. While the number of countries receiving aid from Canada steadily increased during the case time period, it also increased at a similar rate prior to that. Furthermore, the amount of aid does not correlate with the amount of energy produced. This indicates that there is some other driver behind the ability to pay foreign aid to other countries.

[372] The World Bank, "Net bilateral aid flows from DAC donors, Canada (current US$)," accessed 22 April 2019, https://data.worldbank.org/indicator/DC.DAC.CANL.CD.

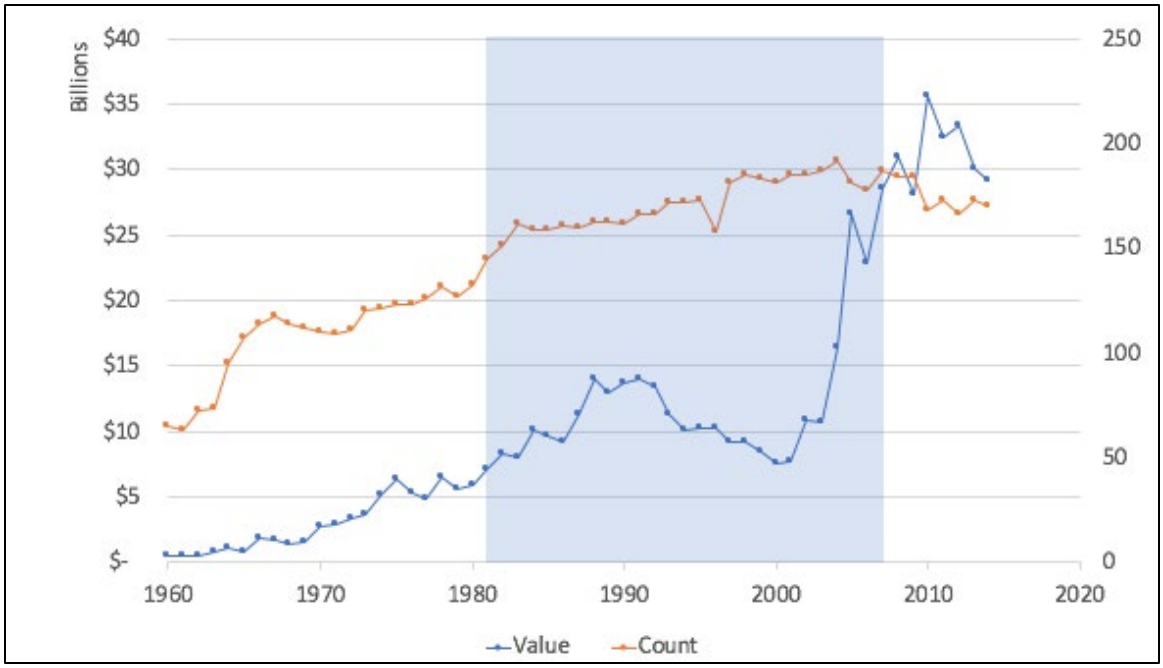

Figure 9. Canada Foreign Aid

Source: The World Bank, "Net bilateral aid flows from DAC donors, Canada (current US$)," The World Bank, accessed 22 April 2019, https://data.worldbank.org/indicator/DC.DAC.CANL.CD.

The second component of diplomatic power is trade measured through the value of imports and exports, and the trade balance. Canada's government website contains trade data back to 1971. In the decade before the case trade grew linearly, as exports grew from $86 billion in 1971 to $188 billion in 1980. Imports grew from $69 billion to $176 billion. The average trade balance over this period favored exports by $9.31 billion per year. Imports and exports jumped higher in the first year of the case to $338 billion in exports and $339 billion in imports, representing a $1.5 billion trade deficit. Over time, imports and exports grew exponentially to a peak in 2000 with $1.37 trillion in exports and $1.25 in imports. This also led to a peak in the trade balance of $122 billion. In 2001

imports and exports were cut to roughly two thirds of their prior year total. Imports and exports grew from this lower rate, but did not eclipse the highs from 2000 prior to 2011. The trade balance declined from its peak in 2000 and crossed to a net importer in 2006. This decrease in trade balance continued until 2011.[373] (Figure 10.) The trade balance generally supports the idea of increased energy production increasing economic power. The significant jump in imports and exports at the beginning of the case provides support, as does a consistent growth during the case. Imports and exports grew faster than energy production and sustained a correction in 2000. However, they maintained their growth after a one year reset. The size of economic power also considers the role of sanctions.

[373] Government of Canada, "Exports and imports of goods and services, annual, 1971 – 2011," accessed 22 April 2019, https://open.canada.ca/data/en/dataset/25ab9dfd-7152-4c30-8333-b08c21f83155.

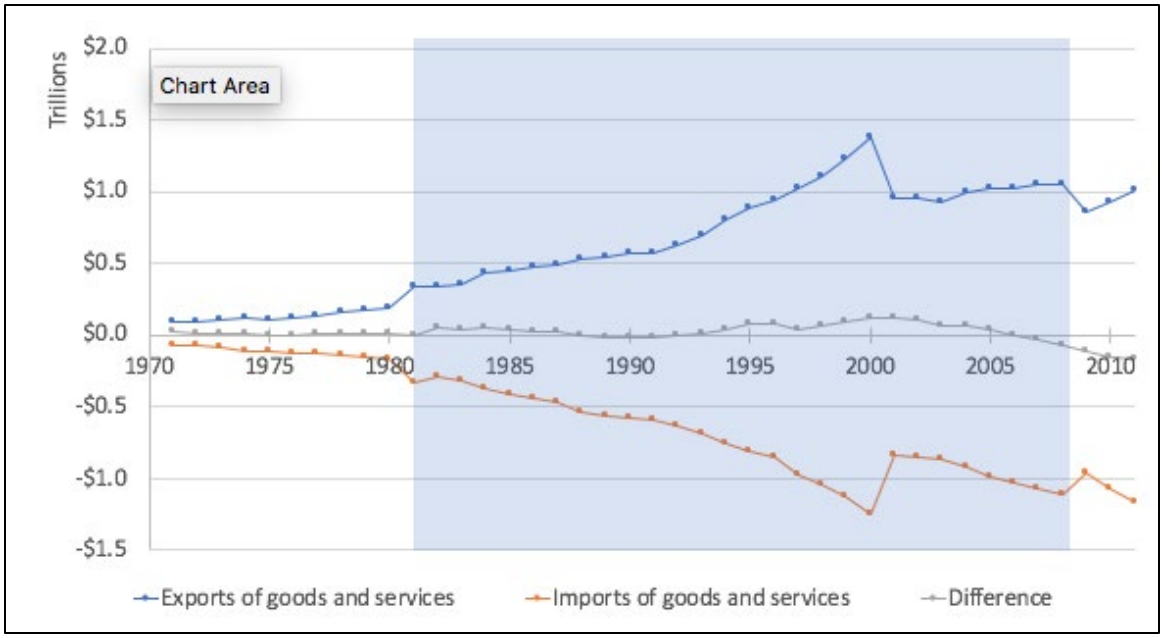

Figure 10. Canada Imports and Exports

Source: Government of Canada, "Exports and imports of goods and services, annual, 1971-2011," accessed 22 April 2019, https://open.canada.ca/data/en/dataset/25ab9dfd-7152-4c30-8333-b08c21f83155

The finance component of diplomatic power is measured through the number of sanctions imposed by Canada. Sanction in Canada take two flavors. The first are sanctions imposed by the United Nations and supported by Canada. These sanctions were given a legal basis in Canada under the United Nations Act in 1985. The first sanctions supported by Canada were imposed on Iraq in 1990. The number of sanctions increased to 5 by 1992 due to sanctions on Yugoslavia, Libya, Somalia, and Liberia. The number remained at roughly this level until 2004, when it increased to 10 and peaked at the end of the case in 2007 with 14. This level of UN backed sanctions remained roughly the same after the case. The second type of sanctions are unilaterally imposed by Canada under the Special Economic Measures Act signed in 1992. It was first used to apply

sanctions on Haiti for a short time in the early 1990s. It was not used again until 2006 to apply sanctions on Belarus. This type of sanction grew rapidly after the cased ended and resulted in a peak of 9 countries with sanctions imposed from 2014 to 2015.[374] (Figure 11.) This pattern shows that the application of sanctions is not closely related to the increase in energy production. Supporting sanctions from the Untied Nations does not demonstrate national power and only one unilateral sanction is applied during the case. After the case the number of sanctions increased rapidly, showing a potential negative correlation as sanctions increased despite reduced energy production.

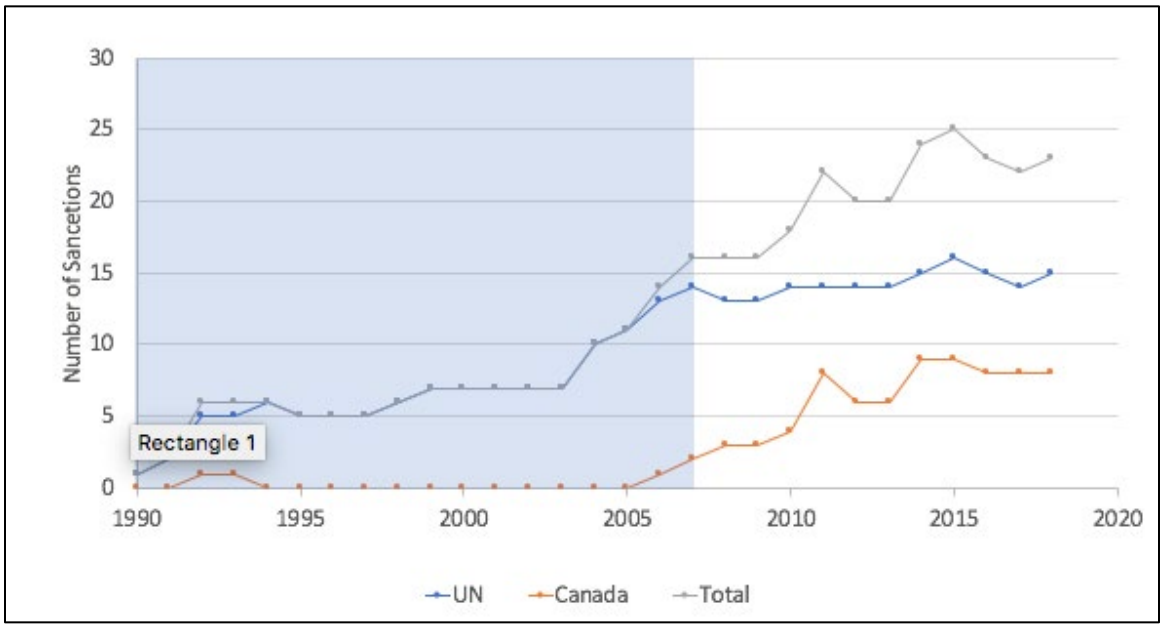

Figure 11. Canada Sanctions

Source: Government of Canada, "Current sanctions imposed by Canada," accessed 22 April 2019, https://international.gc.ca/world-monde/international_relations-relations_internationales/sanctions/current-actuelles.aspx?lang=eng.

[374] Government of Canada, "Current sanctions imposed by Canada," accessed 22 April 2019, https://international.gc.ca/world-monde/international_relations-relations_internationales/sanctions/current-actuelles.aspx?lang=eng.

The results of the diplomatic measures are resoundingly mixed. The number of countries receiving foreign aid showed a potential link, but was not supported by the uncorrelated data between energy production and the amount of foreign aid. Trade showed a likely correlation, but is weakened by the bubble bursting in 2001. Sanctions were neutral during the case but increased outside of it. Taken together this implies that increased energy production may provide capacity for power, but does not guarantee its implementation.

Evaluating the diplomatic instrument of power will focus on the same components of representation, negotiation, and implementation. Canada's origins and relationship with the Britain heavily influence their diplomatic relations. Canada started having a separate foreign policy with the approval of the Statute of Westminster in 1831..[375] Canada's representation is measured by the number of countries with which they have diplomatic relations. Canada has steadily grown their number of diplomatic relationships since they became responsible for their own foreign policy. The rate of increase does not seem to change much since World War II, except for two periods of rapid expansion of diplomatic relations. (Figure 12.) The first was an increase from 51 countries in 1960 to 78 in 1962 due to the decolonialization of countries in Africa. Canada established relations with these countries shortly after they gained their independence. The second period of rapid transition was the expansion from 145 countries in 1990 to 160 countries in 1992 after the Soviet Union fell. Similar to the decolonialization period, Canada established relationships with countries as they declared

[375] Cuggy, "Canada's Declaration of Independence."

independence.[376] Even though the second period took place inside the boundaries of the case, it is more likely that this was caused by an aggressive foreign policy focused on representation rather than being enabled by an increase in energy production. This case does not support the thought that increased energy production increases the representation component of the diplomatic instrument of national power.

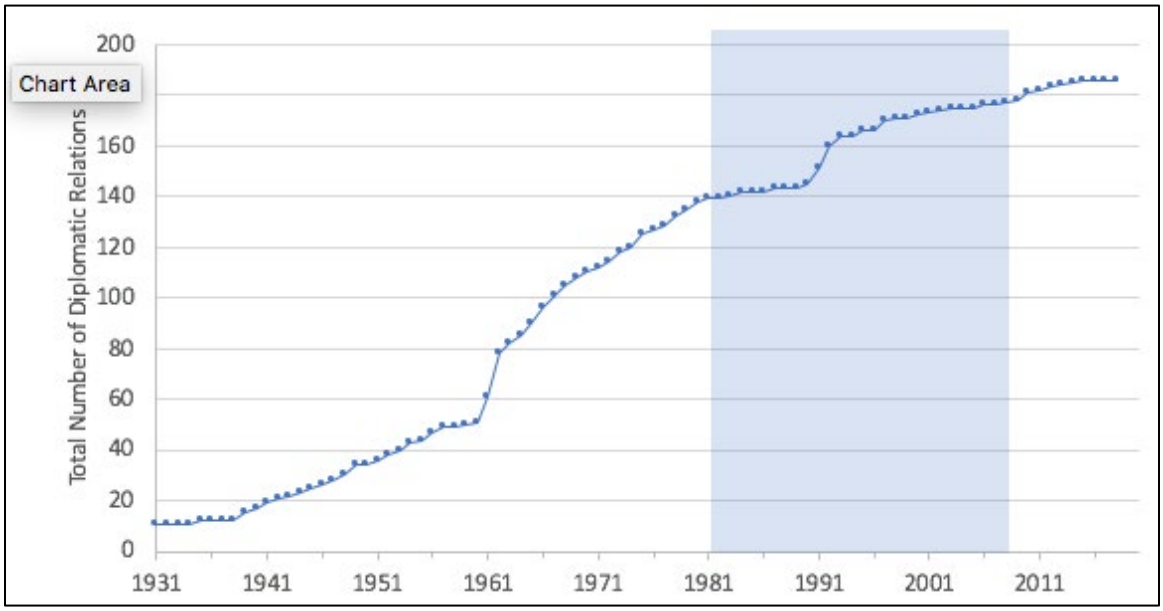

Figure 12. Canada Relations

Source: Government of Canada, "Canada's bilateral relations," accessed 22 April 2019, https://international.gc.ca/world-monde/international_relations-relations_internationales/bilateral_relations-relations_bilaterales.aspx?lang=eng.

[376] Government of Canada, "Canada's Bilateral Relations," accessed 22 April 2019, https://international.gc.ca/world-monde/international_relations-relations_internationales/bilateral_relations-relations_bilaterales.aspx?lang=eng.

The second component of the diplomatic instrument of national power is negotiation, measured by the number of treaties signed per year. The treaties include both unilateral and multilateral treaties signed by Canada. The number of treaties generally increased from 1931 to 1980 with a spike after World War II from 1946 to 1947. Canada signed 31 bilateral agreements and two multilateral agreements in 1981. The number increased to a maximum of 57 total agreements in 1991 (39 bilateral and 18 multilateral), many of which were signed with the United States. This fell to less than half that number in 1993 to 27 total agreements. Agreements spiked again in 1995, but fell precipitously afterward to their historical low of 4 bilateral agreements and no multilateral agreements.[377] (Figure 13.) This demonstrates a weak negative correlation that does not support a connection between energy production and the number of agreements.

[377] Government of Canada, "Canada Treaty Series," accessed 22 April 2019, https://www.treaty-accord.gc.ca/cts-rtc.aspx?lang=eng&_ga=2.141756475.842139710.1554221750-666526143.1554221750.

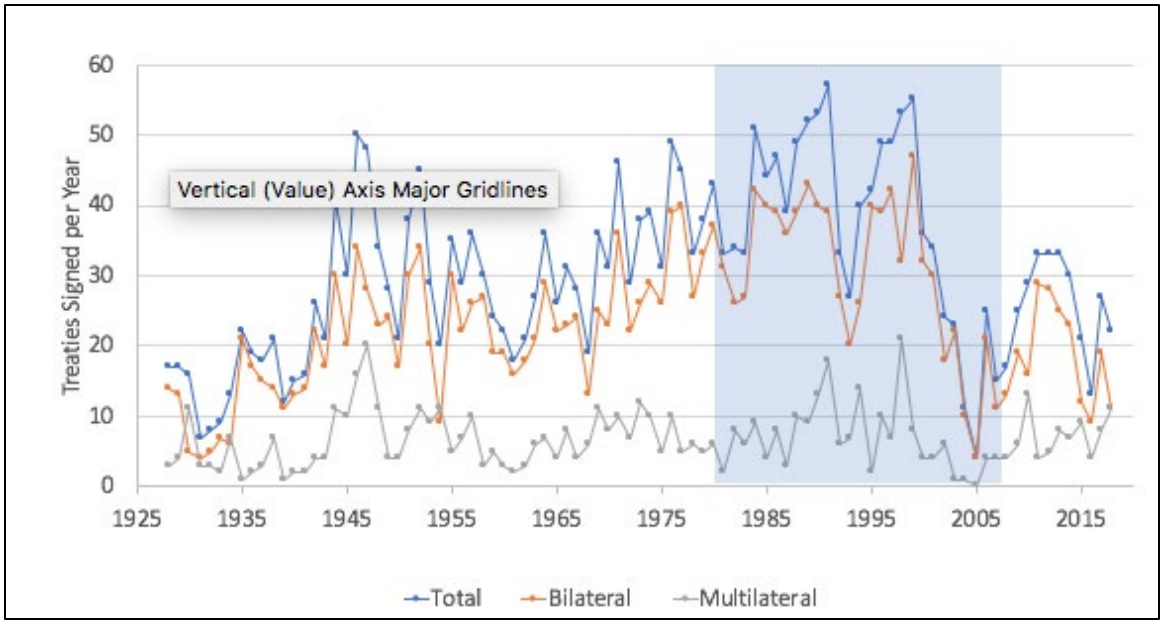

Figure 13. Canada Treaties

Source: Government of Canada, "Canada Treaty Series," accessed 22 April 2019, https://www.treaty-accord.gc.ca/cts-rtc.aspx?lang=eng&_ga=2.141756475.842139710.1554221750-666526143.1554221750.

Implementation is the third component of diplomatic power and is evaluated through the number of multilateral organizations of which Canada is a member. Canada became a member of the Commonwealth of Nations to retain ties with the Britain and the other former colonies following the signing of the Statute of Westminster in 1931. The next major push to join multilateral organizations did not occur until after World War II with organizations such as the United Nations, International Monetary Fund, and World Bank.[378] After the initial surge of memberships the rate of increase smoothed for the next

[378] Government of Canada, "Partnerships and Organizations," accessed 22 April 2019, https://international.gc.ca/world-monde/international_relations-relations_internationales/partnerships_organizations-partenariats_organisations.aspx?lang=eng#a1.

65 years. Canada went from 24 organizations in 1981 to 37 in 2007.[379] (Figure 14.) This increase is roughly the same pace as before the case and implies that the increased in production is not the driving factor behind the number of multilateral organizations.

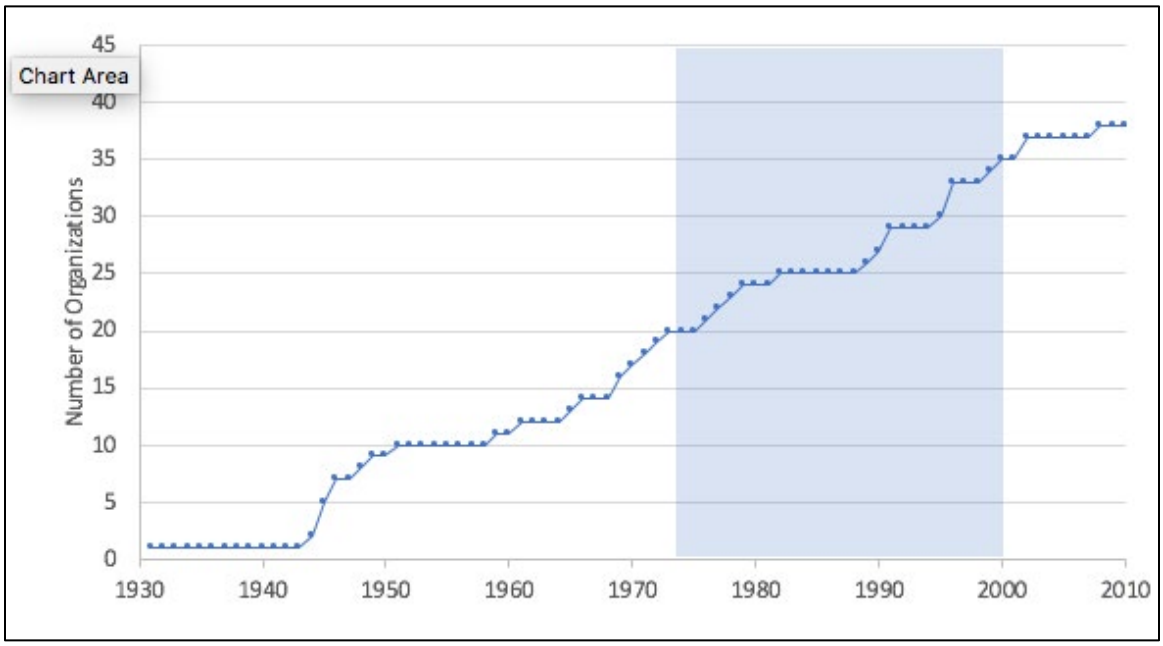

Figure 14. Canada Organizations

Source: Government of Canada, "Partnerships and Organizations," accessed 22 April 2019, https://international.gc.ca/world-monde/international_relations-relations_internationales/partnerships_organizations-partenariats_organisations.aspx?lang=eng#a1.

The diplomatic instrument of national power does not fare any better than the economic instrument of power during this analysis. The increase in representation is more correlated to the number of new countries than oil and natural gas production. The

[379] Government of Canada, "Partnerships and Organizations."

number of treaties per year decreased, especially after 1991 and 1995. Lastly, the number of multilateral organizations is more related to a function of time and not necessarily tied to energy production.

The Canada case demonstrates that not all components, especially for the diplomatic instrument of power, support the idea that increased energy production improves national power. The number of countries increased for trade and foreign aid but the total amount decreased during tough economic times. None of the diplomatic components consistently improved with the increased energy production, so other factors must have greater influence over their application. Lastly, the case demonstrates that it is difficult for a market economy with democratic leadership to manipulate power without sacrificing some aspect of their ideals.

This section analyzed the raw data to observe the effect of increased energy production on economic and diplomatic power. The next section draws conclusions from the synthesis of the information to make recommendations.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

This conclusion seeks to make sense of the analysis and discuss the implications. It is organized into three main areas. First, examining each component of economic and diplomatic power across the two cases. Secondly, it summarized the overall lessons from and between the cases. Lastly, these lessons transition to making recommendations based on the findings, separated into recommendations for action and those for further study.

Conclusions

The synthesis of the components starts with the economic instrument of national power. The first component of assistance holds the potential for demonstrating the strongest relationship with energy production. This may be because foreign aid is the most liquid component and easy to transfer. The Soviet Union consistently increased aid and Canada increased the number of countries. Canada's drop in total aid indicates that other economic factors affect the ability to dispense aid. However, Canada showed their commitment to dispensing aid by increasing the number of countries receiving aid and their total aid increased once the economy improved. The ease of transfer also reduces inefficiency and opportunities for losses. As seen in the Soviet Union case, providing foreign aid does not guarantee the effectiveness of influence, which is driven more by the ratio of one provider's aid to the total aid given to a target country. Overall, both cases lend some support to the connection of increased energy production with a country's capacity to provide foreign aid.

The two cases show similar patterns in the second component of economic power, trade. Both cases saw a significant increase in imports and exports during the initial phase of the case before leveling out in the latter portion. The initial growth phase lasted about 20 years for both cases, measured from the first available data in 1965 for the Soviet Union case. The Soviet Union faced a gradual decline after 1984 while Canada had a large decline in 2001 followed by slow growth that did not reach the peak value set in 2000. Additionally, both cases had a positive trade balance that increased during the initial phase of each case. The peak trade balance occurred five to seven years before the end of the case and turned negative at the end of the case. The combination of these two cases demonstrate that an increase in energy output leads to an increase in trade for a time, but does necessarily continue unabated.

The finance component of economic power, defined by economic sanctions, presented the largest surprise of the data analysis. The data in both cases demonstrate no ability to apply more economic sanctions, and potentially indicates that they are used less as more energy is produced. The Soviet Union stopped using sanctions during the case and Canada did not start using unilateral sanctions until after the case, despite already having the legislative authorization to do so. In neither case, however, did the data indicate a direct relationship between these behaviors and energy production. A potential reason for this might be that countries that increase capacity are looking for markets to consume their product and those that need energy will not trust a country that applies sanctions. This shows that the influence of negative power may not be effective when looking to integrate with trading partners.

Summarizing the components of economic power, the positive components of foreign aid and trade increase coincidentally with energy production. The negative component of sanctions decreases. When combined, this means that the capacity of economic power increases, but not limitlessly, and not necessarily because of energy production. The capacity only builds if there is a market to receive their energy products, so understanding the state of other energy needs is required before applying power.

The diplomatic instrument of power provides additional context for the role energy production plays with national power. The first component, representation, highlights slight differences between the two cases. The data available for the Soviet Union case is based on the establishment of embassies in a foreign country, while the Canada case uses when diplomatic relations were established. In some cases, Canada delayed building an embassy or used one embassy to administer relations with multiple countries. These differences mean that the cases cannot be directly compared, but conclusions can still be drawn from the direction and magnitude of relationships. Both cases had increasing relations before the case began. The acquisition of new diplomatic relations for the Soviet Union stalled in the five years preceding the start of the case, and started to rise rapidly after the start of the case. Additionally, the Soviet Union was able to establish relations with further distant countries. These show that the bounty from growing energy production allowed the Soviet Union to project their diplomatic power. Canada, by contrast, gained control of their diplomatic relations a decade after the Soviet Union, but focused on expanding relationships early. They quickly built relationships across the globe. Their two fastest growing periods coincided with the independence of former colonies and the fall of the Soviet Union. Both of these instances created more

countries with which to establish relations. One instance occurred prior to the case, and one during, the fall of the Soviet Union. This pattern shows that Canada's expansion of diplomatic relations showed no relationship with energy production. Taking the two cases together, increasing energy production appears to coincide with the expansion of diplomatic relations, but energy is not required to establish relations. This relationship demonstrates that government priorities and other variables are more important than energy production for diplomatic relations.

Negotiation, the second component of diplomatic power, held similar findings as the first component. The negotiation component is measured through the number of treaties signed. The data on treaties for the Soviet Union used in this study is confined to two categories, high-level treaties for the 20th century and treaties of friendship with the Third World up to 1980. Both of these increase during the case. The more general treaties increase in the 1960s due to agreements with the United States over nuclear weapons. The treaties of friendship start in 1971 and increase throughout the decade showing the shift Soviet foreign policy to expand influence within the Third World. One can observe different effects in the Canada case. The number of treaties signed per year increased during the initial state of the case, but reached a peak before quickly dissipating. A possible explanation is Canada exhausted partners with which to partner and did not need new treaties until the previous ones expired. The results of using treaties as a measure of diplomatic power in these cases are mixed. The Soviet government, looking to formalize relationships and legitimize standing as a major global power, expanded their use of treaties at the same time energy production increased. Canadian policy seemed to be more influenced by other factors. Taking both cases together, expanding energy

production by itself does not lead to increased treaties. Priorities established by the government play a crucial role in determining the number of treaties signed.

The implementation of diplomatic power, the third component, also shows differences between the two cases. The countries' membership and leadership in multilateral organizations determined the strength of implementation. The Soviet Union did not seek to join many multilateral organizations as a matter of foreign policy. Instead, they sought to dominate the few organizations they led to push the influence of communism. Their strong leadership of Comecon and the Warsaw Pact demonstrated an increasing amount of diplomatic power, although only over a small group of satellite countries, that derived in part from the Soviet Union's ability to export energy to other members. In the other case, Canada did not show a significant change in the number of multilateral organizations to which they joined. This again shows that increased energy production, while it might be a factor, cannot get credit for providing a capacity to increase diplomatic power. Instead, government priorities determine if it will be applied.

For the diplomatic instrument of national power, none of the components showed a direct relationship with an increase in energy production across both cases. Instead, the results that could be derived from the cases provided either inconclusive or opposing views of across the components of this instrument of national power.

Recommendations

The research and conclusions above provide the opportunity to provide recommendations along two lines. The first line are recommendations for action for any country that is increasing oil and natural gas production over a sustained period. The

second line are recommendations for further research to expand and refine the findings. These recommendations flow from the previously derived analysis and conclusion.

The first recommendation for action is to secure domestic supply by increasing oil and natural gas production. For the United States, this increase allows them to move from a net importer of oil and natural gas to a net exporter. Reducing the need for imports insulates the country from supply disruptions, whether they be purposeful or unintended. Increasing production alone is not enough to ensure supply. The global energy market is deeply integrated so that a lack of supply in the international community still causes domestic prices to rise as energy companies export oil and natural gas in lieu of meeting demand.

The second recommendation for action is that the United States should include production capacity as part of the strategic reserve as capacity increases. The key to the strategic reserve is to prevent supply disruptions, but having the supply in storage is not enough to meet demand. The United States supply can serve a role similar to Saudi Arabia with flexible production, although this will be more difficult due to a less centralized structure. A way to implement this is to allocate a percentage of new wells to strategic production to be used only in the case of a domestic shortage.

The third recommendation for action is to seek a diversified array of export markets for their excess supply to ensure sustainability for sources of demand. Exporting to one or a few countries can have negative impacts if that country no longer needs imported energy, from increased domestic sources or decreased total demand. Having multiple sources spreads the risk. This can be expanded to promoting investment of energy transportation infrastructure in other places, including oil pipelines and liquid

natural gas terminals. Liquid natural gas terminals in Europe allow the United States to supply Europe with natural gas and reduce Russia's ability to cut off natural gas supply to Western Europe.

Fourth, the United States should resume leadership role in multinational organizations focused on curbing global emissions. The United States can have a large role given its access to the bridge fuel of natural gas. Switching from coal and oil to natural gas has environmental effects, but also benefits domestic energy companies. The increased demand for natural gas ensures a market for the additional capacity installed as American production increases. This is especially important as renewable sources rapidly increase in production capacity, providing a horizon for which increasing natural gas production will be useful.

The fifth recommendation is to avoid the temptation for negative sanctions as it could decrease the ability to integrate into other markets. Sanctions did not grow in either case as the ability to grow in a positive direction outweighed the potential benefits of adding negative sanctions. The extra capacity makes its unnecessary to resort to sanctions. It is more important to focus on the positive aspects of trade and aid to increase economic power.

This study are several potential avenues to expand this research, especially to increase breadth and depth. The first recommendation for further study is to expand the breadth of research to include all energy sources and all instruments of national power. The same framework can be applied and may be useful to determine interactions between other variables not captured in this data. The second recommendation for further study is to increase depth by adding additional methods and metrics to evaluate each component.

Increasing depth could provide more resolution on the component and further understand the interactions between all components.

Another way to increase the depth of understanding is to examine additional cases. In addition to having different government types, it would be useful to have a case in which the country went from being a net importer to a net exporter. It would also be helpful to examine the corollary in which energy production decreased over a sustained period.

The final way to expand the study would be to perform a quantitative analysis in lieu of a qualitative one. This will be difficult given data currently available, but several sources are working to provide an annual quantitative ranking of national power. This data can be compared to energy production totals to quickly conduct a more quantitative approach to this study.

The primary purpose of this thesis was to explore the relationship between energy and national power. These recommendations would continue to expand the knowledge. The expansion of energy provides some unique opportunities, but is not a blank check that allows instant growth. The application of power remains constrained by other outside forces. Understanding the relationship allows policy makers to make educated decisions and enables military leaders to better visualize the operating environment.

BIBLIOGRAPHY

Books

Baev, Pavel. *Russian Energy Policy and Military Power: Putin's Quest for Greatness.* Hoboken: Taylor and Francis, 2012.

Creswell, John W. *Qualitative Inquiry & Research Design: Choosing Among Five Approaches.* Los Angeles: Sage, 2013.

Deese, David A., and Joseph S. Nye. *Energy and Security*. Cambridge, MA: Ballinger Publishing Company, 1981.

Deni, John R., ed. *New Realities: Energy Security in the 2010s and Implications for the U.S. Military*. Carlisle Barracks, PA: United States War College Press, 2015.

Foster, John. "Energy Policies in Canada." In *Relations Between Mexico and Canada,* edited by Omar Martinez, 143-96. Mexico: Colegio de Mexico, 1990. Accessed 14 April 2019. https://www.jstor.org/stable/j.ctv3dnrxk.12.

Jacobson, Jon. *When the Soviet Union Entered World Politics*. Berkeley: University of California Press, 1994.

Jordan, Amos A., Willian J. Taylor Jr., Michael J. Meese, and Suzanne C. Nielsen. *American National Security*. 6th ed. Baltimore: The Johns Hopkins University Press, 2009.

Laird, Robbin F., and Erik P. Hoffman, eds. *Soviet Foreign Policy in a Changing World.* New York: Aldine de Gruyter, 1986.

Mahdi, Ahmed. *Energy and US Foreign Policy: The Quest for Resource Security after the Cold War*. London: I.B. Tauris: London, 2012.

Mitchell, Timothy. *Carbon Democracy: Political Power in the Age of Oil*. London: Verson, 2011.

Nye Jr., Joseph S. *The Future of Power*. New York: Public Affairs, 2011.

Nye Jr., Joseph S., and David A. Welch. *Understanding Global Conflict and Cooperation: An Introduction to Theory and History*. 10th ed. Boston: Pearson, 2017.

Prokhorov, A. M., ed. *Great Soviet Encyclopedia: A Translation of the Third Edition.* Vol. 8. New York: Macmillan, Inc. 1975.

Stokes, Doug, and Sam Raphael. *Global Energy Security and American Hegemony.* Baltimore: Johns Hopkins University Press, 2010.

Ulam, Adam B. *Expansion and Coexistence: Soviet Foreign Policy 1917-1973.* 2nd ed. New York: Praeger Publishers, 1974.

Yergin, Daniel. *The Prize: The Epic Quest for Oil, Money & Power*. New York: Free Press, 2009.

———. *The Quest: Energy, Security, and the Remaking of the Modern World*. New York: The Penguin Press, 2011.

Yergin, Daniel, and Joseph Stanislaw. *The Commanding Heights: The Battle for the World Economy.* New York: Free Press, 2002.

Zickel, Raymond E., ed. *Soviet Union: A Country Study.* Federal Research Division, Library of Congress. 2nd ed. Washington, DC: The Division, 1991. Accessed 30 March 2019. https://archive.org/details/sovietunioncount00zick/page/n7.

Periodicals

Blas, Javier. "Texas Is About to Create OPEC's Worst Nightmare." *Bloomberg*, 20 November 2018. Accessed 24 December 2018. https://www.bloomberg.com/news/articles/2018-11-21/opec-s-worst-nightmare-the-permian-is-about-to-pump-a-lot-more?utm_campaign=news&utm_medium=bd&utm_source=applenews.

Brown, Archie. "Change in the Soviet Union." *Foreign Affairs* 64, no. 5 (Summer 1986): 1048-1065. Accessed 23 March 2019. https://www.jstor.org/stable/20042780.

Frost, Ellen L. "What is Economic Power?" *Joint Force Quarterly*, no. 53 (April 2009): 9-11.

Glaser, John. "Does the U.S. Military Actually Protect Middle East Oil?" *The National Interest,* 9 January 2017. Accessed 14 October 2018. https://nationalinterest.org/blog/the-skeptics/does-the-us-military-actually-protect-middle-east-oil-18995.

Goldman, Marshall I. "The Soviet Union." *Daedalus* 104, no. 4 (1975): 129-143. Accessed 23 March 2019. https://www.jstor.org/stable/20024366.

Guan-Fu, Gu. "Soviet Aid to the Third World an Analysis of Its Strategy." *Soviet Studies* 35, no. 1 (1983): 71-89. Accessed 11 April 2019. http://www.jstor.org/stable/151493.

Hannah, John. "Energy Security is the Real Way to Put America First." *Foreign Policy,* 10 August 2018. Accessed 15 October 2018. https://foreignpolicy.com/2018/08/10/energy-security-is-the-real-way-to-put-america-first-trump-iran-oil-sanctions/.

Hennigan, W. J. "Iran Sanctions Test US Diplomatic Power." *Time* (19 November 2018): 6-7.

Johnson, Keith. "Why American Oil Hasn't Been a Total Game-Changer." *Foreign Policy,* 14 November 2018. Accessed 15 December 2018. https://foreignpolicy.com/2018/11/14/why-american-oil-hasnt-been-a-total-game-changer/.

Kao, Philip Y. "Future Approaches to the Economic Instrument of Power." *Joint Force Quarterly,* no. 43 (4th Quarter 2006): 51-53.

Krauss, Clifford. "Oil Boom Gives the U.S. a New Edge in Energy and Diplomacy." *New York Times,* 28 January 2018. Accessed 14 October 2018. https://www.nytimes.com/2018/01/28/business/energy-environment/oil-boom.html.

Kunz, Diane B. "When Money Counts and Doesn't: Economic Power and Diplomatic Objectives." *Diplomatic History* 18, no. 4 (1994): 451-462. Accessed 24 December 2018. http://www.jstor.org/stable/24912306.

Lavigne, Marie. "The Soviet Union inside Comecon." *Soviet Studies* 35, no. 2 (April 1983): 135-153. Accessed 23 March 2019. https://www.jstor.org/stable/151775.

Licklider, Roy. "The Power of Oil: The Arab Oil Weapon and the Netherlands, the United Kingdom, Canada, Japan and the United States." *International Studies Quarterly* 32, no. 2 (June 1988): 205-226. Accessed 23 March 2019. https://www.jstor.org/stable/2600627?seq=1#metadata_info_tab_contents.

McDougall, John N. "The Canada-US Free Trade Agreement and Canada's Energy Trade." *Canadian Public Policy* 17, no. 1 (March 1991): 1-13. Accessed 23 March 2019. https://www.jstor.org/stable/3551187.

Milina, Velichka. "Energy Security: A Paradigm Shift." *Connections* 12, no. 4 (Fall 2013): 75-98. Accessed 23 March 2019. https://www.jstor.org/stable/26326342.

Mills, John R. "All Elements of National Power: Re-Organizing the Interagency Structure and Process for Victory in the Long War." *Strategic Insights* 5, no. 6. (July 2006).

Nye Jr., Joseph S. "The Changing Nature of World Power." *Political Science Quarterly* 105, no. 2 (Summer 1990): 177-192. Accessed 29 April 2019. https://www.jstor.org/stable/2151022.

Rai, Kul B. “Foreign Aid and Voting in the UN General Assembly, 1967-1976.” *Journal of Peach Research* 17, no. 3 (1980): 269-277. Accessed 23 March 2019. https://www.jstor.org/stable/424322?seq=1#metadata_info_tab_contents.

Rapier, Robert. “How Long Will Natural Gas Be a Bridge Fuel?” *Forbes*, 9 September 2018. Accessed 14 October 2018. https://www.forbes.com/sites/rrapier/2018/09/09/how-long-will-natural-gas-be-a-bridge-fuel/#62126ec44579.

———. “Is U.S. Energy Independence in Sight?” *Forbes*, 14 November 2017. Accessed 14 October 2018. https://www.forbes.com/sites/rrapier/2017/11/14/is-u-s-energy-independence-in-sight/#10fd719d71a6.

———. “Natural Gas Is Already a Bridge Fuel.” *Forbes*, 2 September 2018. Accessed 14 October 2018. https://www.forbes.com/sites/rrapier/2018/09/02/natural-gas-is-already-a-bridge-fuel/#3994b089975f.

———. “Oil Will Remain a Large, Viable Industry.” *Forbes*, 14 September 2018. Accessed 14 October 2018. https://www.forbes.com/sites/rrapier/2018/09/14/oil-will-remain-a-large-viable-industry/#6a2bb87f2d3d.

Rio, Fernando Del, and Francisco-Xavier Lores. “Regulation and Rent-Seeking: The Role of the Distribution of Political and Economic Power.” *Journal of Public Economic Theory* 19 (2017): 986-1008. Accessed 24 December 2018. https://doi.org/10.1111/jpet.12231.

Shipler, David K. “Soviet Explains Aim of Its Foreign Aid.” *New York Times,* 6 October 1976. Accessed 30 March 2019. https://www.nytimes.com/1976/10/06/archives/soviet-explains-aim-of-its-foreign-aid-with-unusual-candor-moscow.html.

Sivaram, Varun, John O. Dabiri, and David M. Hart. “The Need for Continued Innovation in Solar, Wind and Energy Storage.” *Joule* 2, no. 9. (September 2018): 1637-1908.

Smith, Jordan Michael. “Northern Promises: Will Canada Make It as an Energy Superpower?” *World Affairs* 176, no. 2 (July/August 2013): 72-79. Accessed 23 March 2019. https://www.jstor.org/stable/43554783.

Papers

Asmus, Gerda, Andreas Fuchs, and Angelika Muller. “BRICS and Foreign Aid.” Aid Data: A Research Lab at William & Mary, August 2017.

Chesley, Gary D. “America’s Energy Security Policy: Goals for 2025.” Master’s Thesis, U.S. Army War College, Carlisle Barracks, PA, 1 February 2007.

Kuboniwa, Masaaki, Shinichiro Tabata, and Yasushi Nakamura. "Soviet Foreign Trade Earnings Revisited." Russian Research Center, Institute of Economic Research, Hitotsubashi University, Tokyo, Japan, October 2016.

Mazat, Numa and Franklin Serrano. "An Analysis of the Soviet Economic Growth from the 1950s to the Collapse of the USSR." Centro di Ricerche e Documentazione "Piero Sraffa", Rome, Italy, 2012.

Reports

BP Energy Economics. *BP Energy Outlook: 2018 Edition.* London, UK: BP p.l.c, 2018.

Capuano, Dr. Linda. *International Energy Outlook 2018*. Washington, DC: U.S. Energy Information Agency, U.S. Department of Energy, 24 July 2018.

Central Statistics Office. *Energy Statistics*. New Delhi, India: Ministry of Statistics and Programme Implementation, 2018.

Chevron Corporation. *2017 Annual Report: Human Energy*. San Ramon, CA: Chevron. 2017.

Directorate-General for Energy, European Commission. *Energy 2020: A Strategy for Competitive, Sustainable and Secure Energy*. Luxembourg: Publications Office of the European Union, 10 November 2010.

Energy Research Institute of the Russian Academy of Sciences and Analytica Centre for the Government of the Russian Federation. *Global and Russian Energy Outlook 2016*. Moscow: Russian Federation, 2016.

Eni. *World Oil Review 2018*. Rome, Italy: Eni, 2018.

Equinor. *Energy Perspectives 2018: Long-Term Macro and Market Outlook*. Stavangar, Norway: Equinor, 2018.

ExxonMobil. *2018 Outlook for Energy: A View to 2040*. Irving, TX: ExxonMobil Corporate Headquarters, 2018.

Gas Exporting Countries Forum (GECF). *GECF Global Gas Outlook 2017*. Doha, Qatar: GECF, December 2017.

IHS Markit. *Rivalry: The IHS Markit View of the Energy Future (2018-2050).* Englewood, CO: IHS Markit, July 12, 2018.

Institute of Energy Economics, Japan (IEEJ). *IEEJ Outlook 2018: Prospects and Challenges until 2050*. Tokyo, Japan: IEEJ, October 2017.

International Energy Agency (IEA). *World Energy Outlook 2017: Executive Summary.* Paris, France: IEA Publications, November 2017.

Larrabee, F. Stephen, Stephanie Pezard, Andrew Radin, Nathan Chandler, Keith Crane, and Thomas S. Szayna. *Russia and the West After the Ukrainian Crisis: European Vulnerabilities to Russian Pressures*. Santa Monica, CA: RAND Corporation, 2017.

MacLeay, Iain, Kevin Harris, and Anwar Annut. *Digest of United Kingdom Energy Statistics 2014*. London, UK: United Kingdom Department of Energy & Climate Change, 31 July 2014.

Newell, Richard G., and Stu Iler. *Global Energy Outlooks Comparison Methods*. Riyadh, Saudi Arabia: International Energy Forum, February 2017.

Organization of the Petroleum Exporting Countries (OPEC). *2018 World Oil Outlook 2040*. Vienna: OPEC Secretariat, September 2018. Accessed 14 October 2018. http://www.opec.org.

Shell. *World Energy Model: A View to 2100*. Shell International BV, 2017. Accessed 14 October 2018. http://www.shell.com/scenarios.

Treverton, Gregory F., and Seth G. Jones. *Measuring National Power*. Santa Monica, CA: RAND Corporation, 2005.

U.S. Energy Information Agency. *Annual Energy Outlook 2018*. Washington, DC: U.S. Department of Energy, 6 February 2018.

World Energy Council. *World Energy Scenarios: Composing Energy Futures to 2050.* London: Regency House, 2013.

Xu, Xiaojie. *China Energy Outlook (2015-2016)*. Beijing: Chinese Academy of Social Sciences, September 2015.

Websites

Canada Guide. "Canadian Foreign Policy." Accessed 22 April 2019. http://www.thecanadaguide.com/basics/foreign-policy/.

Central Intelligence Agency. "The World Factbook." Accessed 15 March 2019. https://www.cia.gov/library/publications/the-world-factbook/.

Cuggy, Emily. "Canada's Declaration of Independence." Canada's History. Accessed 15 April 2019. https://www.canadashistory.ca/explore/politics-law/canada-s-declaration-of-independence.

Daiss, Tim. “Citi: U.S. To Become World’s Top Oil Exporter.” OilPrice, 2 May 2018. Accessed 14 October 2018, https://oilprice.com/Energy/Energy-General/Citi-US-To-Become-Worlds-Top-Oil-Exporter.html.

DePersio, Greg. “How does the price of oil affect Russia’s economy?” Investopedia, April 30, 2018. Accessed 14 October 2018. https://www.investopedia.com/ask/answers/030315/how-does-price-oil-affect-russias-economy.asp.

Gaffney, Frank, Jr. “The Economic Element of National Power.” Center for Security Policy, December 14, 2004. Accessed October 14, 2018. https://www.centerforsecuritypolicy.org/2004/12/14/the-economic-element-of-national-power-2/.

Government of Canada. “Canada’s bilateral relations.” Accessed 22 April 2019. https://international.gc.ca/world-monde/international_relations-relations_internationales/bilateral_relations-relations_bilaterales.aspx?lang=eng.

———. “Canada Treaty Series.” Accessed 22 April 2019. https://www.treaty-accord.gc.ca/cts-rtc.aspx?lang=eng&_ga=2.141756475.842139710.1554221750-666526143.1554221750.

———. “Current sanctions imposed by Canada.” Accessed 22 April 2019. https://international.gc.ca/world-monde/international_relations-relations_internationales/sanctions/current-actuelles.aspx?lang=eng.

———. “Exports and imports of goods and services, annual, 1971 - 2011.” Accessed 22 April 2019. https://open.canada.ca/data/en/dataset/25ab9dfd-7152-4c30-8333-b08c21f83155.

———. “Partnerships and Organizations.” Accessed 22 April 2019. https://international.gc.ca/world-monde/international_relations-relations_internationales/partnerships_organizations-partenariats_organisations.aspx?lang=eng#a1.

Hufbauer, Gary Clyde, Jeffrey J. Schott, Kimberly Ann Elliott, and Barbara Oegg. “Summary of Economic Sanctions Episodes, 1914-2006.” Peterson Institute of International Economics, May 2008. Accessed 14 April 2019. https://piie.com/summary-economic-sanctions-episodes-1914-2006.

International Energy Agency. “Energy Security.” Accessed 15 October 2018. https://www.iea.org/topics/energysecurity/.

Kristopher, Gordon. “Why is the Breakeven Price of Crude Oil So Important?” Market Realist, 15 January 2015. Accessed 24 December 2018. https://marketrealist.com/2015/01/breakeven-price-crude-oil-important.

Mandel, Matt. “Experts: Shale Revolution Has Improved U.S. Energy Security and is ‘Shifting the Geopolitical Balance’.” Energy in Depth, 25 May 2018. Accessed 15 October 2018. https://www.energyindepth.org/experts-shale-revolution-improved-u-s-energy-security-shifting-geopolitical-balance/.

Ritchie, Hannah and Max Roser. “Fossil Fuels.” Our World in Data. Accessed 22 April 2019. https://ourworldindata.org/fossil-fuels.

Robert Strauss Center. “The Fungibility of Oil,” Accessed 14 October 2018. https://www.strausscenter.org/energy-and-security/.

———. “The National Security Implications of New Oil and Gas Technologies.” Accessed 14 October 2018. https://www.strausscenter.org/energy-and-security/.

———. “The Oil Market: A Global Bathtub.” Accessed 14 October 2018. https://www.strausscenter.org/energy-and-security/.

———. “The Oil Weapon.” Accessed October 14, 2018. https://www.strausscenter.org/energy-and-security/.

———. “The U.S. Shale Revolution.” Accessed 14 October 2018, https://www.strausscenter.org/energy-and-security/the-u-s-shale-revolution.html.

Rosenberg, Matt. “The Warsaw Pact History and Members.” ThoughtCo, 30 September 2018. Accessed 29 April 2019. https://www.thoughtco.com/warsaw-pact-countries-1435177.

The Natural Gas Solution. “Increasing America’s Energy Security.” 2018. Accessed 24 December 2018. http://naturalgassolution.org/increasing-americas-energy-security/.

The World Bank. “Net bilateral aid flows from DAC donors, Canada (current US$).” Accessed 22 April 2019. https://data.worldbank.org/indicator/DC.DAC.CANL.CD.

U.S. Energy Information Agency. “Dry Natural Gas Consumption, 2017.” Accessed 13 November 2018. https://www.eia.gov/beta/international/rankings/#?prodact=26-1&cy=2017&pid=26&aid=2&tl_id=2-A&tl_type=a.

———. “Dry Natural Gas Production, 2017.” Accessed 13 November 2018. https://www.eia.gov/beta/international/rankings/#?prodact=26-1&cy=2017.

———. “How much coal is in the United States?” 15 November 2018. Accessed 20 November 2018. https://www.eia.gov/energyexplained/index.php?page=coal_reserves.

———. “How much petroleum does the United States import and export?” 3 October 2018. Accessed 14 October 2018. https://www.eia.gov/tools/faqs/faq.php?id=727&t=6.

———. “Oil: Crude and Petroleum Products Explained.” 19 June 2018. Accessed 15 October 2018. https://www.eia.gov/energyexplained/index.php?page=oil_home.

———. “What Countries are the Top Producers and Consumers of Oil?” 9 April 2018. Accessed 14 October 2018. https://www.eia.gov/tools/faqs/faq.php?id=709&t=6.

———. “What is Renewable Energy?” 13 July 2018. Accessed 15 October 2018. https://www.eia.gov/energyexplained/index.php?page=renewable_home.

Other Sources

Joint Chiefs of Staff. Joint Publication 1, *Doctrine of the Army Forces of the United States*. Washington, DC: Government Printing Office, 12 July 2017.

The National War College. *A National Security Strategy Primer*. Washington, DC: National Defense University, 2017.

U.S. Congress. House. Committee on International Relations. *Oil Diplomacy: Facts and Myths Behind Foreign Oil Dependency*. Statement of Dr. Daniel Yergin, Chairman, Cambridge Energy Research Associates. 107th Cong. 2d sess., June 20, 2002.