Summer 2014

Explaining Nuclear Energy Pursuance: A Comparison of the United States, Germany, and Japan

Lauren Emily McKee
Old Dominion University

EXPLAINING NUCLEAR ENERGY PURSUANCE: A COMPARISON OF THE UNITED STATES, GERMANY, AND JAPAN

by

Lauren Emily McKee
B.A. May 2004, University of Southern Mississippi
M.A. August 2007, University of Southern Mississippi

A Dissertation Submitted to the Faculty of
Old Dominion University in Partial Fulfillment of the
Requirements for Degree of

DOCTOR OF PHILOSOPHY

INTERNATIONAL STUDIES

OLD DOMINION UNIVERSITY
August 2014

Approved by:

Steve Yetiv (Director)

Francis Adams (Member)

Heidi Schlipphacke (Member)

ABSTRACT

EXPLAINING NUCLEAR ENERGY PURSUANCE: A COMPARISON OF THE UNITED STATES, GERMANY, AND JAPAN

Lauren Emily McKee
Old Dominion University, 2014
Director: Dr. Steve Yetiv

Energy is critical to the functioning of the global economy and seriously impacts global security as well. What factors influence the extent to which countries will pursue nuclear energy in their overall mix of energy approaches? This dissertation explores this critical question by analyzing the nuclear energy policies of the United States, Germany and Japan. Rather than citizen opposition or proximity to nuclear disasters, it seems that a country's access to other resources through natural endowments or trading relationships offers the best explanation for nuclear energy pursuance.

For my mother, who always knew I could.

ACKNOWLEDGEMENTS

My greatest debt of gratitude is owed to my director and mentor, Dr. Steve Yetiv, whose support and guidance on matters of career, school and "real-life" have proven immeasurably valuable and entertaining. I also have to thank my dissertation committee members, Drs. Heidi Schlipphacke and Francis Adams. Dr. Schlipphacke has been an endless source of encouragement, offering her time and energy as both a teacher and role model. Her combination of professionalism and warmth I constantly try to emulate. Similarly, I owe many thanks to Dr. Adams, who, in addition to offering his time as a dissertation committee member, has also presented me with numerous teaching opportunities in the Political Science and Geography Department for which I will always be grateful. I must also thank Dr. Regina Karp, who has been my go-to "voice of reason" and who gives of herself so freely to help GPIS students. She has been a valuable source of advice for me as a female scholar just starting out, especially in a field and profession where there are still regrettably few women.

My international education would have been incomplete without the friendship of my fellow GPIS students, especially Wiebke Lamer, Renata Giannini, Alessandro Shimabukuro, Carlos Teixiera, Degi Betcher, Katerina Oskarsson, Jeff Mistich, and Sagar Rijal. They all deserve my respect for constantly challenging my perceptions of the world and my deepest appreciation for the community we created in a place where we were all from somewhere else. Special thanks to Wiebke for her insights on Germany, her translations of challenging German words over 35 characters, and her willingness to always "conference" with me.

Finally, I must thank my friends and family who have long supported my dream of getting a Ph.D. and my sometimes "wild and weird" ideas about seeing and studying the world. Thanks are owed to my father, Michael McKee, who inspired my curiosity for what lay beyond Mississippi when I was very young. My oldest friends each deserve my gratitude: Amanda Mills Blackledge, who always knew I was "going places;" Matt Wilson, who can always offer an American perspective; and Bethany Mills Rigney, who always keeps me humble. I also owe a debt to Reggie Shoemake, who did not get to see me finish but was confident that I would. Lastly and most deeply, I must thank my mother, Sheila Shoemake, who instilled my love of and respect for reading and learning and who has always believed in my capabilities, even and especially when I didn't believe in myself. I am absolutely sincere when I say this dissertation and Ph.D. would not have been possible without her constant love and support.

TABLE OF CONTENTS

Chapter Page

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

It was in 1818 that Mary Shelley first published the tale of Dr. Frankenstein and his monster in *Frankenstein; or Prometheus Unbound,* a novel which tells of man's need to use science for innovative creation and the ways in which those creations can be man's undoing. A controversial novel published in the midst of the 19th century scientific enlightenment, thoughts of Dr. Frankenstein's monster would again come to mind in July of 1945 when the United States conducted the first test-detonation of the nuclear-powered atomic weapon that would later be used as a prototype for the bomb that was dropped on Nagasaki, Japan, in August of the same year. It would not be until 1954, nine years later, that nuclear power would be harnessed to create energy for a power grid at the former Soviet Union's Obinisk Nuclear Power Plant. Since then, nuclear energy has proven to be a man-made power that theoretically has the potential to free humans from their dependence on fossil fuels for clean energy yet has remained controversial for many reasons.

To its favor, nuclear power is a sustainable energy source that cleanly produces electricity without releasing carbon emissions into the atmosphere and can increase energy security by reducing foreign dependence on other energy sources. Despite these positive attributes, fear still persist that the costs of nuclear technology outweigh the potential benefits. Past nuclear disasters have demonstrated the consequences of the potential instability of nuclear energy production, such as the spread of radiation leakages over large geographical distances and the contamination of water supplies. The storage of

nuclear waste is also a controversial issue as well as health-related side effects in communities where nuclear reactors operate. The spread of nuclear technology to terrorist groups or unstable states for use as weaponry is also of concern to the international community. Pro-nuclear supporters claim that tougher safety regulations and increased security measures can solve most of these problems associated with nuclear energy, and any risk incurred is worth the independence from dirty and expensive fossil fuels that nuclear energy could provide.

The arguments for and against nuclear energy are many and varied, and it would be a difficult task to credit one side as being any more correct than the other. Rather than pursue such a line of inquiry, this project will instead attempt to methodically and objectively identify which variables seem to be most important in determining a country's nuclear energy policy. In other words, this project seeks to offer an explanatory theory for contemporary decisions about pursuing or not pursuing nuclear energy in the United States (US), Germany and Japan. The impetus for this project began with the March 2011 nuclear incident at the Fukushima Daiichi nuclear plant and the varying responses different countries around the world had to this occurrence. While all expressed concern for the victims of what came to be known as the "triple disaster" related to the Tohoku Earthquake, the resulting tsunami, and the nuclear disaster, what I found most interesting was the way this event caused countries to react to nuclear technology within their own borders. The US, for example, continued its pursuance of nuclear energy and, in early 2012, the Nuclear Regulatory Commission (NRC) even approved the first new reactor construction project in early since 1978. In the months following March 2011, Germany gradually revealed an energy plan that would include

completely abandoning nuclear energy by the year 2022 and a renewed focus on renewable energy alternatives based on wind and photovoltaic (solar) sources. Japan, a country still dealing with forced evacuations of thousands of people from Fukushima Prefecture and attempts at radioactivity contamination and reactor decommission, chose to close all reactors in operation over the course of 2011 and 2012 for safety reevaluation; however, the current energy plan for Japan's future includes continued reliance of nuclear energy.

And so the puzzle of post-Fukushima nuclear energy policy had begun to unfold. Why would German Chancellor Angela Merkel choose to abandon nuclear energy when she and her majority Christian Democratic Party (CDU) had run (and won) in 2009 on a pro-nuclear platform, even voting to extend the lives of existing reactors another two decades? The majority Democratic Party of Japan and 2011 Prime Minister Naoto Kan similarly vowed that Japan would move away from nuclear energy, but a 2012 landslide victory for the Liberal Democratic Party (LDP) reversed that course and current Prime Minister Shinzo Abe assures citizens that nuclear energy is necessary for economic growth. As a counter-balance to these reactions, the US chose to increase its reliance on nuclear energy through the construction of new nuclear reactors. It was because of these varying reactions to Fukushima that these three countries were chosen as particularly suitable cases to study, but also because these three countries are so similar in many regards: all economically developed, wealthy, democratic, "Western" countries. By controlling for these similar variables, this project will attempt to explain the differences in their current nuclear energy policies by testing various hypotheses in each case to determine their impact on nuclear energy pursuance.

The first hypothesis that will be tested is that countries where public opinion is more favorable toward nuclear energy are more likely to pursue nuclear energy. Conversely, countries where public opinion in opposition to nuclear energy is higher will be less likely to pursue nuclear energy. Public opinion will be measured by using polling data collected within each country that asks variations of questions related to approval of nuclear energy. In a perfect world, this polling data would be collected by the same independent source in each country at the same intervals of time over a number of years by asking a similar sampling of respondents the same question. Unfortunately, this type of data does not exist. Even so, reliable opinion polling information is nonetheless available in each country, and that information is what will be used here. The idea behind including public opinion as an independent variable is that, especially in strong democracies represented by these three case studies, society possesses some agency in influencing government decisions. Opinion polling alone may not reflect this, so a qualitative analysis of actions related to shifts in public opinion, specifically, recent voting patterns and protest activity, are also included as a supplement to this variable.

The second set of hypotheses to be tested deal with nuclear accidents, specifically, Three Mile Island (1979), Chernobyl (1986), and Fukushima (2011). This section will partially incorporate data from opinion polls conducted over time to explore whether past nuclear disasters have had any correlating impact on approval for nuclear energy. The hypothesis is simply that nuclear disasters, regardless of where they happen, negatively affect decisions to pursue nuclear energy. Each disaster is examined in each case study by examining levels of nuclear energy output, reactors approved over time to look for decreases of each following Three Mile Island, Chernobyl and Fukushima. I additionally

discuss any changes to nuclear energy policy in the US, Germany and Japan following these disasters.

The final hypotheses focus on domestic resources and international and regional energy trading relationships. The hypothesis is that the greater a country's endowment of natural resources (oil, coal and natural gas) the less likely it will be to pursue nuclear energy while countries that lack natural resource endowments will be more likely to pursue nuclear energy. Additionally, countries that have reliable and affordable trading options for energy resources are less likely to pursue nuclear energy while countries that lack reliable and affordable energy trading options are more likely to pursue nuclear energy. Here, "reliable" trading options are defined broadly as trading partners that possess stable supplies of energy resources and are likely to continue exporting this energy resource into the foreseeable future. "Affordable" is defined as a price that is comparable to prices other countries are paying for the same energy source without adding on additional expenses for lengthy transport or to construct additional infrastructure to receive imports. This variable attempts to capture countries' likelihood to pursue nuclear energy in light of other possible energy options that may be available to them either because they have access to domestic resources or because they can easily and cheaply obtain them from other sources. This hypothesis will be tested by first looking at what other energy sources make up electrical energy generation, where those energy sources come from, and then qualitatively analyzing both the future availability of those resources and the current and projected future prices of those sources. For example, if a country has an abundant source of domestic natural gas, oil or coal, it will be more likely to use those sources rather than choose nuclear energy. Or, if a country has

a friendly trading relationship with other countries that possess these natural resources and this trading relationship allows the country to buy them at reasonable prices, then that country will also be less likely to pursue nuclear energy.

By examining these variables in the US, Germany and Japan, this project will make three important contributions to the existing body of knowledge. First, it will update the existing literature on nuclear energy policy since the Fukushima disaster of 2011. This course of questioning is not necessarily new, as will be demonstrated in the following section that contains a literature review. It is, however, one of the first studies to take up the topic of the future viability of nuclear energy since Fukushima. Secondly, this is also one of the only studies to include an Asian country as a case study together with the US and a European country. Past studies have been much more likely to compare the US and Sweden, or the US and Germany, or to include France in a similar constellation of cases. Any current or future project would be remiss to not include Japan as it presents an opportunity to study the direct impact of a nuclear disaster on resolve to pursue nuclear energy. Since Japan is normally classified as a Western country in terms of both democracy and economic development, it possesses the necessary control variables to methodologically justify inclusion in this study. Lastly, this project's overall goal is both explain current nuclear energy pursuance as well as offer future predictions as to the future viability of nuclear energy as a power source.

The format of this project is as follows: the second chapter will offer a look at the existing literature on nuclear energy beginning around the time of its first use as an atomic weapon in World War II and subsequent development around the world as a civilian energy source. This familiarizes the reader with a general history of nuclear

development, the conclusions of existing comparative studies, and illustrates what this particular project has to offer within this body of work. The second, third and fourth chapters are case studies on nuclear energy in the United States, Germany and Japan, respectively. Each case study follows roughly the same format of first offering a more detailed history of nuclear energy development in each country, followed by sections that engage the issue of public opinion, nuclear disasters, and access to other resources. Each individual case study finishes with conclusions drawn from that particular case study. The sixth chapter offers an integrative analysis that examines the three case studies taken together and draws broader conclusions about nuclear pursuance in the three cases and how those conclusions can be adapted to apply to other democratic, economically developed countries. The final, concluding chapters first develops an energy outlook for the United States, Germany and Japan. Lastly, the primary conclusions of the study are "tested" in three countries (Russia, China and Ukraine) that do not possess the control variables of democracy and economic development to determine the conclusions' applicability beyond the democratic, developed world.

CHAPTER 2

LITERATURE REVIEW

This literature review will first offer a general overview of the very early development of nuclear energy and the debate surrounding it since the 1940s. For clarity's sake, the academic literature on the subject of nuclear energy is then divided into three phases, the first from the 1950s until the 1986 nuclear disaster at Chernobyl; the second from Chernobyl until the 2011 disaster at Fukushima; and the third from Fukushima looking forward. Finally, this literature review will focus on comparative literature that has been produced thus far, dating from 1977 to the present.

Background Literature

Nuclear fission refers to the process in which an atom divides into smaller parts, thereby releasing a very large amount of energy. This manner of "splitting" is descriptively fitting, considering nuclear technology has been a mixed blessing since its first public use on the 6th of August, 1945. Nuclear technology has the potential to be both constructive and destructive, and the difference between the peaceful and harmful natures of the split atom has more to do with politics than with physics. It seems an almost cruel irony that an energy source once deemed "too cheap to meter"[1] also possesses the potential to be the most powerful and destructive weapon that humans have ever created. While the bombing of Hiroshima and Nagasaki showed the world the dark side of nuclear technology, nuclear energy supporters worked diligently in the decades that followed to demonstrate that nuclear technology could be used for good, too. This

[1] Quote credited to Lewis Strauss in a speech to the US Atomic Energy Commission, 1954.

legacy of duality has followed nuclear energy throughout the decades, beginning truly in the 1950s and continuing even today.

The 1950s and 1960s were known as "The Atomic Age," or a time when optimism for nuclear energy was at an all-time high. James Mahaffey notes that, in retrospect at least, "the post-World War II years were wildly optimistic and forward-looking, and it was an optimum time to explore new ideas for energy production"[2]. In 1953, American President Dwight D. Eisenhower delivered his "Atoms for Peace" address, assuring audiences that his country wanted to be "constructive, not destructive." Lewis Strauss, of the infamous "too cheap to meter," claim, went on to say in the same 1954 speech to the Atomic Energy Commission that people were entering an age in which their children

> ...will know of great famines in the world only as matters of history; will travel effortlessly over the seas and under them and through the air with a minimum of danger and at great speeds, and will experience a lifespan far longer than ours, as disease yields and man comes to understand what causes him to age. This is the forecast of an age of peace.[3]

It would be difficult to find a speech that better illustrates the optimism of many governments in the world during the 1950s, though many people still had to be convinced that nuclear power should not necessarily be associated with mushroom clouds, craters, and vaporization.

The majority of the nuclear-focused scholarly literature that accompanied the years of the 1950s and 1960s can be grouped into two main subject areas: 1) debates on

---

[2] James Mahaffey, *Atomic Awakenings: A New Look at the History and Future of Nuclear Power* (New York: Pegasus Books, 2009), XV.
[3] Mahaffey, *Atomic Awakenings,* XVI.

the decision to use atomic bombs against Japan and nuclear weaponry in general[4], and 2) speculation as to the future of nuclear technology as a power source.[5] Perhaps the most well-known of the works on nuclear proliferation is Kissinger's *Nuclear Weapons and Foreign Policy* (1957, 1st ed.) in which he argues that the limited use of nuclear weapons need not necessarily escalate into a situation of mutually assured destruction. It was also during this atomic age that we begin to see the first signs of states' failure to separate nuclear weapons from nuclear energy in the discourse about nuclear energy. The titles of the books published during the 1950s and 1960s alone allude to the multiple dimensions of the nuclear debate at the time; for example, G. Wendt's 1956 book titled *Nuclear Energy and Its Uses in Peace* can be contrasted with John Bowle's 1959 work *Adapt or Perish: The Dilemma of Nuclear Politics*.

Despite the reassurances coming from the Atoms for Peace project, even combined with the air of excitement and optimism coming from the nuclear science community, there were still those who were skeptical of the potential to turn such a dangerous technology into a peaceful means of energy generation without incurring some grave cost, whether political or physical. Bertrand Russell, British philosopher and winner of the 1950 Nobel Prize for literature, was one such prominent anti-nuclear activist. Together with Germany physicist Albert Einstein, the very scientist who had contributed to the creation of the atomic bomb in the 1940s, the two released the *Russell-Einstein Manifesto* in 1955 that called for governments in both the East and the West to

---

[4] See: Shogo Nagaoka, *Hiroshima Under Atomic Bomb Attack*, 1951; Abraham Meyer, *Changing Japanese Attitudes Toward Atomic Weapons* (1954); Henry Kissinger, *Nuclear Weapons and Foreign Policy* (1956); Burr W. Lyson, *Atomic Energy in War and Peace* (1951); John Bowle, *Adapt or Perish: The Dilemma of Nuclear Politics*, (1959); Stephen King-Hall, *Defense in the Nuclear Age* (1959); Pierre-Marie Gallois, *The Balance of Terror: Strategy of the Nuclear Age* (1961).

[5] See: G. Wendt, *Nuclear Energy and Its Uses in Peace* (1956); Donald James Hughes, *On Nuclear Energy: Its Potential for Peacetime Uses* (1957); Werner Heisenberg, *Philosophical Problems of Nuclear Science* (1952); Dewey Larson, *The Case Against the Nuclear Atom* (1956).

come to some agreement abolishing the possession and use of nuclear weapons. "Remember your humanity, and forget the rest," they say, lest we should all choose death because "...we cannot forget our quarrels."[6] The Russell-Einstein Manifesto illustrates the fact that a suspicion of nuclear energy, at the very least, and an out-right rejection of nuclear technology in some instances was occurring in both Europe and the U.S. around the same time. It is Einstein who is often quotes as saying that he knew not with what weapons World War III would be fought, but he suspected World War IV would be fought with sticks and stones, an observation that clearly demonstrates his pessimism for the peaceful use of atomic technology. This duality surrounding the nuclear debate would continue into the 1970s and 1980s, but the events of those decades would introduce a new sense of urgency for testing the viability of energy alternatives, including nuclear energy.

During the 1970s, multiple events coalesced that drastically increased the market price of oil. From 1947-1967, the price of a barrel of oil in United States dollars has risen less than 2 percent. In the 1970s, however, as the U.S. and then Great Britain began floating their currencies and their values depreciated, the Organization of Petroleum Exporting Countries (OPEC) began pricing a barrel of oil against gold. In the years after this "oil shock," OPEC was slow to readjust their prices to reflect the depreciation of currencies around the world. To further complicate matters, in 1973, the Organization of Arab Petroleum Exporting Countries instituted an embargo against Western Israeli supporters that would last until March of 1974. In 1979, political upheavals lowered Iranian production of oil and the resulting increases in the price of oil were felt all around the world as gasoline was rationed, national speed limits were instituted. In Germany, for

---

[6] Sandra Ionno Butcher, "The Origins of the Russell-Einstein Manifesto," *Pugwash History Series*, (2005): 1, accessed June 10, 2011, http://www.pugwash.org/about/manifesto.htm.

example, driving, flying or boating were pastimes all outlawed on Sunday. Japan also sought to decrease its oil consumption, but benefitted from the oil crisis as well through increased export of smaller, more fuel efficient vehicles. In the US, domestic production and exploration were increased. Perhaps most importantly, the need to find alternative forms of energy was finally real and present.

Naturally following these events, there was much scholarship in the 1970s and 1980s that focused on nuclear energy policy. Though much scholarship had been produced in the past decades either espousing the virtues or vilifying the nature of nuclear energy, the first wave of true literature on the politics of nuclear energy and the creation of nuclear energy policy begins at the end of the 1970s and reflects the need policy-makers felt for alternative energy exploration after the oil crises of the past decade[7]. It was also during this time that we begin to see a move in the scholarship to separate the issues of nuclear weapons and nuclear energy, and researchers began to focus on the safety and economic viability of nuclear energy as an alternative. Following the 1979 nuclear incident at Three Mile Island, the marketplace was flooded with books on nuclear power and alternative energy sources. Many were written very quickly to satisfy the public thirst for information on radiation, wastes, nuclear hazards transportation, and other related topics.[8]

---

[7] See: David M. Elliott, Pat Coyne, Mike George, *The Politics of Nuclear Power* (1978); Duncan Lyall Burn, *Nuclear Power and the Energy Crisis* (1978); Kristen S. Shrader-Frechette, *Nuclear Power and Public Policy* (1980); James Everett Katz, *Nuclear Power in Developing Countries: An Analysis of Decision-Making* (1982); Stanley M. Nealey, *Public Opinion and Nuclear* Energy (1983); Eds. William R. Freudenberg and Eugene A. Rosa, *Public Reactions to Nuclear Power: Are There Critical Masses?* (1984) *Walter A. Rosenbaum, Energy Politics and Public Policy* (1987).

[8] See Jerry W. Mansfield, *The Nuclear Power Debate: A Guide to the Literature (1984)* for a full bibliography.

Mansfield claims in his guide to the literature on nuclear energy that in the years leading up to 1984, more books were written against nuclear energy than in support of it.[9] Multiple factors could explain this divergence in the literature. One could speculate that those who are against a movement are frequently more vocal and that nuclear activists had to shout twice as loudly to have their point heard. It could also have been that there was more of a demand in the market for anti-nuclear research, or that the books published against nuclear energy were well-financed by highly visibly anti-nuclear groups. Or, it could be that the proliferation of books supporting the anti-nuclear movement was simply reflective of the general sentiment of the public at the time. In 1986, this debate would become further complicated by the explosion of reactor number four at the Chernobyl plant in current-day Ukraine. Besides fueling the on-going sentiment that the generation of nuclear energy was unsafe, neighboring European countries and environmentalist groups were concerned with the spread of radiation from Chernobyl that, by some estimates, reached Helsinki to the north and Munich to the east.[10]

After 1986, much of the scholarship that was produced in the second wave was published in English and focused on what effects the nuclear disaster at Chernobyl would have on the future of energy policy. Many works attempted to measure public opinion post-Chernobyl, mainly in Western Europe where the nuclear debate was the strongest and most diverse. [11] There was also a strong push to study nuclear technology in the light

---

[9] Jerry Mansfield, *The Nuclear Power Debate: A Guide to the Literature,* (New York: Garland, 1984), 2.
[10] Jim Smith and Nicholas A. Beresford, *Chernobyl: Catastrophe and Consequences,* (Chichester: Springer Books, 2005), 3.
[11] See: Peter Gould, *Fire in the Rain: The Democratic Consequences of Chernobyl* (1990); James M. Jasper, *Nuclear Politics: Energy and the State in the United States, France, and Sweden* (1990); Detlaf Jahn, "Nuclear Power, Energy Policy, and New Politics in Sweden and Germany" (1992). Christian Joppke, *Mobilizing Against Nuclear Energy: A Comparison of the US and Germany* (1992); Koichi Hasegawa, "A Comparative Study of Social Movements in the Post-Nuclear Era in Japan and the United States" (1995); Peter Hodgson, *Nuclear Power, Energy and the Environment* (1999).

of weapons acquisition during this time, and understandably so: both China and India had already tested nuclear weapons and there were rumors that Pakistan would soon follow suit.[12] This wave of scholarship also coincided with the beginnings of the environmental movement, and the narrative of "risk" vs. "benefits" begins to also appear as a theme in the literature.[13] As nuclear energy became an attractive possibility to rapidly developing countries such as China and India, by the turn of the 21st century, studies were being published that examined the nuclear energy programs of developing countries as well as Western ones.[14]

Comparative Literature

The body of true comparative literature on nuclear energy spans a gamut of topics though is mainly limited in geographical scope to Western Europe and the United States. Leon Lindberg is the researcher most often credited with composing the ground-breaking comparative work on the topic of nuclear energy policy *The Energy Syndrome: Comparing National Responses to the Energy Crisis* (1977), a work that examines the construction of the energy policies of 7 countries[15] through a collection of country-specific essays[16]. In the introduction to this work, Lindberg identifies three characteristics common to all of the case studies in the book: 1) continued increases in energy

---

[12] See: John Lewis and Litai Xue, *China Builds the Bomb* (1991); Robert G. Sutter, *Chinese Nuclear Weapons and American Interests: Conflicting Policy Choices* (1983); Geogre H. Quester and the Strategic Studies Institute, *Nuclear Pakistan and Nuclear India: Stable Deterrent or Proliferation Challenge?* (1992); Praful Bidwai and Achin Vinaik, *New Nukes: India, Pakistan and Global Nuclear Disarmament* (2000).

[13] See: Joseph V. Rees, *Hostages of Each Other: The Transformation of Nuclear Safety Since Three Mile Island* (1994); Gwyneth Cravens, *Power to Save the World: The Truth About Nuclear Energy* (2007).

[14] See: M.R. Srinivasan, *From Fission to Fusion: The Story of India's Atomic Energy Program* (2003); Jonothan Benjamin-Alvarado, *Power to the People: Energy and the Cuban Nuclear Program*(2000); Yi-Chong Xu, The Politics of Nuclear Energy in China (2010); Daniel Marcos Bonotto, *The Pocos de Caldas Hot Spot: A Big Blast for Nuclear Energy in Brazil* (2010).

[15] Britain, Canada, France, Hungary, India, Sweden and the United States.

[16] Leon Lindberg, *The Energy Syndrome: Comparing National Responses to the Energy Crisis,* (University of Michigan: Lexington Books, 1977).

consumption 2) public policies that focus almost exclusively on the supply side and 3) institutional and structural obstacles to the adoption of alternative policies, all of which make up what Linberg refers to as the Energy Syndrome, a phenomenon which can explain a lack of policy reform. Ultimately, Lindberg suggests that, as the boundaries of energy policy continue to expand, fundamental reforms must be undertaken to if these energy policy lags and institutional rigidities are to be overcome.

Seven years after the publication of *The Energy Syndrome,* in 1984, Michael T. Hatch notes that the characteristics identified by Lindberg still represent an accurate assessment of present energy policy and that Lindberg's greatest contribution was a recognition that the creation of energy policy was only going to become more complex. Hatch's work *Politics and Nuclear Power: Energy Policy in Western Europe* details the specific responses of West Germany, France, and the Netherlands to this growing complexity of the energy issue[17]. While the central question of his work is what pushed nuclear energy to the top of the political agenda in his chosen cases, his analysis examines the overall evolution of energy policy over time in an attempt to identify clear patterns of cause and effect often muddled by the complexities of energy policy creation. Hatch's research concludes that it was not by chance that anti-nuclear forces became a politicized national movement in the 1970s. While opposition had existed before, it was not until this decade that the movement became cohesive and comprehensive and pushed a rational-analytic strategy of the articulation of energy-related concerns into the national agenda. However, Hatch disagrees with Lindberg's assessment that this politicization of energy concerns would result in a political stale-mate; to the contrary, the opposite is

[17] Michael T. Hatch, *Politics and Nuclear Power: Energy Policy in Western Europe,* (Lexington, KY: University Press of Kentucky: 1984).

illustrated by the varying degrees of success enjoyed by governments in the execution of their overall energy policies[18]. Hatch concludes that, while an analysis of overall decision-making strategies is useful to understating how nuclear energy in particular was pushed to the top of the political agenda, it is less useful in accounting for the different political outcomes in each country.

James M. Jasper takes up this theme of policy divergence in his 1990 comparative study *Nuclear Politics: Energy and the State in the United States, France and Sweden*, which examines reasons why three countries that illustrated similar enthusiasm for nuclear energy ultimately diverged in their commitment to nuclear energy[19]. Jasper takes a state-driven approach to his analysis, largely because "Political conflicts within the state are crucial to an explanation of French, Swedish and American commitments to nuclear energy" (6). Even though decisions made outside the state did matter to some extent, these decisions were shaped by public policies so that the explanation for the decision ultimately leads back to the state. In regard to the anti-nuclear movement, while Hatch states that it politicized the nuclear issue and therefore thrust it onto the political agenda, Jasper claims that the pro-nuclear movement had far more access to political structures such as government agencies and politicians than did the anti-nuclear movement and, as a result, anti-nuclear movements had little effect of nuclear energy policies in any country, therefore making it is impossible to explain the policy divergence by means of the anti-nuclear movement[20]. This lack of efficacy on the part of the anti-nuclear movement supports Jasper's structural state-centered bureaucratic approach,

---

[18] Hatch, *Politics and Nuclear Power*, 191.
[19] James M. Jasper, *Nuclear Politics: Energy and the State in the United States, France and Sweden,* (Princeton, NJ: Princeton University Press, 1990).
[20] Jasper, *Nuclear Politics*, 8.

though it leaves little room for consideration of the role of individuals such as elected officials or scientific elites. In the end, Jasper would acknowledge this shortcoming and others of a purely structural state-centered approach when studying policy creation. His overall conclusion as to the divergence of American, French and Swedish nuclear energy policy lies in the rigidity of policy-making structures. Reminiscent of Linberg's conclusions about nuclear politics and political stalemates, Jasper claims that as the flexibility of policy-makers in all three countries has shrunk in the past ten years, so has the potential for revival or reform of nuclear energy policy.

The scholarship in the 1980s and 1990s focused on the role of the state in determining energy policies, though scholars disagreed to what extent the state is autonomous from traditional, non-bureaucratic influences. Regardless of to what extent a researcher finds it theoretically necessary to follow the lead of scholars such as Theda Skocpol and "bring the state back in" this theme in the literature suggests the general politicization of the production of energy. One influence that reinforces this notion began appearing in the 1980s and 1990s was the presence of Green parties across Europe. The first of these ecological and alternative political groups technically emerged in Britain in 1973, but most European Green parties were not created until a decade or more later. It was not until the early 1980s that the Green Parties of Europe would make significant strides at integration into political structures, especially in Germany where the Green party *Die Grünen* attracted nearly a million votes in the Parliamentarian election and won a significant number of seats for the first time.

German scholar Detlaf Jahn examines the influence of the Green Parties in Germany and Sweden, the social movements from which the party grew, as well as the

popular claim at the time that nations such as Germany and Sweden had reached the limits of their industrialized growth.[21] Jahn claims that these two factors, the increasing popularity of Green parties and the peak of growth, are interrelated and explain the politicization of energy production, thought the extent to which this production is politicized varies among countries. By comparing nuclear energy policy on the one hand and attitudes to and movements against nuclear energy on the other in Germany and Sweden, Jahn arrives at the conclusion that, in Germany, production is much more exposed to politicization than is Sweden and therefore stands a greater chance for new politics to form. Whereas Jasper claimed that Sweden's bureaucratic flexibility left room for potential nuclear policy reform in Sweden, Jahn suggests that Sweden's lack of politicization implied a decreased chance to institutionalize new energy politics. Koopmans and Duyvendak would return to this theme of politicization in 2005[22] to examine the construction of the nuclear "problem" in Germany, France, the Netherlands, and Switzerland after the nuclear disaster at Chernobyl. In an attempt to explain the countries' differing reactions to Chernobyl, the authors conclude that similar conditions and events (like Chernobyl) do not necessarily lead to consensus reactions: to the contrary, Chernobyl led to widely divergent interpretations and levels of antinuclear mobilization in their case countries, exhibited by varying levels of success at slowing down or blocking the expansion of nuclear energy. They ultimately conclude that a combination of the political opportunity and framing perspectives is most fruitful in making sense of the differential careers of the nuclear energy conflict in Western Europe.

---

[21] Detlaf Jahn, "Nuclear Power, Energy Policy, and New Politics in Sweden and Germany," *Environmental Politics,* 1:3 (1992).

[22] Ruud Koopmans and Jan Willem Duyvendak, "The Political Construction of the Nuclear Energy Issue and its Impact on the Mobilization of Antinuclear Movements in Western Europe." *Social Problems*, 42:2 (1995).

While Jahn analyzes environmental social movements as a cause of the politicization of energy production, other branches of nuclear energy research examine these types of movements, particularly that of the anti-nuclear sentiment, as an effect of nuclear politicization. One of the first works on the antinuclear movements in France and West Germany, Dorothy Nelkin and Michael Pollok's *The Atom Besieged: Exparliamentary Dissident in France and Germany*[23], offers a comparative analysis of the nuclear opposition in both countries in the 1970s. Perhaps most interesting is the authors' discussion of their belief that fear is primarily responsible for fueling the nuclear opposition, a sentiment which, in their opinion, is fundamentally altering societal make-up but has little effect on nuclear-related decisions which are made by the government and the nuclear industry. The authors conclude that these broad-based and widespread movements shared many structural similarities but ultimately differed in their ability to influence the decision to pursue nuclear power. In Germany, the protest movement accomplished a (temporary) moratorium on nuclear development by raising questions about the constitutionality of nuclear technology. In France, however, where protest is dismissed an insignificant feature of political culture, ignorance, or demonstrative of popular resistance to change, there were no similar consequences.[24]

As demonstrated, the majority of the comparative research on nuclear energy throughout the 1970s and 1980s focused primarily on Western Europe, particularly Germany, Sweden, and France. Perhaps similar political structures, histories, or political cultures explain this comparative limitation. By the 1990s, however, comparativists

---

[23] Dorothy Nelkin and Michael Pollok, *The Atom Besieged: Exparliamentary Dissent in France and Germany,* (Cambridge, MA: MIT Press, 1981).

[24] Other works by Dorothy Nelkin and Michael Pollok: The Politics of Participation and the Nuclear Debate in Sweden, the Netherlands, and Austria (1977); "Ideology as Strategy: The Discourse of the Anti-Nuclear Movement in France and Germany (1980).

began widening their lens to capture a wider view of the nuclear debate beyond just that of Europe. The first of these comparisons to include the United States, "Political Opportunity Structures and Political Protests: Anti-Nuclear Movements in Four Democracies" (Kitschelt, 1986) compares the antinuclear movements of the United States, Sweden, France and West Germany, though the focus is not necessarily on the impact of the antinuclear movements themselves[25]. Rather, Kitschelt uses the antinuclear movements in each of these countries to arrive at a theoretical generalized understanding of the factors that determine the dynamics of social movements. Echoing the findings of previous researchers, Kitschelt found that in societies where state capacities to implement policies were weak yet the system of inputs from society were strong, such as West Germany and the United States, the antinuclear movement had at least a chance to effect some change on nuclear development. Where state capacities were stronger, such as Sweden and France, the decision making process was shielded from the influence from the antinuclear movement, while Sweden best exemplified the type of society in which a system of inputs and outputs allowed for most policy innovation. These conclusions about the efficacy of the German antinuclear movement and the flexibility of Swedish nuclear policy-making were not necessarily new at the time, though the addition of the United States to the comparative equation was.

In 1990, Dieter Rucht responded to Kitschelt's model of political opportunity structures, claiming that it was too simplistic to adequately explain the diversity of oppositional movement actors, strategies and action repertoires.[26] In 1992, Christian

---

[25] Herbert Kitschelt, "Political Opportunity Structures and Political Protests: Anti-Nuclear Movements in Four Democracies," *British Journal of Political Science,* 16 (1986).
[26] Dieter Rucht, "Campaigns, Skirmishes and Battles: Nuclear Movements in USA, France and West Germany" *Organization and Environment,* 4: 1990.

Joppke would again take up this debate in his work *Mobilizing Against Nuclear Energy: A Comparison of the US and Germany*[27]. Similar to the work by Rucht and Kitschelt, his topic harkens back to previous work that attempted to assess the role of the state in energy policy decision making. Joppke uses the antinuclear movements as a medium to studying social movements and ultimately develops a political process perspective that focuses on the interrelationship between the state and social movements, thus bringing the state back into the study of process, but also incorporates a state-and-society approach that would later be popularized by Joel Migdal. Joppke's model takes into account a variety of forces, including different state structures, political cultures, and movement organizations. Whereas including the United States in comparisons previously presented a theoretical hurdle, researchers such as Joppke used its inclusion as a way to strengthen theoretical models with their application to countries with different structures, cultures, and organizations. Though the intent of these types of studies was a contribution to the theoretical study of social movements, they also contributed to a better understanding of the politics of nuclear energy as well.

The first study to turn its focus to the nuclear politics of non-Western countries was that of Koichi Hasegawa in his 1995 article "A Comparative Study of Social Movements in the Post-Nuclear Era in Japan and the United States."[28] In contrast with skepticism from the US and other Western countries regarding nuclear energy from the 1970s-2000s, East Asian countries such as China, South Korea and Japan all shared pro-nuclear energy policies. Hasegawa claims this is because of the relative strength of the

---

[27] Christian Joppke, *Mobilizing Against Nuclear Energy: A Comparison of the US and Germany*, (Berkeley, CA: University of California Press, 1992).
[28] Koichi Hasegawa, "A Comparative Study of Social Movements of the Post-Nuclear Era in Japan and the United States," *International Journal of Japanese Sociology*, (1995).

antinuclear movements of countries like the US and Germany compared to Asian countries such as Japan. Using qualitative data studying the antinuclear movements in the US and Japan, Hasegawa studies 1) political opportunity structures 2) resources, actors, and major support base 3) framing based on cultural attitudes in both countries.[29] He concludes that a relatively open and decentralized system in the US allowed environmental groups to become the major influence on the management of energy utilities by stressing efficiency and exploring energy alternatives. For sociopolitical reasons, however, the same influence over nuclear utilities was not shared by the antinuclear movement in Japan.

The most recent scholarship (prior to 2011) on energy reflects new themes and trends in the political debate on energy. Most comparative studies still focus on similar set of countries, but have changed the focus from solely nuclear energy to more comprehensive studies of energy and environmental policies in general. In 2003, Miranda Schreurs widened the scope beyond just nuclear energy to broad environmental politics in her comparative study of American, German and Japanese environmental policy-making.[30] Schreurs and In-Taek Hyun also released an edited work titled *The Environmental Dimension of East Asian Energy Security* in 2007 that examines issues such as water scarcity, fishing and pollution, and climate change policies. In 2009, Martin Chick published a historical comparison of the development of electricity and energy policy in Britain, France and the United States.[31] This shift in focus is understandable as

[29] Hasegawa calls this the "Triangular Model of Social Movement Analysis" (TRIM)
[30] Miranda Schreurs, *Environmental Politics in Japan, Germany and the United States*, (Cambridge, UK: Cambridge University Press, 2003).
[31] Martin Chick. *Electricity and Energy Policy in Britain, France and the United States Since 1945,* (Northampton, MA: Edward Elgar Publishing, 2009).

nuclear energy is now increasingly linked with other topics, such as clean energy goals, economic growth, or energy security and proliferation.

This project is situated within this comparative literature by engaging similar issues as many of these previous works, such as the efficacy of public opinion and the anti-nuclear movement, lasting consequences of nuclear disasters, and regional and international dynamics that play a part in determining a country's overall energy portfolio. However, this project departs from the general literature on this subject in its overall explanatory goals. Whereas many previous works have focused on understanding political processes such as citizen opportunity structures or state capacities by using nuclear politics as a case study, this project's goal is to determine the future viability of nuclear energy by exploring the impact of citizen movements, public opinion, nuclear disasters, natural resource endowments and trading relationships in country-specific case studies. In this way, the independent and dependent variables are reversed and this project thus offers something new to the literature on nuclear energy.

The following chapters will explore each hypothesis in the United States, Germany and, finally, in Japan. These case studies will be followed with a chapter of analysis that unites the three cases with conclusions that return to the original hypotheses and offer an overall explanation for nuclear energy pursuance in each country. The concluding chapter will expand the focus of the study to the issue of nuclear energy in other countries beyond the scope of this project and will offer suggestions for future research on this topic.

CHAPTER 3

NUCLEAR ENERGY IN THE UNITED STATES

Objective

The goals of this chapter on nuclear energy in the United States are to first offer an historical background on the development of nuclear energy in the US. Each country builds their energy portfolio to meet different demands, and an explanation of why and how nuclear energy became a part of the US energy supply mix lends a greater understanding of how citizens view this energy source as well as to what extent the US chooses to use it. Secondly, this chapter aims to explore the relationship between public opinion and nuclear energy in an attempt to determine to what extent positive or negative opinion influences the pursuance of this energy source. "Nuclear energy pursuance" is operationalized as the overall percentage nuclear provides to the electrical energy supply. The hypothesis is that countries with higher levels of public support for nuclear energy will more actively pursue nuclear energy and that in countries where negative opinion is higher, nuclear pursuance will be reduced. Public opinion is measured with opinion polling data supplemented by qualitative analysis of protest activity and recent voting activity related to nuclear political agendas. Next, this chapter will analyze data over time that measures to what extent public opinion and nuclear energy pursuance have changed in response to nuclear disasters at Three Mile Island, Chernobyl, and Fukushima. Lastly, this chapter will turn to an analysis of the US's natural resource endowments and energy trading relationships with other countries. The hypothesis here is that if the US possesses

endowments of natural resources and/or can easily and affordably obtain energy from other sources, it will be less likely to pursue nuclear energy.

Development of Early Energy Policy in the US

Following World War II, nuclear energy was allowed to develop in the US relatively free of political controversy or public input. Because of the highly scientific and technical nature of the subject, there were few politicians, members of Congress or laypeople who had the resources (or desire) to understand nuclear technology. In addition, nuclear technology really began as an issue of national security, not necessarily of energy production, and so was further insulated by the secrecy and security measures surrounding the issue. Following the conclusions of Duffy in *Nuclear Politics in America*, the result of this initial insulation was that early American nuclear energy policy was allowed to grow within a particularly nurturing community composed of four key sets of actors: The Atomic Energy Commission (AEC), the Joint Committee on Atomic Energy (JCAE), the nuclear power industry and the scientist and engineers. This was an important time in American nuclear development. Early enthusiasm for nuclear power and the overwhelmingly positive perception of nuclear potential allowed favorable laws and institutions to develop that would set the stage for nuclear policy for the next two decades.[1]

Atomic Energy Acts of 1946 and 1954

It was originally out of a post-war fear for national security that Congress passed the Atomic Energy Act of 1946, which effectively legislated a continuation of nuclear research and gave the Atomic Energy Commission ownership of all atomic materials, facilities and information from the Manhattan Project. This granting was significant,

[1] Robert J. Duffy, *Nuclear Politics in America,* (Lawrence, KS: University Press of Kansas, 1997), 26.

considering that, at the time of transfer, more than 2,000 military personnel, 4,000 government employees, and 38,000 contactor employees were involved with the project, and the facilities used by the Manhattan Project swept in scope across the United States. The structure of the AEC as well as the five year fixed tenure of its members indicated that Congress intended to make the committee independent of the American president, an action the results of which were two-fold. First, the AEC would be less susceptible to legislative influence. Secondly, this independence reduced presidents' control of and effectively their interest in the program. Interestingly enough, it seems that lack of presidential involvement in nuclear programs has been very common throughout much of the atomic program's history.[2] In addition, all of the information accumulated through the Manhattan Project was marked as confidential and, since nuclear technology was primarily seen in terms of security during this time, almost all of the information the AEC dealt with was marked 'restricted,' further insulating the Commission. Clearly this was intended to be a powerful agency capable of exercising its agenda relatively free of confines.

Because the five members of the AEC were without significant technical knowledge, the 1946 act also created the General Advisory Committee (GAC) which would advise the AEC on "scientific and technical matters relating to materials, production, research, and development.[3] Original members included J. Robert Oppenheimer, Enrico Fermi, (two of the original designers of the US atomic weapon) and Glenn Seaborg, three choices which indicate this committee represented truly the top nuclear scientists appointed by the president. Because of their extensive scientific

---

[2] Duffy, *Nuclear Politics in America*, 56.
[3] Christopher Bosso, Pesticides and Politics: The Life Cycle of a Public Issue, (Pittsburg, PA: University of Pittsburg Press, 1988.), 197.

experience, especially with nuclear technology, the AEC often deferred to the GAC on matters of policy decisions, a behavior that is not uncommon in science and technology policy arenas. In fact, because these two groups worked simultaneously to form congruence between science and policy, they are often seen as a unitary actor.

Within Congress, the Joint Committee on Atomic Energy was chosen for their backgrounds in defense and security rather than for their scientific knowledge. States with national laboratories and atomic facilities were also represented disproportionately on the committee, signaling that the value of the program lay not only in terms of security but also in its "pork barrel" possibilities. The JCAE operated relatively free of hindrance from other Congressional committees for a variety of reasons. First, most of the funds for nuclear technology were earmarked for defense spending at the time. The perception of the program and the Joint Committee as guardians of the atomic secret and its military application lent credibility and legitimized decision-making. Secondly, the theme of specialized knowledge is applicable in this instance as well, since the JCAE became an elite Congressional group to which others consistently and almost without choice deferred to on all atomic matters. Senator Brian McMahon (D-Conn) is noted as saying: "Congress has only the most general idea of what the atomic package contains...So far as atomic energy is concerned, Congress simply lacks sufficient knowledge upon which to discharge its constitutional duties."[4] Without an adequate understanding on nuclear technology, Congress was shy to impose legislative parameters upon its development. The Committee's position was also protected by the perception that one had to be "qualified" to discuss nuclear energy, a perception which the JCAE created and then

---

[4] Frank R. Baumgartner and Bryan D. Jones, *Agendas and Instability in American Politics, (*Chicago: University of Chicago Press, 1993), 72.

strove to reinforce, thus effectively controlling the dissemination of atomic energy information to Congress and the public throughout the 1940s and early 1950s.

Cold War Considerations and the 1954 Atomic Energy Act

In 1954, the Soviet Union began operation of the first nuclear energy power plant at Obinisk, a station which was state-owned but civilian operated. Because the US and the USSR were in the beginning stages of the Cold War and the USSR had already tested their own military nuclear devices, nuclear energy built upon military technology in the US was considered a necessary part of the arms race of the 1950s. The relationship between military and civilian uses of nuclear technology in the US at the time was expansive. For example, private utility companies were given government subsidies to develop nuclear power plants, and "...in 1956 the AEC guaranteed that it would buy the plutonium these plants produced since it was needed for the governmental development of nuclear warheads."[5] By 1957, the US's first commercial atomic plant was ready to begin operation in Shippingport, Pennsylvania.

In an attempt to further the goal of using nuclear energy for peaceful purposes (while also using the by-products for military ones), the Atomic Energy Act of 1954 opened the door to greater private industrial and international participation. Power companies were initially reluctant to invest in nuclear technology with the claim that the high risks of atomic energy production made it unlikely that the generation of nuclear energy could ever be profitable.[6] In response, Congress passed the Price-Anderson Act in 1957 which guaranteed the law would "hold hold harmless [nuclear] licensee and other persons indemnified" from public liability claims arising from nuclear accidents causing

---

[5] Kristin Shrader-Frechette, *Nuclear Power and Public Policy: The Social and Ethical Problems of Fission Technology,* (New York: Springer Publishing, 1980), 10.
[6] Shrader-Frechette, *Nuclear Power and Public Policy*, 10.

damages in total excess of $560 million.[7] Originally, the Price-Anderson Act was meant to only last ten years, with the assumption that the safety and regulatory issues that were of concern to power companies would be resolved within that time frame. The provisions in the Price-Anderson Act were extended in 1965 for another ten years, and then extended again in 1975 and in 1988 the operators' liability was increased from $700 million to $7 billion. The latest revision of this act was a part of the Energy Policy Act of 2005 which passed with strong bi-partisan support and extended the limited liability provision of the act Price-Anderson Act through December 31, 2025. [8]

Because of the nature of the Price-Anderson Act's limited liability for investors and increased payout by taxpayers, it has been controversial through the years, though highly beneficial to electrical companies with nuclear interests. In 1973, a case was brought to the Supreme Court which challenged the act's constitutionality. The court ruled that the act's goal of encouraging private investment in energy technology was not unconstitutional, and the act stood. Many argue that, without this provision, the nuclear industry in the US would never have survived to present day and, if the limited liability provision is cut in the future, utility companies will be unlikely to shoulder the financial burden and risk of constructing nuclear reactors.

Energy Upheaval in the 1970s

After an initial thirty years following WWII in which the same government agency controlled, promoted and regulated the nuclear industry, in 1975 the Energy Reorganization Act separated the promotion and regulation functions of the government

---

[7] Shrader-Frechette, *Nuclear Power and Public Policy* ,17.

[8] According to the American Nuclear Society, the purpose of the most recent incarnation of this act is to limit the liability private investors could potentially face in the event of a nuclear disaster, thus removing a major deterrent from private investment and ensuring greater supply of nuclear energy in the future.

by abolishing the AEC and creating the Nuclear Regulatory Agency (NRA) which is the precursor to the modern Nuclear Regulatory Commission (NRC). Originally, the AEC was given the dual mission to both promote and regulate nuclear energy, which contributed to an early development of regulatory capture between the AEC and the nuclear industry. The circumstances surrounding this change are that the AEC had repeatedly been under fire from courts and the public for failing to effectively regulate nuclear safety standards and for subscribing to the demands of the industry rather than the safety of the people. The Reorganization Act therefore created the NRC for regulation purposes and the Department of Energy for promotion purposes, but there has long been a revolving door between the NRC and DOE—and the nuclear industry. It was also during this time in the early 1970s that, for the first time, nuclear experts and scientists began coming out against nuclear energy by pointing out potential safety hazards in an organization that came to be known as the Union of Concerned Scientists, an organization that would eventually gain significant international membership. By 1971, the doubts of these scientists were beginning to appear in journals and information was being leaked from inside the AEC as to disagreements among staffer scientists, which the AEC is rumored to have tried to cover up. Nelkin and Pollak argue that the nuclear establishment's legitimacy was sustained by its expertise, and when disagreement happened within the establishment, that legitimacy was weakened.[9] As this scientific opposition movement became more vocal, the AEC, which had previously been sheltered from public or governmental opposition, was moved into the public arena.

What had previously been a topic limited to technical scientific discussion, the 1970s saw nuclear energy become an issue of public opinion. The media had previously

[9] Nelkin and Pollak, *The Atom Beseiged*, 85.

shown little interest in nuclear power, so anti-nuclear groups quickly learned that they had to bring the issue to public attention. Ralph Nader, who would later earn the title of the nation's number one critic of nuclear power, became one of the movement's most outspoken. In 1974, he organized a group called Critical Mass, which was designed to coordinate the activities of local anti-nuclear activists by providing them with information and technical expertise. As Duffy notes, like much of the movement activity of the 1970s, participation like Nader's attracted media attention and mobilized grass-roots support across the nation.[10] It was also in the 1970s that a presidential candidate addressed the issue of nuclear energy for the first time during a campaign when Jimmy Carter endorsed an anti-nuclear movement in Oregon. The nuclear industry, which had grown up insulated from outside pressures and criticism, suddenly found itself spending millions of dollars on public relations campaigns to counter its critics.

This gravitation of nuclear energy from protected industry to public topic of debate was magnified by the energy crises of the 1970s. The increase in oil prices from the 1973 Arab Oil Embargo and the 1979 Iranian Revolution had pushed the topic of energy supply onto a wider stage of debate and though it would seem logical to assume these crises helped the prospects of nuclear energy, promoters of nuclear energy now found themselves competing with other alternative forms of energy for government development subsidies. At the same time, government officials began to recognize the need for a more comprehensive long-term energy policy rather than the ad hoc decisions that had been characteristic of energy policy in the past. By 1976, there were 23 committees and 51 sub-committees in Congress that were responsible for energy issues.[11]

---

[10] Mahaffey, *Atomic Awakenings*, 68
[11] Ibid, 70.

Division in the 1980s

The discourse surrounding nuclear energy in the 1980s was drastically different from that of the past two decades. For one, there were two distinct coalitions with differing nuclear agendas. The ant-nuclear coalition of the time was comprised of environmental groups such as the Sierra Club, local citizen intervention groups specific to certain reactors, safety groups like the Union of Concerned Scientists, and officials at state and local levels. The White House slid decisively into the pro-nuclear group with the elections of Republicans Reagan in 1981 and Bush in 1989, both nuclear supporters. Other governmental nuclear supporters included the Department of Energy (DOE) and various elected officials at the state and local levels, and private support came from reactor vendors and suppliers, nuclear utilities and construction firms, other private citizen groups.

Changes in actual energy policy during this time were limited, despite having presidential support again after an anti-nuclear Carter Administration. The nuclear accidents at Three Mile Island in 1979 and Chernobyl in 1986 precluded any serious changes that may have eased safety regulations and encouraged investment, and both presidents were unwilling to expend much political capital in a no-win situation. The two most important exceptions were the revision of the Price-Anderson Act in 1988 that increased the amount the nuclear industry would be responsible for paying should a disaster happen, and various legislation that attempted to find suitable storage for nuclear waste. States began increasingly blocking and protesting federal investigation of sites for nuclear waste repositories within their borders. Disagreements between and among states and federal legislators and bureaucracies continued through the 1980s until, in 1987,

Congress designated Yucca Mountain in Nevada as a repository site, even though the decision was followed by outcry from Western states. Though other storage facilities are now in operation in most states with nuclear reactors, the largest proposed repository to date is still located at Yucca Mountain in Nevada, though the site was closed in 2011 under the Obama administration.

Despite the controversy surrounding nuclear energy in the 1970s and 1980s, most of the working nuclear reactors that are online in the US today came into operation between 1967 and 1990.[12] However, reactors are not generally built until 5-6 years after the sites have been approved and the NRC has reviewed and approved the application for the reactor. By this timetable, most of the reactors in operation today were designed and approved between the late 1950s (when the nuclear sector was still insulated from outside pressures) and the late 1970s, before anti-nuclear opinion really gained ground. No new reactors were approved throughout the 1980s, 1990s, or early 2000s.

1992 Energy Policy Act

By 1990, the US was operating 110 nuclear power plants which accounted for 22 percent of the electricity generated in the US. The problem with the licensing and construction process for these plants approved and built between the 1960s and 1980s was that plants were issued a construction permit based on a preliminary design and the plant's safety issues were not fully resolved until construction was complete, which meant the public did not have the details of the design until after the plant had already been built. The stipulations regarding licensing in the 1992 Act required the safety regulations be moved to the front of the three necessary processes: approval of standard

[12] "Nuclear Power in the USA," World Nuclear Association, last updated March 2014, http://www.world-nuclear.org/info/inf41.html.

designs, early site permits (ESPs), and combined construction permits and operating licenses (COLs). Theoretically, the new process would allow greater opportunity for the public to be involved in the process and ensure that construction companies would build the sites according to the design agreed upon in the license.

In the 1990s the Clinton White House instituted deep budget cuts to reactor technology development and DOE subsidies. By 2005, after the world had seen another steep increase in the price of oil following the American intervention in Iraq and President George W. Bush called for increased production of nuclear power plants, citing nuclear energy as one of the "safest, cleanest sources of power in the world."[13] According to the Government Accountability Office, between 2002 and 2007, nuclear technology received $6.2 billion for research, twice as much as fossil fuel programs received.[14] If the Bush administration began a nuclear renaissance, then President Obama's administration and the current NRC has continued it in 2012 with the first new reactors approval since 1979. Following the Fukushima disaster in Japan, President Obama continued his support of nuclear energy with a public statement that all energy sources have their potential downsides, but all still have to be considered in the array that makes up energy supply.[15] In his 2012 campaign against Mitt Romney (who has also publicly supported pursuing nuclear energy) Obama mentioned nuclear technology as an energy source of the future and has included its pursuance as part of his proposed energy policy, as has Romney. In

---

[13] J.R. Pegg, "Bush Calls for Development of More Nuclear Power," *Environmental News Service,* 28 April 2005.
[14] Ibid.
[15] "Obama Defends Nuclear Energy," NBC News, 16 March 2011. Accessed June 1, 2011, http://www.nbcnews.com/id/42106967/ns/politics-white_house/t/obama-defends-nuclear-energy/#.Uy3V6vldVTk.

2011, following Fukushima, US Secretary of Energy Steven Chu announced the Obama administration would continue to support nuclear energy despite the crisis in Japan.

The history of the early development of nuclear technology and policy in the US is important to this research because it illustrates three main issues that will contribute to the analyses in this project. First, nuclear technology in the US has a long history of being a topic one has to be "qualified" to talk about. This creates a separation of power on 2 levels: at the legislative level, this was seen in the 1940s and 1950s as the AEC created and then perpetuated its own singular legitimacy on the topic of nuclear energy policy. Even when the Energy Reconstruction Act separated the regulatory and promotion functions of the NRC and the DOE, regulatory capture and revolving door practices continued.[16] This perception of qualification excluded public participation in the nuclear debate well in to the 1990s until the 1992 Energy Policy Act. Currently, the public has been granted greater participation in NRC proceedings, and though the general consensus has been that these public hearings and forums during the initial approval stages are exercises for show, calls for more public input are beginning to gain some teeth, evidenced by the recent federal court mandate that the NRC must either allow more public participation in its decision about fire safety at the Indian Point 3 nuclear reactor in New York or provide documented evidence as to why such input is impractical or inappropriate.

Second, nuclear power began as a military imperative in the US. The extent of nuclear power that was demonstrated in WWII coupled with the arms race of the Cold War mean that public perception of nuclear energy developed on a different time-line in

[16] The consequences of regulatory capture and revolving door practices will be discussed in the conclusions section of this chapter.

the US than in other places around the world. Because its development was insulated for so long behind the curtain of national security secrecy, following a war that did not necessarily create wide-spread feelings of governmental mistrust and animosity for nuclear technology among citizens (unlike post-WWII in Germany) nuclear energy did not develop in a cloud of controversy, which only came much later in the 1970s, after most of the reactors currently in use had been approved.

Lastly, this history demonstrates the roots of the anti-nuclear movement in the US, which grew out of a community of scientists rather than from groups of citizens, though scientists were eventually able to mobilize them. In the US, the threat of a nuclear attack, even from the Soviets, was not effectively linked to nuclear energy until the 1980s Cold War arms race build-up, at which point most operating nuclear sites had already been approved. Nuclear energy and nuclear weapons operated in relative separation from one another in the most important years of licensing and building, and the threat of proliferation, though present among the anti-nuclear groups, was a small consideration early-on. These early beginnings also account for the relatively depressed nature of nuclear protest in the US.

Nuclear Public Opinion in the United States

The original hypothesis of this project was that in countries where public support for nuclear energy is high, nuclear energy will have a greater share in a country's overall energy supply. Conversely, in countries where public opposition to nuclear energy is high, there will be less nuclear energy pursuance. This will be tested in the U.S. by first examining public opinion polls that measure American public support for nuclear energy at present as well as over time and in reaction to disasters such as Three Mile Island,

Chernobyl and Fukushima. This data will be compared with nuclear pursuance over time. The hypothesis is that greater public support for nuclear energy will equal a greater pursuance of nuclear energy.

To what extent the US pursues nuclear energy must first be determined. This will be done with two measures, first by looking at the percentage nuclear currently makes up of total electrical energy consumption and secondly by examining the number of reactors that have been approved for life extension and new reactors that have been approved for construction. In 2013, 40 percent of energy consumption in the US was electrical. Of that 40 percent, only 1 percent was supplied by petroleum, while coal provided 37 percent; natural gas, 30 percent; renewable energy, such as hydro-electric, geothermal, solar, wind, and biomass, 7 percent; and nuclear, 20 percent.[17] Figure 1 illustrates this distribution:

[17] "Primary Electrical Energy Consumption by Source and Sector, 2013" US Energy Information Administration, Accessed October 14, 2013, http://www.eia.gov/totalenergy/.

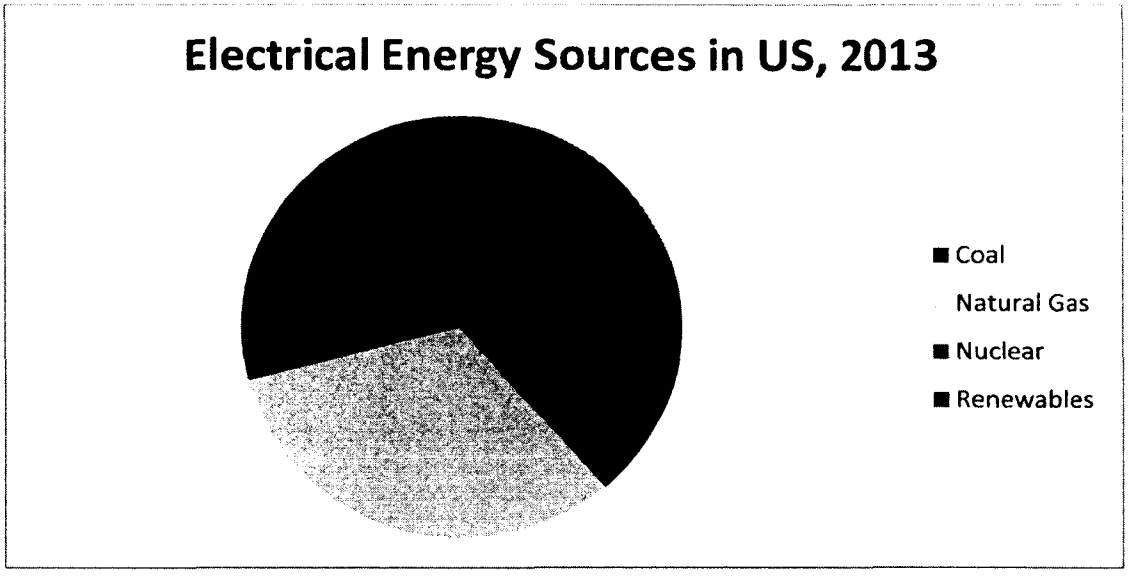

Figure 1: Electrical Energy Sources in the US, 2013.[18]

In addition, 51 plants have applied to extend the life of their existing reactors; of those 51 applications, 42 have been approved and the remaining 9 are still under investigation, which is to say they have neither been approved nor denied. In September of 2007, an application was lodged with the NRC for a new reactor in southern Texas, the first new reactor application in over three decades. There would ultimately be 5 applications for 8 reactors in 2007. The following year, the NRC received 11 applications for 16 new reactors in the US. In 2012, the first new reactor was approved since 1978 for a 2-reactor expansion at the Vogtle plant in Georgia. US nuclear pursuance can currently be characterized as relatively low compared to coal usage at 36 percent and natural gas at 30 percent, but consistent since the mid-1990s. In 1973, nuclear made up 5 percent of

[18] Data compiled by author from United States Energy Information Administration.

overall electrical energy generation. By the early 1990s, that percentage share had grown to roughly 20 percent where it has remained ever since.[19]

In terms of new and existing reactors, the general trend has been for the NRC to approve life extensions for existing reactors, though with the exception of the new Vogtle expansion, few utilities are carrying applications for new reactors through the construction process to completion. In a few additional instances, reactor life expansions have been applied for, have been approved, and then intervening economic circumstances caused plants that were approved well into the future to shut down. For example, in 2008, the NRC approved an operating license for the Kewaunee Power Station located in Carlton, Wisconsin, to extent into 2033; however, the plant ceased operation in May of 2013. According to the press release of the operating utility company, Dominion, the decision was the result of falling wholesale electricity prices due to cheap natural gas, a purely economic decision that in no way reflected disapproval of nuclear energy.[20] In similar circumstances, the Vermont Yankee plant announced in 2013 that it would close in 2014 after receiving an extended operating license, again citing similar economic barriers to continued operation. These occurrences are only marginally important to this section on public opinion, but will be discussed more fully in the later section on endowments of domestic natural resources.

To measure public opinion toward nuclear energy in the US, this research utilizes information gained from a poll conducted by Gallup which asked the same question in yearly polls from 1994 through 2012. When asked "Overall, do you strongly favor,

---

[19] "Primary Electrical Energy Consumption by Source and Sector, 2012" US Energy Information Administration, Accessed October 14, 2013, http://www.eia.gov/totalenergy/.

[20] "Dominion Shuts Down Kewaunee Power Station Permanently," Dominion Press Release, May 17, 2013, Accessed March 22, 2014, http://dom.mediaroom.com/2013-05-07-Dominion-Shuts-Down-Kewaunee-Power-Station-Permanently.

somewhat favor, somewhat oppose, or strongly oppose the use of nuclear energy as one of the ways to provide electricity for the US," in 1994, 57 percent of Americans were in favor of nuclear power, meaning they either answered that they strongly or somewhat favor the use of nuclear energy as one of the ways to provide electricity for the US. The highest level of support was in 2010, when 62 percent of Americans favored nuclear power, and the lowest in 2001, when only 46 percent favored nuclear power. In 2012, 57 percent of respondents again answered that they were in favor of nuclear power, a percentage equal to the response in 1994 and only 5 percent less than positive public opinion at its peak in 2010. Figure 2 illustrates these trends in opinion polling from 1994-2012:

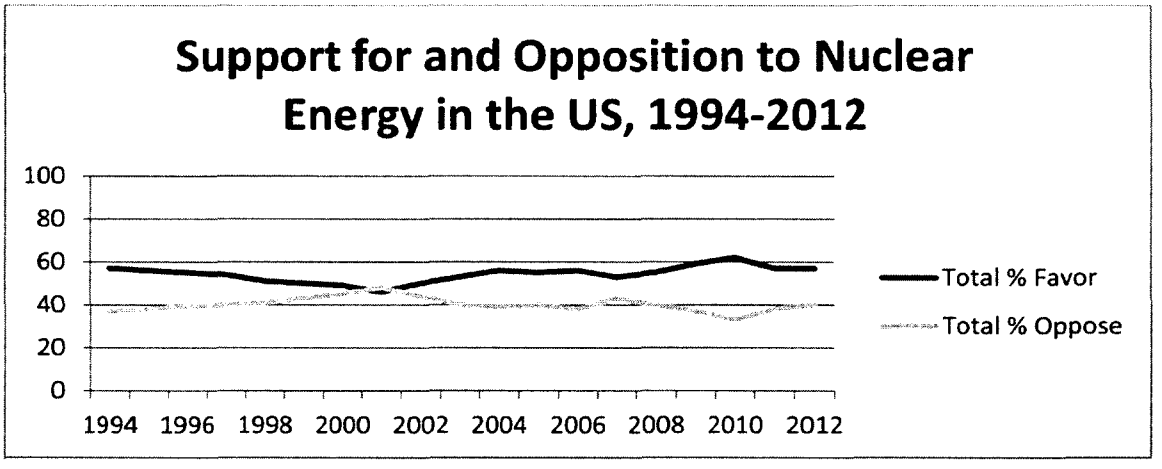

Figure 2: Public Opinion on Nuclear Energy in the US, 1994-2012.[21]

[21] "Americans Still Favor Nuclear Power a Year After Fukushima," Gallup, March 26, 2012, Accessed July 1, 2012, http://www.gallup.com/poll/153452/Americans-Favor-Nuclear-Power-Year-Fukushima.aspx.

A basic analysis of nuclear energy pursuance and public opinion in 2012 alone reveals very little, considering public opinion for nuclear energy only decreased 5 percent from 2010-2012 and public opinion against nuclear energy only increased roughly 7 percent in the same time period. To compare that with nuclear energy pursuance in terms of percentage shares of total energy, nuclear remained steady at from 2010-2012. In this respect, there was little change in either opinion or pursuance. Nor do minute changes in public opinion explain the move in 2011 to approve the first new reactors since 1978. The comparative results of public support for nuclear and nuclear pursuance show that while support has fluctuated over the years, varying from 48 percent support at the lowest and 62 percent at its peak, nuclear pursuance in the US has been consistent since the 1970s, varying only between 18 and 21 percent of overall electrical energy production. Figure 3 demonstrates this relationship between public opinion data (from previously cited Gallup polls) and nuclear pursuance from 2000-2011:

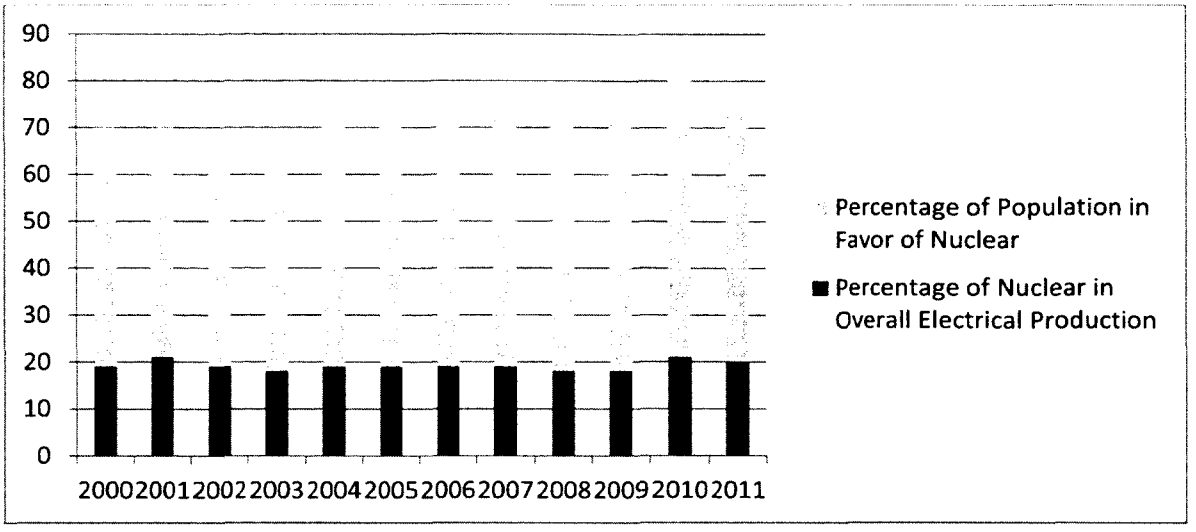

Figure 3: Public Approval and Nuclear Pursuance in the US, 2000-2011.[22]

Similarly, while opposition to nuclear energy varies, nuclear pursuance remains steady. Figure 4 demonstrates this relationship:

[22] Data compiled by author from Gallup poll and US Energy Information Administration.

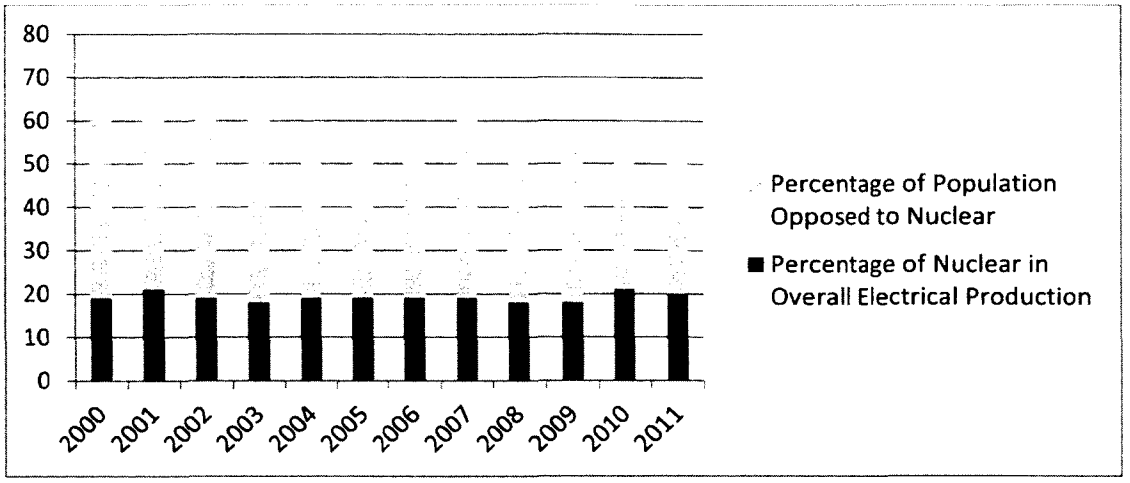

Figure 4: Public Opposition and Nuclear Pursuance in the US, 2000-2011.[23]

The data so far seems to point to a weak relationship between nuclear support or opposition and actual changes in nuclear energy pursuit. Fluctuations in public opinion (which have been small, according to these Gallup polls) have not resulted in any correlating, consistent changes in nuclear output as a percentage share of total energy production. The following section will examine to what extent nuclear disasters had an impact on public approval for nuclear energy as well as any measurable effect on the decision to pursue nuclear energy.

Three Mile Island, Chernobyl, and Fukushima

Nuclear pursuance in the US has varied little since the mid-1990s, but polling data from earlier time periods can be used to measure reactions to the nuclear disasters at the Three Mile Island accident and Chernobyl. Various media outlets reported that global citizen support of nuclear energy dropped directly after Fukushima in 2011, though

[23] Data compiled by author from Gallup poll and US Energy Information Administration.

Fukushima was not the first nuclear disaster of its kind. A smaller, more contained disaster took place at the Three Mile Island facility in Pennsylvania in 1979, and the slightly more well-known disaster at Chernobyl, former USSR, happened in 1986. In order to determine whether Fukushima will have a long-term impact on nuclear pursuance, one can look to similar disasters like Chernobyl and Three Mile Island and measure responses over time for trends which may be applicable in the long-term wake of Fukushima. The hypothesis is that nuclear disasters negatively impact a country's decision to pursue nuclear energy. This variable tries to capture public opinion reactions to disasters that may impact decision to pursue nuclear energy as well as possible post-disaster cost-raising safety enhancements that would create a market-based deterrence to investing in nuclear energy. Rather than using data that merely measures general support or opposition to nuclear energy, this section will use polling data that also measures public support for building new nuclear reactors. The reason for this is that general questions about supporting or not supporting nuclear energy really only engage respondents at a theoretical level, or at a level where there is no risk involved. Asking more specifically about building new reactors makes the response more personal. An additional hypothesis here is that while people support nuclear energy in theory, they are less supportive when it comes to the possibility of a reactor in their community.

The most comprehensive polling data available in the US[24] reveals that, despite data which suggests Americans support nuclear energy in theory (such as that already provided here by Gallup), they have been increasingly opposed to the reality of supporting nuclear expansion in the form of building new nuclear reactors. The data

[24] Eugene A. Rose, "Public Acceptance of Nuclear Power: Déjà vu all Over Again?" *Physics and Society,* 30 (April): 2001.

reveals that, from 1974-1979, fewer people opposed new reactors with the decline in support beginning in 1979 following the Three Mile Island incident; however, that trend was inconsistent. Support for new reactors declined from around 45 percent in 1979 to a low of around 40 percent in February of 1980, but then jumped again to 50 percent support in April of 1980 and declined very little until January of 1982. Opposition to new reactors did spike in February of 1979 from 30 percent to around 45 percent, but then hovered between 45 percent and 40 percent until a sharp increase in opposition in February of 1982. Because there are no significant and consistent increases or decreases in opposition or support following 1979, there is no clear correlation between the disaster at Three Mile Island and levels of public support. Similarly, though nuclear output decreased between 1979-1980 from a 13 percent share to a 10 percent share, in 1981 nuclear output again rose and climbed consistently until 1986.

Similarly, following Chernobyl in March of 1986, there was an increase in opposition for new reactors from around 62 percent to 70 percent, but then opposition levels fell back to 60 percent in April of 1986 and hovered between 60-70 percent until January of 1990. Levels of support for new reactors had dropped to around 30 percent in February of 1986 and rose and fell between 20-30 percent from early 1986 to January of 1990. Again, there is no observable sharp and consistent decrease in levels of public support that would demonstrate a strong and lasting impact on American public opinion resulting from the disasters at Three Mile Island in 1979 or Chernobyl in 1986. Similarly, there is a decrease in nuclear output from 1986-1987 from a 19 percent share to a 16 percent share, but output levels again began increasing in 1988.

Rather than demonstrating that public opinion turned in opposition to nuclear energy after Three Mile Island or Chernobyl, this data suggests that it was neither Three Mile Island nor Chernobyl that caused the most drastic and lasting impact on public opinion for building new reactors, but was rather triggered by the Cold War arms race buildup of the early 1980s. The most dramatic shift in public support for building new reactors happened between the polling in April of 1981 and polling in January of 1982 when, according to this data, opposition overwhelmed support in what proved to be an irreversible trend.

To gauge changes in public support for nuclear energy directly following the Fukushima incident on March 11, 2011, Gallup provides a measure of public opinion on new reactors in the US in 2001 and again in 2011.[25] Table 1 demonstrates the results of polling in regard to the question: "Which comes closer to your view about increasing the number of nuclear power plants in the country—nuclear power is necessary to help solve the country's current energy problems, or, the dangers of nuclear power are too great, even if it would help solve the country's current energy problems?".

[25] "Americans Still Favor Nuclear Power a Year After Fukushima." 26 March 2012. Gallup. http://www.gallup.com/poll/153452/Americans-Favor-Nuclear-Power-Year-Fukushima.aspx

	Percent Nuclear Power is Necessary	Percent Dangers of Nuclear Power Are Too Great	Percent No Opinion
MAR 25-27, 2011	46 percent	48 percent	6 percent
MAY 18-20, 2001	49 percent	46 percent	5 percent

Table 1: Support for and Opposition to New Nuclear Reactors in the US, 2001-2011.[26]

Between May 2001 and 25 March of 2011, directly following the disaster at Fukushima on March 11 of 2011, public opinion on increasing the number of nuclear power plants has remained fairly steady. This data further suggests there has been no substantial diminution in support for nuclear power plant construction over this past decade -- despite the current and highly visible nuclear problems in Japan. This initial reaction to Fukushima showed the American public remained as it was before Fukushima: fairly equally divided in terms of new reactors.

This polling information seems to suggest that, though most Americans support nuclear energy in theory, the practical use of that energy in terms of building new reactors is problematic. When questions about nuclear energy in general are asked, there is moderate to strong support, but that support decreases when the specific question of building new reactors is posed. Respondents may see nuclear as a necessary part of what should make up future energy sources, yet are uncomfortable with the idea of a nuclear reactor in their community. This is a typical "Not In My Backyard" response that is commonly observable in relation to a variety of issues. Most importantly, it is evident from the polling data that support has never consistently decreased in response to

[26] Ibid.

previous disasters. Additionally, despite the immediate dip in nuclear output following Three Mile Island and Chernobyl, nuclear output has always recovered to pre-disasters levels. This negates the hypothesis that nuclear disasters have a negative impact of decision to pursue nuclear energy, and though Three Mile Island and Chernobyl caused temporary "shocks" to both public opinion and nuclear output, neither are long-term effects and the shifts in both are relatively small.

Despite this consistent support for nuclear energy, however, no new reactors were approved in the US for well over three decades, from 1978-2007. This trend of continuing the life of existing reactors but not approving new ones may be congruent with public opinion: Americans believe existing nuclear capacity will play a part in their future energy supply (approval to continue the life of existing reactors) but oppose expanding nuclear capabilities with new reactors (absence of new reactors approved between 1978 and 2012). However, it is unclear what the causal relationship is in this case. Did public opinion cause a shift in nuclear pursuance policy for new reactors after 1978, or was the decrease in building new reactors caused by something else (most likely legal, political and economic road blocks) and the American public interpreted no new reactors as a beneficial shift in policy after Three Mile Island? It is almost impossible to clearly state a clear directional relationship.

The most likely scenario is that the nuclear construction take-off in the early 1970s cost electrical companies far more than they expected and saddled rate-payers with higher bills for decades. Some nuclear reactors approved prior to 1978 continued under construction until the early 1990s, but by 1985 twenty-eight nuclear plants under

construction were cancelled.[27] The Shoreham plant on Long Island, for example, was finished but never brought online. It was not that the NRC was denying applications to build, but that utility companies were simply not applying for them, or were applying, starting construction, and then abandoning projects for various reasons. The costs of building and operating these nuclear facilities with their extensive licensing processes and safety regulations, especially after the public relations challenges of the 1970s and the 1992 Energy Policy Act, became so great that many electrical companies decided the cost would exceed the benefit, which most likely resulted in the decline of new reactors in the following decades. This indicates that the more important relationship in determining whether to pursue nuclear energy with new reactors may be between the government (NRC) and the nuclear industry rather than the government and the public, though markets also play a large role in determining cost-effectiveness and profitability. In order to better understand the nature of the anti-nuclear movement in the US and determine to what extent it had any impact on the decision to pursue nuclear energy, the following section will offer a qualitative analysis of protests and organized movements against nuclear energy in the US.

Nuclear Protest in the US

Historically, protest against nuclear energy in the US gained little momentum until the early 1970s. A government technology that was federally funded and promoted, nuclear energy reactor production was already in full swing by the time the public knew enough about it to protest it. By the time a widespread awareness of nuclear energy became main-stream in the 1970s, the nuclear industry had already received licenses to

[27] Ralph Vartabedian and Ian Duncan, "First New US Nuclear Reactors in Decades Approved," Los Angeles Times, February 9, 2012, Accessed February 27, 2012, http://articles.latimes.com/2012/feb/09/nation/la-na-nuclear-20120210.

build most of the 104 reactors currently in operation in the US. The beginnings of nuclear opposition began in the 1960s not with the public but in elite scientific circles such as the Union of Concerned Scientists, many of whom were working for the government within nuclear regulatory fields. In fact, only 12 percent of all licensing application submitted between 1962 and 1966 were legally contested by local citizen groups.[28] However, between 1967 and 1972, local interveners challenged 73 percent of all applications reviewed in the AEC hearings.[29] Public interest lawyers, many of whom were skilled trial lawyers, entered the fray to represent intervening groups, and many of the hearings became long and acrimonious with much procedural wrangling which continued throughout the 1970s.[30] Though these hearings delayed the commencement of some plants' construction and operation, it is important to note that, in each case where there were such hearings, licenses were granted at the end of the proceedings.

Though no new reactors were licensed in the US from 1978 until 2012, a number of hearings have been scheduled in recent years in response to applications filed with the NRC to extend the operating life of existing plants. Original licenses issued in the 1970s were good for forty years with the option to renew for another twenty. This means that the utility owners of existing plants would begin seeking the option to renew around 1998, allowing for time to proceed through the relicensing process (average time of 3+ years) and make updates and corrections to the facility before the existing license expired. Since 1998, 51 plants have applied for renewed licenses.[31] For example, the

---

[28] Christian Joppke, *Mobilizing Against Nuclear Energy,* 31
[29] Ibid. 31.
[30] Harold P. Green. "Public Participation in Nuclear Power Plant Licensing." *William and Mary Law Review.* 15:3 (1974).
[31] "Fact Sheet on Reactor License Renewal," United States Nuclear Regulatory Commission, Accessed April 5, 2013, http://www.nrc.gov/reading-rm/doc-collections/fact-sheets/fs-reactor-license-renewal.html.

operating license for the Pilgrim Nuclear Generating Station in Plymouth, Massachusetts, was originally scheduled to expire in 2012. In 2006, the Louisiana-based company that owned Pilgrim, Entergy, filed an application with the NRC to extend the operating life of the plant until 2032. The local nuclear watchdog organization, Pilgrim Watch, filed multiple contentions and movements for hearings with the NRC and, according to NRC protocol, hearings were held on behalf of the group and other concerned citizens throughout 2011. The proceedings were open to the public and signs, banners, posters and displays were permitted in accordance with NRC policy.[32]

Despite repeated hearings initiated by Pilgrim Watch, in May of 2012, the NRC eventually approved the 20-year extension for the Pilgrim reactor. In 2011, 18 separate hearings or pre-hearing conferences calls were scheduled to address concerns related to 10 different nuclear operating plants or uranium enrichment facilities, down from 19 hearings in 2010. The lowest number of hearings held in one year between 2006 and 2012 was 2007, in which only 11 hearings were held. In 2012, the number had increased to 22 separate events scheduled to address concerns over nuclear licenses.[33]

In fact, public hearings have taken place for each license renewal application since the first for Calvert Cliffs in 1998, a hearing at which the local Baltimore Sierra Club, among others, filed opposed the relicensing of the reactors.[34] Every application for renewal that was filed between 1998 and 2008 was approved between 2000 and 2011 with the exception of the Indian Point facility filed in 2007. When Indian Point in

---

[32] Docket from NRC proceedings, Matter of Pilgrim Nuclear Power Station. 9 Feb 2011. Docket # 50-293-LR http://pbadupws.nrc.gov/docs/ML1104/ML110400428.pdf.

[33] Atomic Safety and Licensing Board Panel Proceedings, 2012. United States Nuclear Regulatory Commission, Accessed April 30, 2013, http://www.nrc.gov/reading-rm/doc collections/aslbp/proceedings/2012/ .

[34] Kevin McQuaid, "Worries Heard at Nuclear Relicensing Hearing," *Baltimore Sun*. July 10, 1998. Accessed Feb 1 2012.

Buchanan, New York, initially filed for an extension in 2007, the operating utility company asserted that because the buried pipes at the facility do not carry radioactive liquid they were not subject to the aging management review. Two years later in 2009, however, a leak from these pipes containing thousands of gallons of water containing radioactive material proved Baltimore Gas and Electric Company wrong. As a result, New York Attorney General Eric Schneiderman and Connecticut Attorney General Robert Snook began lobbying on behalf of their respective states against the NRC renewing the license for this facility. The operating license is set to expire in December of 2015, but the NRC has given Entergy permission to continue operation while the license renewal application is under review. This is the first instance of a state countering the NRC's relicensing, and also the first instance in which a new license was not granted in the usual 30 month time frame.[35]

Analysis of this information indicates that localized opposition to extending the life new reactors in the form of formal hearings and challenges has been consistently present yet ultimately ineffective, considering every relicensing application since 1998, with the exception of Indian Point, has been challenged during hearings and then approved by the NRC. The significant difference with the Indian Point facility is the anti-licensing lobby of New York and Connecticut as states rather than complaints lodged by individuals or groups. Separate conclusions can be drawn from this information. First, opposition to building new reactors exists in the US, but it is localized rather than nationalized. Nationally, polls reveal that Americans support nuclear pursuance. Opposition to the actual reality of pursuing nuclear energy in the form of building new

[35] With the exception of the relicensing of the Crystal River Unit 3, which has been delayed due to infrastructural damage.

reactors exists, but at a more local level among those who live in the communities where reactors are supposed to be built.

However, that is not to say that significant support in favor of new reactors does not exist within communities where reactors are proposed. The first plant to apply for and be granted a new reactor license since 1978 is a 2 reactor expansion of the Vogtle plant in Georgia. During the public hearing proceedings of April 2008, twelve individuals in total addressed the panel, five speaking in support of the Vogtle license and seven against. Those who spoke in favor of the license mainly represented organizations, such as Citizens for Nuclear Technology Awareness; the Burke County School Board; the Clean and Safe Energy Coalition; Columbia County Chamber of Commerce; Augusta Metro Chamber of Commerce; plus individual citizens from local communities. They cited clean energy, employment benefits, and low electricity prices among the reasons that SNC had their support to expand the Vogtle plant. Those who spoke against Vogtle's license approval were, in contrast, comprised completely of local citizens who did not represent groups or organizations, though it was the local anti-nuclear groups that originally lodged the challenges that instituted the hearings. Their reasons for concern were fairly consistent: pollution in the Savannah River; damage to local fish and animal populations; use of water in a drought area; radioactive contamination; high local cancer rates; waste disposal. [36]

The Voglte expansion public hearing in 2008 can be classified as fairly representative of the relicensing hearings documented since the late 1990s. The interest and governmental groups represented may go by different names, but most of them put

[36] Docket from NRC proceedings, Matter of Southern Nuclear Operating Company Early Permit for Vogtle. 20 March 2008. Docket # 52-011-ESP http://pbadupws.nrc.gov/docs/ML0808/ML080800263.pdf.

forth the same arguments for continuing the life of existing reactors: economic growth, jobs provided, clean energy, and future low energy prices. Local chambers of commerce tend to support keeping and building reactors, as well as local pro-nuclear and environmental groups. Those who tend to oppose the reactors are anti-nuclear groups such as the Sierra Club (which is well represented at many of these NRC hearings) and local citizens with concerns for their personal quality of life related to issues of contamination, cancer, or pollution. As with the applications for renewed licenses, the application for a license to build the two new reactors at Voglte was eventually approved. According to the timeline provided by the NRC, new licenses are generally approved or denied approximately 6 years after their application. SNC applied in 2006, obtained its ESP in August of 2009, and then the COL in February of 2012, right on schedule. The next opportunity for public hearings will occur within the next 6 years during the Plant Construction/Verification stage.

Secondly, this information suggests that citizen complaints and challenges from local interest groups matter little in the approval process of new or existing reactors. What does seem to matter are challenges brought forth on behalf of states in the licensing process. Indian Point provides the first opportunity to follow this process of state opposition in the US system.

Historically, physical demonstrations and protests have been happening in the US since the 1970s. Some took place in Washington DC, such as the 65,000 person protest in 1979, and some in New York City such as the 200,000 person protest in the same year. In 1982, the largest anti-nuclear protest in the US took place in New York City's Central Park. More often than not, these national demonstrations were organized on behalf of

international causes like the International Day of Nuclear Disarmament and Great Peace March for Global Disarmament, and so were politically focused on nuclear weapons rather than nuclear energy. To find specific protests against nuclear energy, one has to look locally. The Clamshell Alliance, for example, was organized in 1976 specifically to take non-violent action against construction of the Seabrook nuclear reactor in New Hampshire. The 4000+ members of the group, known as "clams" have over the years continually engaged in "civil disobedience" with some protests resulting in arrests and the need for National Guard intervention. The Clamshell Alliance inspired similar protests at the Diablo Canyon plant in California by the Abalone Alliance, and then across the nation at other nuclear facilities. Despite these protests, both the Seabrook and Diablo Canyon reactors are currently in operation. There is one instance in the US in which a local community effectively decommissioned a nuclear power plant by public vote in 1989 in Sacramento, California. Though the local community initially voted to embrace the Rancho Seco plant in the mid-1960s, 14 years after its start date they again voted to decommission to plant, citing problems with fuel storage as their chief concern.[37] This remains the sole instance to date in which a reactor already in operation has been decommissioned as a result of public vote.

Similarly, there is only one instance in which such protests are believed to have halted the initial construction of a nuclear facility, the Black Fox facility, which never reached the stage of license application from the NRC. In May of 1973, the Public Service Company of Oklahoma (PSO) announced plans to install Oklahoma's first nuclear power plant in Inola, just south of Tulsa. The local movement against the

---

[37] Andrew Sabey, "Sacramento Shuts Out Rancho Seco," University of California Davis Law Brief, Accessed April 10, 2013. http://environs.law.ucdavis.edu/issues/13/2/articles/sabey.pdf.

building of this plant, lead mainly by a local school teacher named Carrie Barefoot Dickerson, buried the construction plans and licensing process under so much legal wrangling and subsequent construction delays that in 1982, almost ten years after the reactors were first proposed, PSO cancelled the project called Black Fox due to cost overruns resulting from the large-scale community opposition to the reactors themselves and to paying the rate increases necessary to build the reactors.[38] Though her efforts in protesting Black Fox bankrupted her, Dickerson is remembered as being the key actor in the movement that halted the construction of a nuclear facility in the US.

Even in the instance of Black Fox, it is difficult to clearly demonstrate that public opinion against Black Fox's construction was the sole variable driving the decision to abandon the project. The main question here is whether or not PSO would have consented to halt facility construction based solely on reactionary public opinion, or if the abandonment of Black Fox had more to do with the increasing costs of building the reactors the longer the legal wrangling carried on. In the end, the most likely scenario is that negative public opinion created an anti-Black Fox movement that was able to mobilize in a way that created real and costly barriers to continuing construction. After all, similar protests existed in different places and reactor construction proceeded without delay. In Oklahoma, these costly barriers to construction were the key determinant in abandoning Black Fox, without which the movement most likely would not have been as effective.

Ultimately, there is no clear correlation between public opinion and nuclear energy pursuance in the US. The first hypothesis proposed in this project was that the

---

[38] Scott Thompson, "Rogers Woman Who Fought Black Fox Plant Left Lasting Legacy," *Oklahoma's Own,* April 28, 2011, Accessed 28 Sept 2011, http://www.newson6.com/story/14536815/decades-later-claremore-womans-fight-against-black-fox-plant-still-inspiring.

greater the support for nuclear energy, the greater the pursuance and, conversely, the greater the opposition the lesser the pursuance. This relationship between public opinion and nuclear pursuance has proven weak at best in the US. When asked about nuclear energy in general, a majority of Americans consistently support it. When asked specifically about building new reactors, support decreases. Therefore, it is difficult to define what public opinion really is in the US. Support is greater in theory, but less so in practice.

In terms of voting preferences, both major parties, Democrats and Republicans alike, are currently pro-nuclear and support an "all of the above" approach to a comprehensive energy policy. In the 2012 US election, both Democratic and Republican candidates Barack Obama and Mitt Romney ran on a pro-nuclear platform, though nuclear energy was not a central issue in the election, coming in far from first after the economy, healthcare, foreign policy and even after the importance of other energy sources like petroleum and natural gas, which were mentioned more frequently by both candidates during the campaign than was nuclear. The only anti-nuclear political party in the US is the Green Party, which received .3 percent of the overall national total votes. In the US's two-party, winner-take-all system, voters have little motivation to vote for a third party, anti-nuclear candidate when the chances of electing a Green Party President or even Congressional member are slim. Ultimately, American voters are left with only two viable candidates for President, and, in most cases, for Congress, both of which support pro-nuclear platforms.

The greater the protests against nuclear energy the less a country will pursue it has also been shown to be a weak assertion. Though every re-license application has been

formally challenged, they have all been approved. Similarly, challenges were raised for the first new reactor application at Vogtle, which was also approved. The lone exceptions are the Indian Point reactor, which faced intervention from NY and CT states rather than just individuals and organizations (and is still underway); the Rancho Seco plant in California which was abandoned after a negative public referendum; and Black Fox, which stands as the lone example of how protests kept a reactor from being built (though in the end it had more to do with how the protest raised the cost of building the reactor than with push-back from the public).

The second hypothesis, that nuclear disasters negatively impact decision to pursue nuclear energy, is also without strong support. The amount of nuclear energy generated from the early 1980s until 2014 has remained relatively steady, even after Three Mile Island in 1979, Chernobyl in 1986 and Fukushima in 2011. Of course, most reactors in operation now that are generating that steady supply of nuclear power were approved prior to the 1979 Three Mile Island disaster. While it is true that no new reactors were approved after 1978, that is likely due to market considerations rather than safety or public approval issues. Various circumstances in the 1970s coalesced to increase the cost of investing in nuclear energy: expensive public relations campaigns, necessary for the first time to counter an emerging anti-nuclear voice; competition with other resources for subsidization money after increases in the price of oil; and policy enacted by anti-nuclear President Jimmy Carter, specifically the 1978 Energy Tax Act which rewarded citizens with tax credits for home investment in renewable energy all increased the price of initial investment in nuclear energy. This increased cost is the most likely explanation for the lack of new reactor applications after 1978. Though Three Mile Island in 1979 and

Chernobyl in 1986 may have had some reinforcing impact, the market had already established this decline in nuclear energy investment in the 1970s.

Secondary findings in this case are that nuclear disasters—particularly Chernobyl, Three Mile Island and, to the extent that it can be tested now, Fukushima—have no discernible lasting impact on levels of public opinion in the US. Though there may be a momentary dip in support for nuclear energy, levels of support eventually return to pre-disaster levels. Nuclear technology loses the most support when it is militarized in the sight of the public. For example, support after Three Mile Island decreased to a small extent and then rose again, but after the Cold War arms build-up began in the early 1980s, there was a sharp and unrecoverable decrease in support for nuclear energy.

Additionally, this research finds that support of nuclear energy in the US varies nationally and locally. In theory, when asked about using nuclear energy, people tend to support it. However, when asked specifically about building new reactors, there is less support. This is a sort of "not in my backyard" response. When it comes to protesting reactor applications, states are more successful interveners in the NRC licensing process than individuals or organizations. Protests brought about by individuals or organizations have only been successful when they can increase the cost of building a new reactor to the point where it is no longer economically feasible for the electrical company, as in the case of the Black Fox plant.

There should, of course, be some acknowledgement that true public opinion can be a difficult variable to capture. While Gallup is a generally reliable source of polling information, depending on the makeup of the random sampling, the timing and wording

of the questions, and participants' willingness to answer truthfully, the results of any poll may not be representative of the true general feelings of a given population. It is for this reason that a qualitative study of protest activity and voting preferences have been included with public opinion polls as these are the most accessible outlets through which citizens can take action based on their opinions.

Access to Other Resources

Whereas the previous sections sought to determine to what degree public opinion and nuclear disasters influence pursuance of nuclear energy, this section will examine supplies of other electricity-producing resources with the hypothesis that the greater the endowment of or access to domestic natural resources, the less a country will pursue nuclear energy. Renewable sources and petroleum do account for a small percentage of electricity generation in each case, but the share is so small that these energy sources are not yet a sole viable alternative to nuclear in the same way as coal and gas. For this reason, only coal and natural gas supplies will be considered in the US case.

In 2013, coal provided 37 percent of American electrical energy; natural gas, 30 percent; and nuclear, 20 percent. In relying on nuclear for 20 percent of electrical energy needs, the US is the second largest nuclear consumer in the world, following only France. In 2011, nuclear made up a significant portion of overall electrical production in the US, equal to that of natural gas. In the past 2 years, however, natural gas usage has increased from 20 to 30 percent, the result of technological advances in drilling technology that has granted access to natural gas reserves previously unreachable by existing extraction methods. Even with this natural gas boom, coal still remains the largest electrical energy

generation resource, though its usage decreased from 46 percent in 2011 to 37 percent in 2012, the continuation of a general trend of decreasing reliance on coal since 2009.[39]

This hypothesis about nuclear energy in relation to other energy resources can first be examined by looking at consumption statistics over time to determine whether using more coal or natural gas at any given time necessarily equaled a reduction in nuclear generation. Nuclear energy did not have a share in the overall US electrical consumption until 1958, when 2 trillion BTUs were generated from nuclear. Since then, the reliance on nuclear has steadily increased; similarly, reliance on coal has likewise increased steadily until 2012, while reliance on natural gas deceased in the early 1980s only to increase again in the 1990s.[40]

As the US economy has expanded since 1950, there have been general increases in the use of coal, natural gas, and nuclear energy, with the most significant increases coming from coal-produced electricity, usage which only began to decrease in 2009. While there seems to be little relationship between usage of coal and nuclear (both increased steadily) there is a correlation between natural gas and nuclear. When natural gas consumption decreased in the early 1980s, nuclear energy consumption increased. Both consumption levels then remained steady, until the lines cross again in 2012, when reliance on energy sources for electricity in the US saw fairly significant shifts. Coal reduced its share from 46 percent to 37 percent; Natural gas increased its share from 20 percent to 30 percent; Nuclear decreased slightly from 21 percent to 19 percent.[41]

---

[39] Annual Energy Review, 2012, *US Energy Information Administration,* Accessed April 23, 2014. http://www.eia.gov/totalenergy/data/annual/pecss_diagram.cfm.
[40] Annual Energy Review, 2012, *US Energy Information Administration,* Accessed April 23, 2014. http://www.eia.gov/totalenergy/data/annual/pecss_diagram.cfm.
[41] Annual Energy Review, 2012, *US Energy Information Administration,* Accessed April 23, 2014. http://www.eia.gov/totalenergy/data/annual/pecss_diagram.cfm.

The biggest shift in these electrical energy sources came mainly from an increase in natural gas usage, which resulted in decreases in both coal and, to a much lesser extent, nuclear. The explanation here is clearly the intense surge in hydraulic fracturing techniques the US has been experiencing in the past year and the glut of cheap natural gas that increased production is creating. While more natural gas did, in this case, mean a very slight reduction in reliance on nuclear (21 percent to 20 percent) the decrease was negligible compared to the changes in coal consumption (46 percent to 37 percent). Nuclear replaced natural gas in the 1980s as the price of natural gas increased, but as natural gas prices plummet and the US moves to rely less on coal, there may be future increases in both natural gas *and* nuclear.

This fluctuating reliance on different energy choices is not necessarily a new phenomenon, and has consistently been related to energy resource price. The greatest boom for new nuclear reactors in the US occurred in the 1960s and 1970s, when coal was at its highest price and utilities were predicting a robust growth in electrical demand concurrent with economic growth.[42] The 1973 Arab Oil Embargo also resulted in an increase in the price of oil. The price of natural gas, which had historically been coupled with oil prices, experienced the largest increase up to that point in the 1970s when well-head prices rose from .17 dollars per thousand cubic feet (TCF) in 1970 to $1.18 TCF in 1979.[43] It was during this time that most of the nuclear reactors in operation today were applied for and licensed. After oil and gas prices stabilized at higher prices in the 1980s, no new applications for reactors were submitted to the NRC. A second boom in reactor

---

[42] Lucas Davis, "Prospects for Nuclear Power After Fukushima," Energy Institute at Haas, Working Paper Series, Accessed August 10, 2013, http://ei.haas.berkeley.edu/pdf/working_papers/WP218.pdf.
[43] "US Natural Gas Wellhead Price," US Energy Information Administration, Accessed August 10, 2013, http://www.eia.gov/dnav/ng/hist/n9190us3a.htm .

applications occurred in the late 2000s, when natural gas prices were at an all-time high of $6.25 TCF in 2007 and $7.97 TCF in 2008.[44] Similarly, crude oil prices[45] rose around the same time from an average of $56.64[46] per barrel in 2005 to $99.67 in 2008.[47] Finally, coal prices also increased from an average of $51.16 in 2007 to $118.79 in 2009.[48] These recent trends demonstrate that when gas, oil, and coal prices are high, applications for nuclear reactors increase dramatically, from 0 applications in 2006 to 5 applications in 2007 to 11 applications in 2008. Figure 5 illustrates these trends:

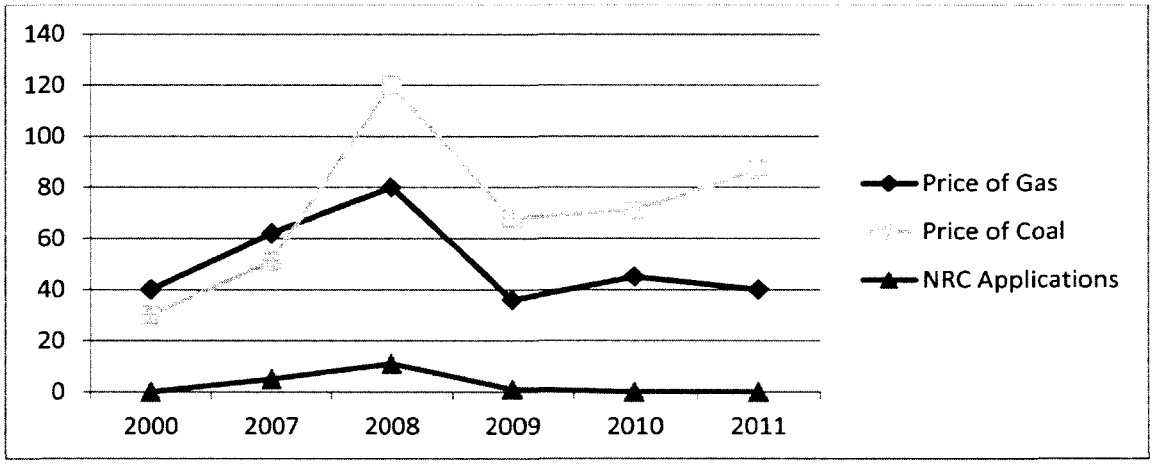

Figure 5: NRC Reactor Applications, 2000-2011.[49]

[44] "US Natural Gas Wellhead Price," US Energy Information Administration, Accessed August 10, 2013, http://www.eia.gov/dnav/ng/hist/n9190us3a.htm .

[45] Though petroleum in only used in small quantities for electrical energy, I include their prices here to demonstrate general increased prices in energy sources, and because, historically, oil and gas prices fluctuated together.

[46] West Texas Intermediary (WTI) Prices.

[47] "Cushing, OK WTI Spot Price FOB," US Energy Information Administration, Accessed August 10, 2013, http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=rwtc&f=a.

[48] BP Statistical Review of World Energy Report, Accessed August 10, 2013. http://www.bp.com/content/dam/bp/pdf/Statistical-Review-2012/statistical_review_of_world_energy_2012.pdf

[49] Data compiled by the author from US Energy Information Administration.

Many of those plans for new reactors have now been abandoned, however. Other than the Georgia Vogtle plant, which was approved for a 2 reactor expansion in 2012, only one other approved site has started construction, in Jenksville, South Carolina. The Chicago-based utility Exelon, for example, which is the nation's largest nuclear operator with 17 units, has postponed its decision on whether to build a twin-unit nuclear plant in Victoria County, Texas. Two other large nuclear suppliers, NRG Energy and UniStar Nuclear Energy, have put off building long-planned plants in south Texas and Calvert County, Maryland, respectively. Of the 11 applications in 2008, four have currently been shelved indefinitely. [50]

Based on this data, we can conclude that enthusiasm for expanding nuclear energy by way of applications for nuclear reactors increases when the price of gas and coal increase as well, and when those gas and coal prices decrease, so do nuclear applications as well as forward movement in building approved reactors. This actually seems fairly commonsensical and is explainable by the fact that there has to be economic justification for building a new nuclear reactor, a venture for electrical companies that has become increasingly costly in the US since the 1970s. In other words, the cost of building a reactor should be less than the cost of continuing to buy gas and coal at elevated market prices. In 2007 and 2008, when gas and coal prices were high, applying for reactor licenses made economic sense. Since then, however, the fracturing boom in the natural gas industry has decreased the price of gas to the point that it makes more economic sense to increasingly rely on cheap natural gas than to buy coal or pay to build a new reactor.

---

[50] "Expected New Nuclear Power Plant Applications," Nuclear Regulatory Commission, Accessed August 19, 2013, http://www.nrc.gov/reactors/new-reactors/new-licensing-files/expected-new-rx-applications.pdf.

Based on these findings about the past relationship between prices of coal and natural gas and nuclear energy pursuance, testing the hypothesis that the higher a country's natural resource endowments or ability to obtain energy from reliable sources and at affordable prices will decrease the likelihood of nuclear energy pursuance will allow for future projections on nuclear energy pursuance in the US. In 2011, oil and gas exploration and production companies operating in the United States added 31.2 trillion cubic feet of wet natural gas reserves to a new record high of 348.8 trillion cubic feet.[51] This is only the second time in US history that the number of natural gas added proven reserves had been over 30 trillion cubic feet, the first time occurring in 2010. The 2010-2011 year added almost 10 percent additional reserve capacity to US natural gas prospects. In terms of natural gas pricing, the US natural gas wellhead price has consistently decreased from its record high of over $10 per thousand cubic feet in 2008 to around $3 per thousand cubic feet in 2011.[52] Even accounting for monthly price increases during the exceptionally cold winter of 2013-2014, the average price of natural gas in the United States has not been this low since the beginning of the 21st century. In times of low natural gas prices, interest in continuing or increasing nuclear energy capacity decreases. This phenomenon explains the previously mentioned closure of at least two nuclear plants, the Kewaunee and Vermont Yankee, which had been approved to continue operation well into the 2030s.

American coal reserves actually surpass natural gas reserves and are, in fact, the US's most abundant natural resource. As of January 1, 2013, the demonstrated reserve

---

[51] "US Crude Oil and Natural Gas Proven Reserves," Energy Information Administration, Last Udpated August 1, 2013, Accessed March 23, 2014, http://www.eia.gov/naturalgas/crudeoilreserves/.
[52] "US Natural Gas Wellhead Price," Accessed 23 March 2014. http://www.eia.gov/dnav/ng/hist/n9190us3m.htm.

base of recoverable coal in the US was 257 billion short tons and The US Energy Information Administration predicted that coal production was expected to grow 3.2 percent in 2014. With this much coal abundance, the US only imported 1 percent of the coal it used to generate electricity in 2011, while US exports of coal increased from 5 percent of coal produced domestically to 10 percent in 2011.[53] Recently pledged clean energy goals coupled with increased availability of natural gas have likely contributed to the decrease in coal reliance. If natural gas abundance continues, as it is likely to do, it is also likely that reliance on coal will decrease as well, though coal production will continue as the US begins exporting more coal to other countries. There seems to be little relationship between coal usage and nuclear reliance, except to say that a guaranteed domestic endowment of coal would likely to be a more affordable fall-back option than nuclear should unlikely circumstances limit natural gas availability.

Though it is established that the US possesses abundant endowments of coal and natural gas, two resources on which it depends most heavily for electricity production, it is still worth mentioning regional energy trading relationships. Since the early 1970s, the US's two most significant energy trading partners have been Canada and Mexico. In 2008, the US imported 3.9 and 3.6 million cubic feet (MCF) of natural gas from each country, respectively. Those numbers have decreased to 2.8 MCF from Canada and 2.7 MCF from Mexico in 2013.[54] Both Canada and Mexico also possess large reserves of coal and natural gas; additionally, all three countries are bound into fair future trading cooperation with the US by the North American Free Trade Agreement, thus giving the

---

[53] "Coal Explained: Imports and Exports," Energy Information Administration, Last Updated July 30, 2012, Accessed March 23, 2014, http://www.eia.gov/energyexplained/index.cfm?page=coal_imports.
[54] "US Natural Gas Imports by Country," Energy Information Administration, Last Updated February 28, 2014, Accessed March 23, 2014, http://www.eia.gov/dnav/ng/ng_move_impc_s1_a.htm.

US multiple future options to obtain affordable energy imports from reliable trading partners should it need to increase imports in the future. The EIA, however, projects that the net import share of total US energy consumption will decrease to 4 percent in 2040, down from 16 percent in 2012 and 30 percent in 2005, and the US will transition from being a net energy importer to a net exporter.[55]

This section produces two separate sets of conclusions: First, that coal consumption and nuclear consumption have little to no correlation in the US. The only relationship seems to be that the US has consistently used more coal for electrical energy than nuclear, and will most likely continue to produce large amounts of coal, even with lower gas prices, for export purposes. Even with environmental movements against coal and allegations that it is a "dirty" resource, the current infrastructure in the US is conducive to using coal while supply remains abundant and prices remain low. The more clear relationship may actually be between natural gas and coal, evidenced by the changes in use of each for electrical energy supply between 2010 and 2012. When natural gas increases, coal (but not necessarily nuclear) decreases.

Second, when supplies of natural gas decrease, nuclear energy production increases. This decreased supply of natural gas increases its price, thereby making nuclear seem a more attractive energy option. To return to the original hypotheses of this section, it seems that the relationship between coal and nuclear is unclear, as usage of both have steadily increased since the 1950s. There also seems to exist a fluctuating relationship between gas and nuclear; that is, when there is less gas, there is more

[55] "AEO2014 Early Release Overview," Energy Information Administration, Last Updated December 16, 2013, Accessed March 23, 2014, http://www.eia.gov/forecasts/aeo/er/early_production.cfm?src=Analysis-b3.

nuclear, and when there is more gas, there is less nuclear (though only small decreases, as in the case of the 2011-2012 decrease from 21 percent to 20 percent).

Other findings in this section relate to the relationship between the price of energy resources and their supply share of US electrical energy. First, when coal and natural gas prices increase, so do application for new nuclear reactors. This phenomenon is observable when gas prices were high in the late 1960s and 1970s, when most of the reactors in operation today were constructed, and then again in 2007/2008 when gas prices were high before the US oil and gas fracturing boom. Lastly, when natural gas prices decrease, so do the applications for new nuclear reactors. As the US supply of natural gas dramatically increased from 2010-2012 and therefore the prices decreased, the applications for new reactors have also decreased from 11 applications in 2008 to none in 2012. Furthermore, much of the construction planned for the previously applied for reactors has slowed if not halted as the high reactor construction costs are difficult to justify in the face of abundant and cheap US natural gas and plants previously approved for extended continued operation are closed because of economic reasons.

Overall, the hypothesis that higher natural resource endowments or reliable and affordable access to resources through trading will equal decreased pursuit of nuclear energy will only become clear in the coming years as operating utility companies apply or do not apply for extended operating licenses on existing reactors. The voluntary closure of the Kewaunee and Vermont Yankee plants for reasons of economic insufficiency seems to indicate that this could be a trend if natural gas supplies remain high and prices remain low. However, the new reactor construction at the Vogtle plant

seems to tell a different story of the future viability of nuclear energy, though the completion and operation of those two new reactors are still years in the future.

Chapter Conclusions

The relationship between nuclear pursuance and public opinion is weak. Though opinion has varied over time, nuclear pursuance increased steadily until it reached the 20 percent mark at which it hovers now. This is one interpretation of the existing data, though another interpretation must be presented. Because opinion measured at the generalized national level has actually varied little over time, a consistent pursuance of nuclear energy could be seen as actually in line with opinion. The argument against this interpretation is that while generalized national support for nuclear energy has been relatively consistent, localized and specific opinion against nuclear has been much stronger. Despite protests and objections from the public, reactor life-extension applications have consistently been approved by the NRC, thus allowing for the continued 20 percent reliance on nuclear energy.

One issue that was not initially formulated into a hypothesis but has become increasingly worth of consideration throughout this research is that of the phenomenon of regulatory capture. Nuclear power seems to be a textbook example of the problem of regulatory capture, a situation in which an industry gains control of and then manipulates in its favor the agency that is meant to regulate it. The safety requirements set forth and enforced by the NRC have long been criticized as patchwork at best and negligent at worst. Victor Gilinsky, who served on the NRC during and after the Three Mile Island incident, recently said in an interview that the NRC is a "...wholly owned subsidiary of

the nuclear power industry."[56] In 2008, during his presidential campaign, President Obama also said that the NRC is a "moribund agency that....has become captive of the industry it regulates."[57] The NRC certainly has motivation to keep regulatory oversight weak. The commission's defenders have pointed out that it must be cautious because increased safety measures would equal increased operating costs, which could hurt the nuclear industry and thus leave the commissioners out of a job. There have also been instances of a "revolving door." In 2008, Jeffrey Merrifield, who had served on the NRC since 1997, left the commission to take a job at The Shaw Group, which has a nuclear division regulated by the NRC.

The likely scenario is that the NRC has continuously made decisions in favor of the nuclear industry despite other considerations such as public opposition or concerns about safety after nuclear disasters. In doing so, the commission has placed its own survival over the integrity of its office. Public opposition seems to be effective only when it can create practical and costly barriers for utility companies, such as the case in the Black Fox plant, or when states intervene in the NRC approval process. Furthermore, voters have few options for electing anti-nuclear representation at the presidential, congressional or even local levels given the nature of the two-party, winner-take-all system that favors the Democratic and Republican parties, both of which are pro-nuclear.

Ultimately, the market seems to provide the most explanatory power for decisions to pursue nuclear power. Most reactors in operation today were built in the 1950s, 60s, and 70s, with original operation licenses for 40 years that can be extended for up to 20 additional years. It is from these reactors that the US gets most of its nuclear

---

[56] Jeff Goodell, "America's Nuclear Nightmare," *Rolling Stone Magazine,* April 27, 2011, Accessed March 23, 2014, http://www.rollingstone.com/politics/news/america-s-nuclear-nightmare-20110427.
[57] Ibid.

energy. The lack of new reactor applications and construction since the 1980s explains the steady 20 percent reliance since the 1980s and why we have not seen a significant increase in nuclear power generation. The early reactor boom brought most of the reactors in operation now, but as these projects wore on, utilities companies realized the immense time and cost involved in constructing nuclear sites. While coal and gas were abundant and relatively cheap, investing such a large amount of capital into a nuclear site became less attractive than the more traditional sources of energy. One may argue that rate payers actually absorb much of the initial cost of construction over time, and this is true, to some extent. However, this increase in electricity rates for citizens is usually quite unpopular, which can in turn mobilize residents against a nuclear facility, even as it promises jobs and industry to an area. Citizen protest, if it is strong enough, can lengthen the process of licensing and construction, thus again increasing the overall cost of a given nuclear site. When citizens can involve states on their behalf, their overall chances of success increase. While this variable is likely insufficient alone, it may be an added deterrent to utilities companies to choose nuclear over less controversial and initially expensive coal or gas. In fact, the Chairman of one of the largest US nuclear companies recently commented that he would not break ground on a new reactor until the price of natural gas was double the current price.[58]

Though the government has instituted policies to make investment in nuclear energy more affordable and with fewer risks for utility companies, it is difficult to say to what extent the US will pursue nuclear in the future. Once the initial construction costs are financed, the sites are relatively inexpensive to run, and since this initial cost has already been absorbed, there is little motivation for the NRC to not re-license an existing

[58] Lucas W. Davis, "Prospects for Nuclear Power," *Journal of Economic Perspectives,* 26:1 (2012), 50.

plant. The real question is how many new reactors will be approved and then, more importantly, actually built and brought online. The new reactor expansion at Vogtle is already delayed, which may be an indicator of what many utility companies can expect in the future. Furthermore, with the glut of cheap natural gas from new technologies and a large domestic supply of coal readily available (and Canadian and Mexican imports on stand-by), there may be even less of a motivation to go with expensive and sometimes unpopular nuclear.

CHAPTER 4

NUCLEAR ENERGY IN GERMANY

Objective

Following the structure of the preceding chapter on nuclear energy in the United States, this case study on Germany aims to first offer a brief background on the development of nuclear energy policy in Germany. Secondly, this chapter will explore the relationship between patterns of nuclear energy pursuance and public opinion in Germany since the 1970s. Again, "Nuclear energy pursuance" is operationalized as the overall percentage nuclear provides to the electrical energy supply and public opinion is measured by using polling data with a supplemental discussion of protest activity and voting preferences. The hypothesis is that in countries where nuclear approval is lower, nuclear pursuance will be lower and, in countries where nuclear approval is higher, nuclear pursuance will be higher. Next, this chapter will analyze data over time that measure to what extent public opinion and nuclear energy pursuance have changed in response to nuclear disasters, specifically disasters at Three Mile Island, Chernobyl, and Fukushima. Lastly, this chapter will examine the share nuclear currently makes up of total German energy consumption with the hypothesis that if Germany has a greater endowment of electricity-generating natural resources or greater access to other reliable, affordable energy resources, its pursuance of nuclear will decrease. The chapter will end with conclusions based on these findings.

Development of Early Energy Policy in Germany

Following World War II, German energy policy was essentially coal policy. The largest indigenous energy source in Western Europe, domestic coal production and consumption dominated German energy patterns.[1] In the 1950s, however, German coal became increasingly uncompetitive with oil, which was priced very cheaply at the time. Despite policies and subsidies aimed at bolstering domestic coal exports, coal production dropped as Germany began importing more oil from foreign producers. The oil price shocks of the 1970s motivated Germany to escalate its on-going investment in nuclear energy (but also renewable energy sources as well) to increase its energy security and independence from oil imports. A relative late-comer to nuclear energy competition, pressure from chemical and electronic companies further pushed nuclear expansion in the 1970s.[2] The first nuclear research reactor came online in Germany in 1957 and the first commercial reactor opened in 1961, though the vast majority of Germany's operating reactors came online in the 1970s and early 1980s. This increased pursuance of nuclear energy was not limited to Germany but was rather quite common policy throughout the European Economic Community (EEC) at the time. A 1972 projection reported that by 1985, the total installed nuclear power in the EEC would provide 33 percent of total electricity consumed, an increase that would require the construction of six to eight new power plants per year.[3]

Germany was banned from developing nuclear weapons after World War II, so the German nuclear industry did not grow up in the shroud of secrecy and protection of

---

[1] Hatch, *Politics and Nuclear Power,* 12.
[2] Dorothy Nelkin and Michael Pollack, "Political Parties and the Nuclear Energy Debate in Germany and France," *Comparative Politics,* 12:2 (1980), 127-141.
[3] Nelkin and Pollack, "Political Parties and the Nuclear Energy Debate in Germany and France," 127.

the "national security" label as it did in the United States. However, very similarly to the US, conventional energy policies in Germany were managed largely by a group of policy-makers and scientists, known as the Economics Ministry, which was made up of officials and interested parties from labor and industry. Likewise, the development of nuclear energy technology was managed primarily by the Bundesministerium fuer Forschung and Technologie (the Federal Ministry of Research and Technology, or BMFT) and experts within the scientific community. Until the 1970s, nuclear technology was largely ignored by the public and the government officials monitoring and legislating it enjoyed relative anonymity and isolation.

The 1959 Atomic Energy Act

The purpose of the 1959 Atomic Energy Act was originally two-fold. While it established a framework for regulating nuclear approval, construction, and operation, it also was fundamentally meant to promote nuclear energy, specifically, to promote private investment in new reactors by making them affordable. The German Atomic Energy Act bore striking similarities to the 1946 and 1954 American Atomic Energy Acts that preceded it by providing for: the privatization of the nuclear industry; limited and exempt liability for nuclear investors; and mandatory public hearings in the reactor approval process. The most significant difference between the German and US Acts lies in the move away from a centralized federal agency to regulate or grant license approval (functions of the NRC in the US) to a Länder (or state-based) control of licensing approval where the reactor is to be installed. Public hearings were mandatory prior to license approval, but only individuals could participate as opposed to organized group

participation on behalf of individuals as is allowed in the US. This contributed to the early regional character of the anti-nuclear protests in Germany.[4]

Subsequent Amendments to the Atomic Energy Act: 2002

Though the original version of the German Atomic Energy Act was consolidated and updated throughout the 1970s and 1980s, the intent to encourage investment in the nuclear energy sector was preserved until the late 1990s when the Bundestag (German Parliament) began proposing changes to the Atomic Energy Act and eventually amended the 1959 Act to the Act on the Peaceful Utilization of Atomic Energy and Protection Against its Hazards.[5] The new policy codified a structured phase-out of nuclear energy which granted the remaining reactors in operation an average life-span of 32 years. This policy shift was the result of a Red-Green Social Democrat-Green party alliance formed within the Bundestag in the late 1990s. Following Chernobyl in 1986, the Green Party gained popularity in Germany and united with the Social Democratic Party (SDP) in 1998 under the leadership of Gerard Schröder. The coalition remained in power in Germany until 2005, when the Christian Democratic Union (CDU), led by Angela Merkel, defeated the Social Democrats. This conservative party has remained in the majority ever since.

Subsequent Amendments to the Atomic Energy Act: 2010

Merkel's Conservative CDU-Liberal FPD (Free Democratic Party or FPD) Coalition changed nuclear course again in 2010, rescinding Schröder's phase-out and granting further extensions for existing nuclear power plants in exchange for new taxes on nuclear power that would then subsidize renewable forms of energy such as wind and

---

[4] Joppke, *Mobilizing Against Nuclear Energy*, 39.

[5] "German Nuclear Legislation." Nuclear Energy Agency. Accessed September 14, 2013, http://www.oecd-nea.org/law/legislation/germany.html.

solar. Contributing to this decision to grant nuclear reactors a longer life was the official ratification of the Kyoto Protocol in 2002, which committed Germany to pursuing clean energy sources to reduce their CO2 emissions. In order to pursue the goals of the Kyoto Protocol, Germany knew it would have to begin moving away from coal (their largest naturally occurring energy resource) and moving toward more natural gas and renewable energy sources. Once it was clear that move would mean importing more energy sources, particularly natural gas, it was quickly apparent that the largest supplier in Europe was Russia. Fearing an inconsistent supply bought at high real and political prices, nuclear energy slowly began a comeback in Germany in the form of the 2010 amendment. *Der Spiegel,* one of Germany's most widely-read news outlets, addressed this nuclear comeback on July 2008 cover of its magazine with a headline that read: "Atomkraft: Das Unheimliche Comeback" ("Nuclear Energy: Its Eerie Comeback"). The article outlined how factors such as the increasing urgency to limit CO2 emissions, the rising costs of fossil fuels, and the political instability of fossil fuel exporters such as Libya and Russia were combining to revitalize a widely unpopular industry that once again appeared to be the "lesser of evils" for energy production.[6]

Fukushima in 2011

The nuclear comeback was short-lived. Following the disaster at Fukushima in March of 2011, by late May Chancellor Merkel had announced that Germany would again begin a phase out of nuclear energy that would run through 2022. The oldest reactors that had been shut down for maintenance before Fukushima were not brought back online and the others would all be subsequently decommissioned before the 2022 deadline. Now, Germany is pursuing what has been called a policy of "energiewende," or

[6] Michael Sauga, "Comeback der Reaktoren: Aufbruch ins neue Atomzietaler," July, 2008, *Der Spiegel.*

energy turn, from conventional energy sources to more renewable sources such as wind, solar, and hydropower, an initiative that so far has been financed largely by private German electrical customers who are paying the highest energy rates in the European Union aside from the Dutch.

This brief background on the development of nuclear energy in Germany illustrates three important factors beyond providing a historical framework for the discussion that follows. First, it highlights the decentralized reactor approval and licensing process that is characteristic to German nuclear energy, a factor which is important when analyzing the efficacy of public opinion and protest activity toward nuclear energy within the Länder in Germany.

Secondly, dissimilarly to the US, this history demonstrates ebbs and flows of pursuance of nuclear energy. Whereas the US has pursued nuclear energy at consistent levels since all operating reactors came online, the nuclear prerogatives of decision-makers in Germany have been in a state of flux since the late 1990s. This is most likely explained by the different considerations in a Parliamentarian system of government compared to a Presidential one. The unique Parliamentarian nature of the German Bundestag means that while anti-nuclear Green Parties are often unlikely to win a majority, even taking a small share of the votes affords them representation in the legislature and, as was the case in the 1998 elections, can also mean a coalition with other parties to form policy-making majorities within Parliament. In Germany, unlike the United Kingdom where a party must receive the majority of votes in a constituency, there is a combination of majority and proportional systems, and the proportional aspect dominates. Every party receiving more than 5 percent of national support gets

parliamentary seats in proportion to its vote. This 5 percent threshold has been very important. It was high enough to force unity on the various Green factions; without it, Green groups and parties would have been fragmented. But it was low enough to allow representation in Parliament at an early stage.[7]

In 1998, the Red Social Democrats joined with the Greens to bring the Greens into the national government for the first time. Consequently, the late 1990s also marked the initial phase-out of nuclear energy that would be reversed with a pro-nuclear Christian Democratic Union win in 2005. In contrast, the US's two-party "winner-take-all" system requires a majority of votes for representation in Congress or a Presidential election. While there is a functioning Green Party in the US, the Green candidates only drew a small percentage of national votes in the 2012 Presidential election. What this difference in legislative structures points to is that, in the US, the low probability of a Green Presidential or Congressional win means decisions and policies will not be influenced by Green Party anti-nuclear objectives. In the German Bundestag, however, even relatively small Green representations can form coalitions and exert influence over energy policy.

Lastly, this history illustrates a point of departure resulting from Fukushima in 2011 that was not present in the US. Following the Japanese disaster that made international headlines, public opinion in the US barely shifted and the NRC approved construction for the first new reactors since the late 1970s. In Germany, however, the reaction was quite different. The following chapter will attempt to determine what factors in addition to Fukushima could have had an impact on this decision to permanently turn away from nuclear energy.

---

[7] Detlaf Jahn, "Green Politics and Parties in Germany," *The Political Quarterly*, 68:B (1997), 174-182.

Nuclear Public Opinion in Germany

After WWII, an anti-militaristic, anti-proliferation doctrine was strictly enforced in Western Germany. Very similarly to the US, there was little public protest against nuclear energy throughout the 1950s and 1960s when reactors were initially being designed and built in Western Germany (Soviet Eastern Germany was consistently pro-nuclear in its policies until its demise in 1990 and reunification with Western Germany). Though there was a strong anti-nuclear weapons peace movement in the 1950s and an anti-NATO sentiment as well, many of the proponents and members remained enthusiastic about the peaceful potential nuclear technology could offer for power generation.[8] Even the anti-nuclear energy movement that was gaining ground in the 1960s was more concerned with environmental safety and waste issues than about the development of nuclear weaponry.

Some scholars try to explain the early lack of clear public opposition to nuclear energy by claiming that public dissent existed but was repressed during this time in a post-Nazi shaming era which created a "culture of consent."[9] Certainly, the image of "Model Germany," or what political economists have termed the depiction of post-war Germany as an island of stability and strength in a crisis-ridden world economy, comes to mind. Most analysts agree that the apparent success of Model Germany can be attributed to a persistent concern for monetary stability, an export-oriented economy, and an active policy of modernization, one pillar of which was a greater energy independence that could be obtained through nuclear power. A second explanation is that nuclear reactors were not numerous enough until the 1970s to cause much alarm. It was not until the

[8] Paul Hockenos, "Angst or Arithmetic?: Why Germans Are So Skeptical About Nuclear Energy," Heinrich Boll Stiftung, Series on Energy Transformation, 2012.
[9] Hockenos, "Angst or Arithmetic," 3.

1970s oil price increases spurred motivation to build new reactors that people's "not in my backyard" reactions were triggered. This section will first determine the state of current nuclear pursuance in Germany and then compare it currently and over time with polling data to determine whether patterns or relationships exist between these two measures.

Germany is currently the largest energy consumer is Europe. In early 2011, Germany received the majority of its electrical energy from fossil fuels such as coal, oil, and natural gas. By the end of 2011, nuclear energy production had dropped from 23 percent to 15 percent, while other renewable sources such as wind, solar and hydropower grew to 15 percent. In 2011, Germany was the largest European producer of non-hydro renewable electricity, wind energy, solar energy, and biofuels.[10] In 2012, the percentage share of renewable energy in the overall mix had grown to 22 percent. Figure 6 illustrates this energy mix:

[10] Germany Country Analysis, US Energy Information Administration, Last Updated May 30, 2013, Accessed March 25, 2014, http://www.eia.gov/countries/country-data.cfm?fips=gm.

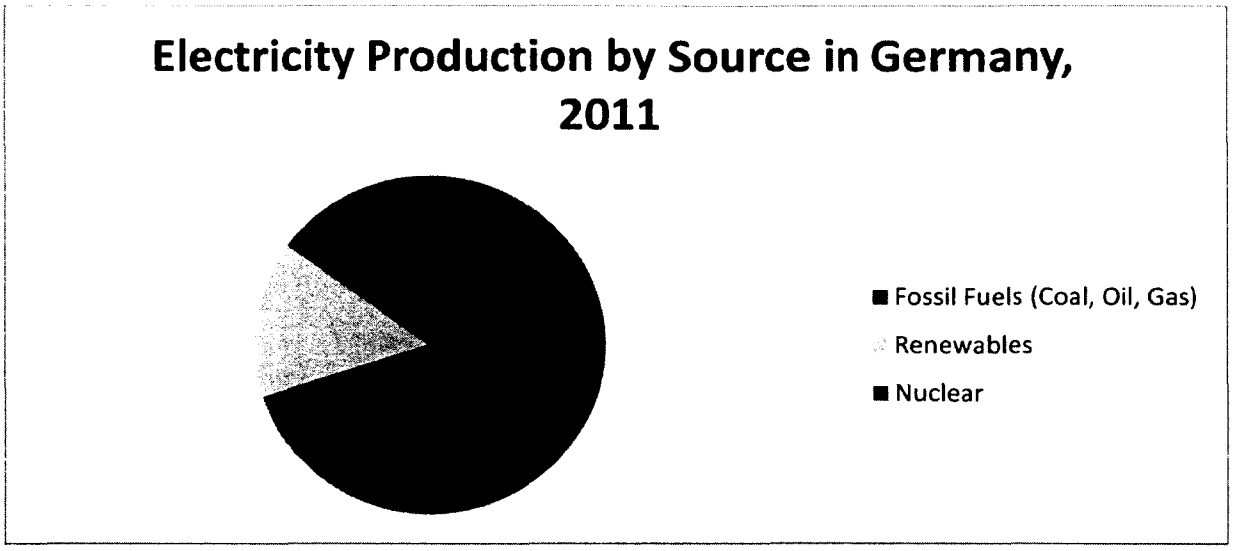

Figure 6: Electricity Production by Source in Germany, 2011.[11]

Since the early 1990s, nuclear's share of total electricity generation hovered between 30 percent and 35 percent, until it began declining slowly in the early 2000s as a result of the phase-out policies of the Atomic Energy Act. In 2011, the nuclear share dropped to 16 percent and then to 15 percent in 2012. Figure 7 demonstrates this trend:

[11] Data compiled by author from German Energy Profile, Energy Information Administration.

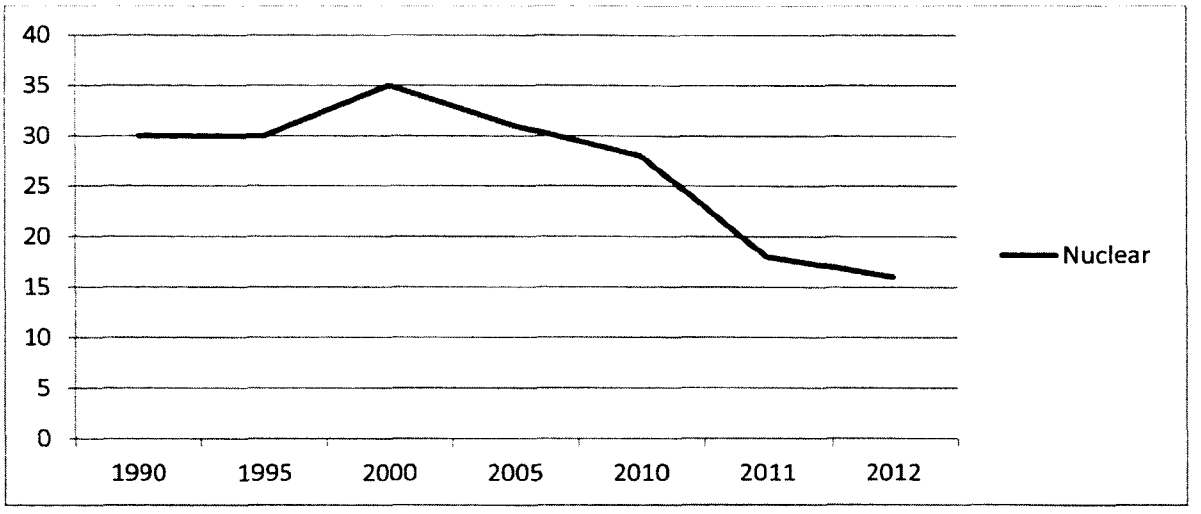

Figure 7: Nuclear Percentage of Net Electricity Generation in Germany, 1990-2012.[12]

Polling Results of German Nuclear Opinion

In 2010, a *Financial Times*/Harris Poll found that 35 percent of Germans strongly opposed the building of new reactors; 29 percent opposed more than favored; 25 percent favored more than opposed; and 12 percent strongly favored. The same poll, asking the same question about building new reactors, found in 2010 that the number of Germans strongly opposed to the building of new reactors had increased to 43 percent; 34 percent opposed more than favored; 16 percent favored more than opposed; and only 7 percent strongly favored. This poll also discovered that Germans were strongly opposed to government subsidies to finance research for nuclear power: 47 percent strongly opposed a government subsidy; 35 percent opposed more than favored; 13 percent favored more than opposed; and only 5 percent strongly favored.[13] This data reveals that in 2010, well

[12] Data compiled by author from World Nuclear Association.

[13] "Large Majorities in US and Five Largest European Countries Favor More Wind Farms and Subsidies for Biofuels, but Opinion is Split on Nuclear Power." PRNewswire. October 13, 2010.

before Fukushima, Germans were already opposed both to building new reactors and financing research to increase nuclear power (77 percent against new reactors, 82 percent against government subsidies). After Fukushima, in November of 2011, Germans responded to a Globescan survey asking whether they supported the building of new reactors with a resounding no: 90 percent of Germans strongly opposed building new reactors.[14] The same poll found that 52 percent of Germans was not only opposed to building new reactors, but supported the Merkel policy to shut down all existing reactors. In June of 2011, 57 percent of Germans responded that they thought the nuclear phase-out would be feasible.[15]

Since Fukushima in 2011, polling conducted in Germany tends to focus less on the topic of nuclear energy and more on support for the energy transition from fossil fuels to more renewable energy sources that Germany is currently undergoing. For this project, support for the energy transition, or energiewende, can be equated with support for phasing-out nuclear energy, since the purpose of the energy transition is to move away from nuclear (but also coal and oil) to other renewable energy sources such as solar, wind, and hydropower. The focus of much of current German polling has to do with willingness to pay energy prices since the transition from fossil fuels to renewables is largely being financed by energy customers through two ways. First, Germans pay an umlage charge on their monthly energy bills that amounts to roughly 14 percent of their total energy cost. This cost is not necessarily new, though the four largest electrical companies in Germany announced in 2012 that the umlage cost would increase to a rate

---

[14] "Opposition to Nuclear Energy Grows." Globescan, November 25, 2011, Accessed September 13, 2013. http://www.globescan.com/commentary-and-analysis/press-releases/press-releases-2011/94-press-releases-2011/127-opposition-to-nuclear-energy-grows-global-poll.html.

[15] "What People Really Think About Nuclear Energy," For Atom Project, 2012. http://www.foratom.org/jsmallfib_top/Publications/Opinion_Poll.pdf.

that amount to an approximate additional €59 on monthly bills per customer.[16] Second, the overall cost of energy is increasing as new electrical grids are built to support renewable energy as well as to finance a feed-in tariff that is paid to anyone who installs solar or wind technology and sells electrical energy to the grid.

A survey taken in mid-March 2013 found that Environmental Minister Peter Altmaier's proposal to dampen increasing energy prices (which essentially meant slowing down the move to renewables) met with great popular resistance. 89 percent of those polled who associated with the Green Party naturally thought "renewables should be consistently expanded"; the Christian Democrats responded at 68 percent in favor of continuing to pursue renewables; and 81 percent of Social Democrats said renewables should continue to grow.[17] Altmaier's proposal has since been rejected in Parliament. Similarly, a German Forsa poll found in October of 2012 that 72 percent of those surveyed supported the switch-over, while only 24 percent opposed it.[18]

These responses of support, however, are only in theory, and thus demonstrate a short-coming of polling data, for it is unclear whether those polled realized the practical price-increase consequences of expanding renewables or supporting the switch-over when answering. When asked specifically about their willingness to finance the transition, responses are less enthusiastic. An Emnid poll conducted in October of 2012 found that two-thirds of those surveyed are not willing to pay more than €50 to finance

---

[16] Lauren E. McKee, "German's Renewable Energiewende: Pioneering Path or Troubled Turn," *Journal of Energy Security,* April 2013.
[17] Craig Morris, "Energy Transition—Nuclear Power, Very Unpopular." Renewables International, Accessed September 11, 2013, http://www.renewablesinternational.net/nuclear-power-very-unpopular/150/537/62320/.
[18] "Poll: Germans Support Abandoning Nuclear Power." The Journal.IE, Accessed September 11, 2013, http://www.thejournal.ie/poll-germany-nuclear-power-644340-Oct2012/.

the switch-over, far less than the impending price increases.[19] Similarly, a 2013 Befragmich poll found that only 38 percent of Germans surveyed were willing to accept a consistent increase in their electricity bill.[20] The *Financial Times*/Harris Poll found in 2010 that 43 percent of Germans were not willing to pay more for energy if it was from a renewable source opposed to a fossil fuel, and 65 percent responded that they were not willing to pay more for energy to cut greenhouse gas emissions or finance renewables.[21]

In this respect, it seems that current nuclear energy pursuance policies correspond to the majority of nuclear public opinion in Germany. Despite questionable willingness to finance the renewable switch-over, polls reveal that in 2013 Germans consistently support moving away from nuclear energy, specifically to renewable energy sources. Accordingly, German energy policy is doing just that—moving away from nuclear energy by closing the oldest reactors and resolving to shut down others in operation by 2022. Both the public's backlash to nuclear and the anti-nuclear policy shift have been attributed to Fukushima, though earlier disasters had already influenced public opinion in Germany. To gain a greater understanding of this relationship between nuclear pursuance and public opinion over time, the following section will examine public reactions to the nuclear disasters at Three Mile Island, Chernobyl and Fukushima as well as offer a qualitative examination of nuclear protest culture in Germany and changes in nuclear pursuance that may have been a result.

---

[19] McKee, "Germany's Renewable Energiewende."
[20] "Energy Policy and Willingness to Pay: 2013," Befragmich. Accessed September 22, 2013. www.befragmich.de.
[21] "Large Majorities in US and Five Largest European Countries Favor More Wind Farms and Subsidies for Biofuels, but Opinion is Split on Nuclear Power." PRNewswire. http://www.prnewswire.com/news-releases/large-majorities-in-us-and-five-largest-european-countries-favor-more-wind-farms-and-subsidies-for-bio-fuels-but-opinion-is-split-on-nuclear-power-104844169.html

The 1970s and Three Mile Island

The anti-nuclear movement was already well underway by the time of the 1979 accident at Three Mile Island, unfolding through a series of sighting conflicts beginning in the late 1960s. In 1971, the first notable citizen opposition occurred in response to a reactor proposed for the small town of Wyhl, located in the southwest corner of Germany. Local farmers, vintners, and environmentalists mobilized early on in protest to issues such as reactor safety, water pollution, and ecological effects. By 1974, this local opposition has gathered 90,000 protest signatures.[22] The structure of the German nuclear license-approval process required a public hearing before the Länder government could vote on reactor approval. As it turned out, in this case, the state government was part-owner of the utility company proposing the project, and thus had a vested interest in seeing the license approved.[23] The opposition force which had grown to encompass most of the outlying region of Baden-Württemburg, where the town of Wyhl was located, organized to show up at the public hearing and voice their opposition to the proposed reactor.

What happened at the public hearings was both predictable and similar to such hearings conducted in the US through the NRC. The impatient state government rushed through the proceedings on the first day, barring the majority of those who showed up to protest the reactor from speaking. The second day followed in much the same way, though those who showed up to the hearing to support the reactor were allowed to speak in favor of the project. It became clear that the majority of those opposed to the project were agriculturally invested, resided in the region surrounding where the reactor would

---

[22] Joppke, Mobilizing Against Nuclear Energy, 98.
[23] Ibid, 98.

be placed, and feared damage to their livelihoods as farmers and vintners. Those who supported the reactor were primarily working-class citizens living in the actual town of Wyhl and saw the reactor as a source of employment for hundreds of people, cheap electricity, and a magnet for further metropolitan investment. In fact, a narrow majority of the citizens voted for the reactor, thus removing the last institutional obstacle to reactor construction.[24] These same distinctions are apparent at public hearings in the US, where the support and opposition are likewise divided among those who fear environmental consequences and those who desire the local economic stimulation building a reactor would bring. As is also the case in the US, reactor licenses are approved regardless of concerns voiced in these public hearings.

The opposition movement saw direct action as their final resort and a spontaneous site occupation turned into a ten-month siege in 1975 that forced Wyhl and the anti-nuclear movement into national public debate. There were reports of police brutality as magazines and television stations showed images of farmers and their wives being dragged away from the proposed nuclear site. At is largest, the protest had grown to between 25,000 and 28,000 participants.[25] This not only drew attention to local nuclear opposition groups, but also to the questionable nature of the state's actions in rushing through the reactor approval stage in spite of large-scale opposition. In light of this negative publicity, the state government did agree to negotiations with local groups, but it would ultimately be actions by another municipality that would shelve plans for the Wyhl reactor. In 1977, the Administrative Court of Frieburg, a town approximately 30

---

[24] Joppke, *Mobilizing Against Nuclear Energy*, 99.
[25] Hatch, *Politics and Nuclear Power*, 73.

kilometers from Wyhl, terminally revoked the construction permit for Wyhl, citing insufficient reactor contamination plans.

Several other critical protests followed, first at Brokdorf where a reactor had been proposed. The anti-nuclear movement had gained momentum from the conflict at Whyl and what had been a localized protest movement grew into nationalized mobilization at Brokdorf with 70-80,000 people participating.[26] Though it was reported that 75 percent of the local population at Brokdorf opposed the nuclear reactor, the local municipal government quickly moved through the public hearing process and, courted by promises of increase tax income and utility donations such as a local swimming pool, they approved the license for a reactor at Brokdorf in 1975.[27]

What followed the Brokdorf license approval was the first instance in which the German anti-nuclear movement would encounter hard push-back from the state. While the anti-nuclear movement had been successful at Wyhl (though only after another municipality had intervened in an official capacity) protestors found that the battle at Brokdorf would be much harder fought. In 1976, local opposition groups announced that they would peacefully protest and occupy the construction site at Brokdorf. They were outraged when the utility company erected a tall steel barrier around the construction site and suddenly began work under the cover of "nacht and nebel" or night and fog. A November 1976 protest escalated into what the media called a "civil war," complete with tear gas, police helicopters, the destruction of a security fence, and, ultimately, the severing of communication between the state and local groups.[28] An administrative court agreed to postpone the construction of the reactor, but in 1981 the construction permit

---

[26] Joppke, *Mobilizing Against Nuclear Energy*, 101.
[27] Ibid, 101.
[28] Ibid, 102.

was reinstated and the Brokdorf reactor first began operation in 1986. It remains in operation today.[29]

Brokdorf was the first instance of violent confrontation in the German anti-nuclear movement, though other similar confrontations would follow throughout the late 1970s and early 1980s. Many of the same protestors who were involved at Brokdorf moved immediately to the small village of Ghronde where a reactor site had been under construction for ten months. There protestors used blowtorches and electric chainsaws to cut through the security fence, and eight hundred protestors and police were injured. The "Grondhe Trials" in 1978 inflicted harsh prison sentences on many of the protestors who were arrested and criminally charged. Similarly to Brokdorf, the protests only temporarily halted construction in 1977 due to unresolved issues concerning waste disposal, and construction began again in 1979. The first power from Ghronde was generated in 1984, and the reactor remains in operation today.

The final significant court case of the time involved the reactor at Kalkar, where an administrative court halted construction because of questions regarding the constitutionality of the 1959 Energy Act, arguing that, having been written in 1959, it could not have foreseen the long-term far-reaching consequences inherent in the application of fast-breeder technology.[30] Demonstrators attempted protest activity at Kalkar, though by this time local police forces and officials were familiar with their modes of operation and blocked roads heading into Kalkar, thus keeping the majority of protests away from the site. Though the Kalkar plant again began construction in the early 1980s and was completed by 1985, it never came into operation. It was only after

---

[29] "Brokdorf Nuclear Power Plant," E.On, Accessed September 25, 2013, http://www.eon.com/en/about-us/structure/asset-finder/brokdorf.html

[30] Hatch, *Politics and Nuclear Power,* 81.

Chernobyl in 1986 that Social Democrat government on North Rhine-Westphalia refused to license the reactor into operation. In fact, a Dutch developer bought the land and the defunct reactor and turned them into an amusement park, complete with swing ride inside the nuclear cooling tower.

So, by 1979 and Three Mile Island, a vibrant anti-nuclear movement was already well established in Germany. From this early protest activity three major trends emerge in relation to the efficacy of public opinion in Germany. First, support and protest for nuclear reactor expansion was often split, and though polls may suggest that most people in a region did not support new reactors in their villages, there was always a faction of people who did support the reactor, whether it was blue-collar workers who anticipated employment or officials who anticipated tax dollars, industry and utility company-provided perks. Figure 8, taken from data from Christian Joppke's 1993 study of anti-nuclear protests in Germany, demonstrates the trends in public opinion polling during the 1970s:

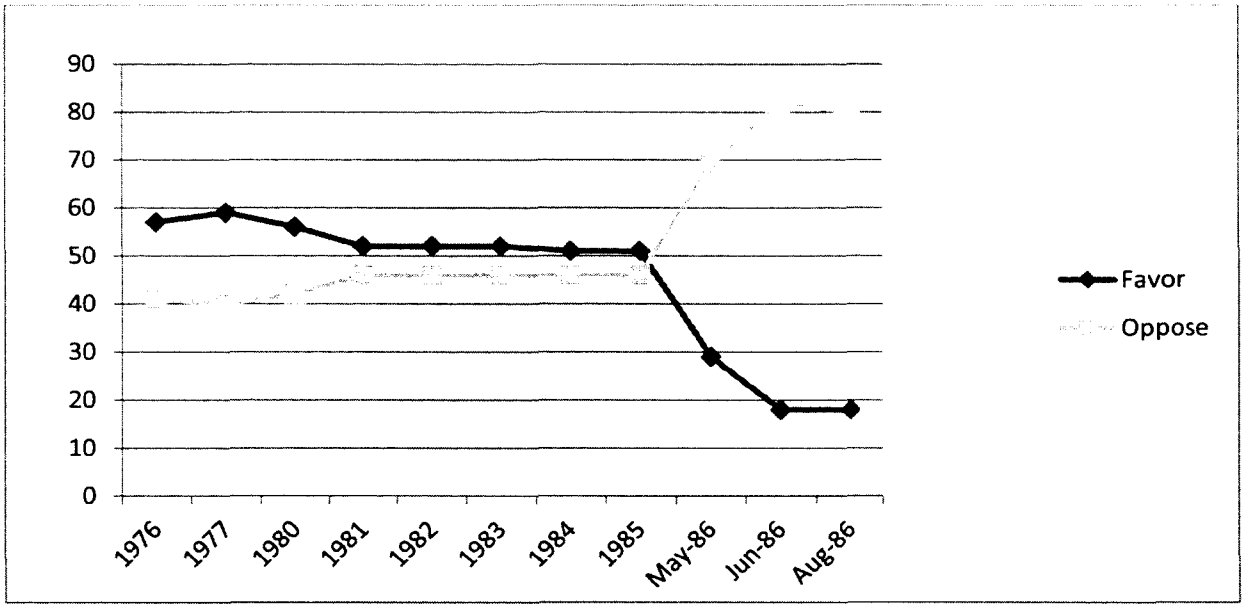

Figure 8: Support for and Opposition to New Nuclear Reactors in Germany, 1976- August 1986.

This polling information demonstrates that many Germans did, in fact, support nuclear reactors, a fact that may not be apparent when only observing protest activity. Secondly, it demonstrates that the most significant moment of change in public support happened in 1986, not 1979, following Chernobyl rather than Three Mile Island.

Second, the evolution of the anti-nuclear protests from non-violent at Whyl to violent thereafter had both positive and negative effects on the movement itself. It is unclear to what extent the anti-nuclear movement would have gained such national attention without having gone to such extreme measures, for it was only after Wyhl and, to a greater extent, Brokdorf that the movement gained national notoriety and increased support. On the other hand, the escalation of the violent protests also brought negative attention, as the trials from Grondhe and the movement itself was increasingly associated with criminality. This negative perception was not helped by the simultaneous Baader-

Meinhof (Red Army Faction or RAF) attacks happening across Western Germany in late 1977 and the resulting "German Autumn" during which labor union representatives were kidnapped and murdered. The result was that the anti-nuclear movement fractured in the 1980s, as various parties and groups chose to promote the anti-nuclear cause in varying ways through different outlets.

Lastly, it is clear that by 1979 and Three Mile Island, the damage to the nuclear industry had already been done. An industry which had previously been unrestrained found itself engaging in costly skirmished with local populations and governments, often with delays in construction that increased the overall prices of construction. No *new* construction licenses were issues for nuclear power plants in Germany between 1977 and July of 1982, during which time a moratorium was placed on licensing new reactors until the approval process could be streamlined and made more efficient and less costly. Thus no new nuclear construction began in Germany between 1978 and 1981.[31] Immediately following the end of the moratorium in 1982, however, three new "convoy" permits were issued for construction. The nuclear industry, federal government and state governments had worked together to revamp the license process, limiting public input unit the late stages of licensing (when the plants were nearing completion). The new process also implemented "standard reactor designs" that could be approved as a group in convoys rather than individually.[32]

This demonstrates a rupture in nuclear energy pursuance between 1975 and 1980: almost all projects begun before that time were completed, in most cases after long and costly struggles; but only three projects would be started and fought through afterward.

---

[31] Felix Kolb, *Protest and Opportunities: The Political Outcomes of Social Movements,* (Berlin: Campus Verlag, 2007), 250.
[32] Joppke , *Mobilizing Against Nuclear Energy,* 164.

Three Mile Island was a contained event: there was little damage to the surrounding environment and no one died. Those in Germany who were already anti-nuclear remained so after Three Mile Island, but the event had little effect on German public opinion overall or on nuclear pursuance. Other external factors, such as increased oil prices throughout the 1970s as a result of the global oil shocks, also played a role in positively determining people's reactions toward nuclear energy, and certainly influenced energy policy at the time. Perhaps even more important, Three Mile Island happened far from Germany in the US, though the reactor explosion at Chernobyl would be a different story altogether.

The Early 1980s and Chernobyl

The early 1980s in Germany brought a decrease in anti-nuclear protests, perhaps due to the decrease in new reactor licenses issued during the time, but also because of the anti-violence related backlash of the earlier protests from which the movement was still recovering. There were fewer than five protests reported from 1982-1985, with an increase to ten protests in early 1986. The increase from 1984-early 1986 is the result of reactions to a nuclear processing plant proposed in Wackersdorf, Bavaria, which attracted national attention and 80,000 participants less than a month before the explosion at Chernobyl. However, in 1986, the number of protests more than quadrupled to approximately fifty protests nation-wide.[33] The previous figure also demonstrates that approval for new reactors dropped significantly from 50 percent of respondents to 30 percent and then even further to 15 percent, while negative responses to new reactors increased from 45 percent to 70 percent to 80 percent.

---

[33] Koopmans and Duyvendak, "The Political Construction of the Nuclear Energy Issue and its Impact on the Mobilization of Anti-Nuclear Movements in Western Europe," 240.

In this way, the nuclear disaster at Chernobyl created a negative "shock" during which public support for nuclear energy decreased dramatically. This reaction is understandable, as the German (and European population in general) dealt with fears about spreading radiation clouds, radiation-contaminated rain, and ground water pollution. Compared to Three Mile Island, the Chernobyl incident resulted in two immediate casualties of plant workers and the deaths of twenty-eight other workers from radiation exposure in the next few months. Chernobyl's impact was not only more significant in scale, but the threat was closer and more immediate than in the case of Three Mile Island. Immediately following this shock, however, protest frequency returned to pre-1986 levels, from a high of 50 protests in 1986 to 15 protests in 1987, to 10 protests in 1988, and eventually back to 0-2 protests in 1990.[34] Even though public opinion may not have quickly recovered from Chernobyl, protest activity decreased quickly following the incident.

What did affect did shifts in public opinion resulting from Chernobyl have on the practical pursuance of nuclear energy in Germany at the time? As the reactors built in the 1970s and early 1980s became operable and started generating electricity, there was a general increase in the nuclear share of electrical energy during the 1980s to peak in 1990, demonstrated here in Figure 9:

[34] Koopmans and Duyvendak, "The Political Construction of the Nuclear Energy Issue and its Impact on the Mobilization of Anti-Nuclear Movements in Western Europe," 239.

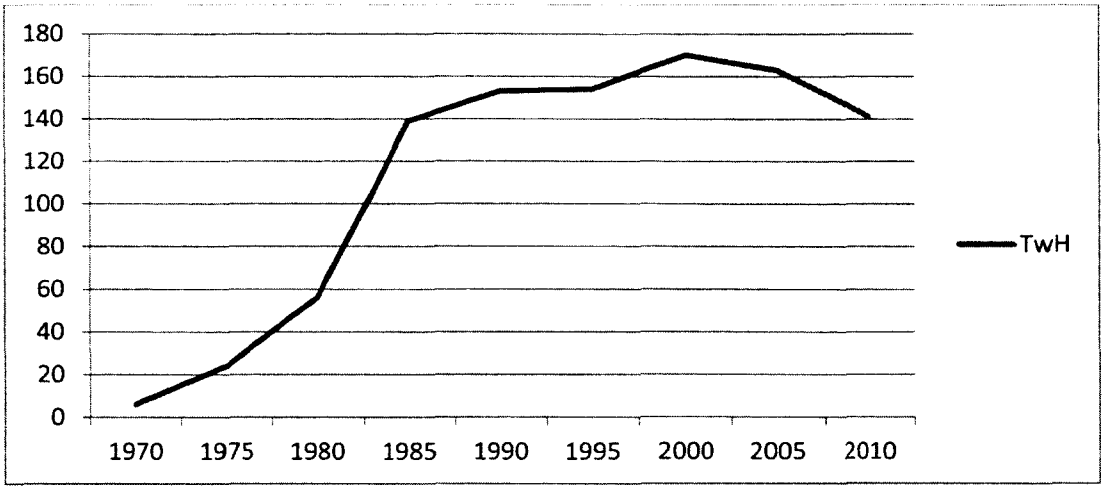

Figure 9: German Nuclear Generation in Terawatt Hours, 1970-2010.[35]

However, no new construction projects for new reactors have occurred in West Germany since the 1982 convoy licenses. Though Chernobyl did have a negative effect on public opinion and temporarily increased protest activity, there is no clear relationship between public opinion and nuclear policy implementation throughout the 1970s and 1980s. The 1970s saw intense and violent public reactions to nuclear energy, significant enough to halt the licensing of new reactors, but this was only a stop-gap measure until the industry, federal and state governments could agree on changes in the licensing process to actually make it *easier* to approve reactors with *less* public input. The 1980s and Chernobyl brought about similar negative reactions, and while it is true that no new reactors were constructed after 1982, there are numerous other intervening variables that could explain the nuclear slow-down besides, or in addition to, public opinion.

For one, oil prices had stabilized in the 1980s following the shocks of the 1970s, and nuclear was becoming a less cost-effective option compared to the new wash of

[35] Data compiled by author from BP Annual Statistical Review of World Energy, 2013.

cheap oil and gas. Domestic coal prices had also risen and government interest and subsidies began shifting to the coal industry. The neo-liberal economic policies of the late 1980s also encouraged the privatization of utility companies with the result of a price increase in electricity as energy was opened up to market policies. Utility companies were less willing to accept the risk of building a new reactor, especially considering the capital required up-front, even though the reactors were relatively cheap to run once built. But other contradictory forces were at work as well in Germany, namely, a new concern over carbon emissions and environmental health. Since nuclear was known to be a low-carbon emission energy source, it remained a viable option in energy policy. 1991 also happens to be the time of the first market creation and introduction of the Electricity Policy Feed-In Act, which regulated the purchase and price of electricity generated by hydropower, wind energy, solar energy, and biomass/other gases.[36] This act was meant to encourage the development of a national base for renewable energies, with the promise of connection to the grid and a Renewable Energy Feed-In Tariff.

The 1980s and early 1990s brought a time of indecision over nuclear energy. On one hand, other sources were becoming cheaper and the initial excitement over nuclear technology was beginning to wane. Accordingly, there were fewer applications for reactors in the mid-to-late 1980s than in the 1970s. On the other, nuclear energy still provided a clean source of energy, and what would eventually count for over a quarter of Germany's electricity. Though it seemed the nuclear industry survived Chernobyl to some extent, at least to continue operation of existing reactors, the 1990s would not be kind to the nuclear energy industry in Germany as the first Green party win signaled a

[36] "30 Years of Policies for Wind Energy: Lessons from 12 Markets," International Renewable Energy Agency, 2012, 68.

policy-based move away from nuclear. Before examining the reactions to Fukushima, it is important to examine the 1990s and 2000s and the back and forth policy movement on nuclear that happened in the interim between Chernobyl and Fukushima, mainly to demonstrate the importance that political parties and electoral systems play in the nuclear question in Germany.

The 1990s and the Rise of the Der Grünen Partei

Every reactor that would come online in Germany had already done so by 1990. The last finished and approved reactor, Neckarwestheim, began operation in 1989. Figure 10 demonstrates the trends of reactor operation:

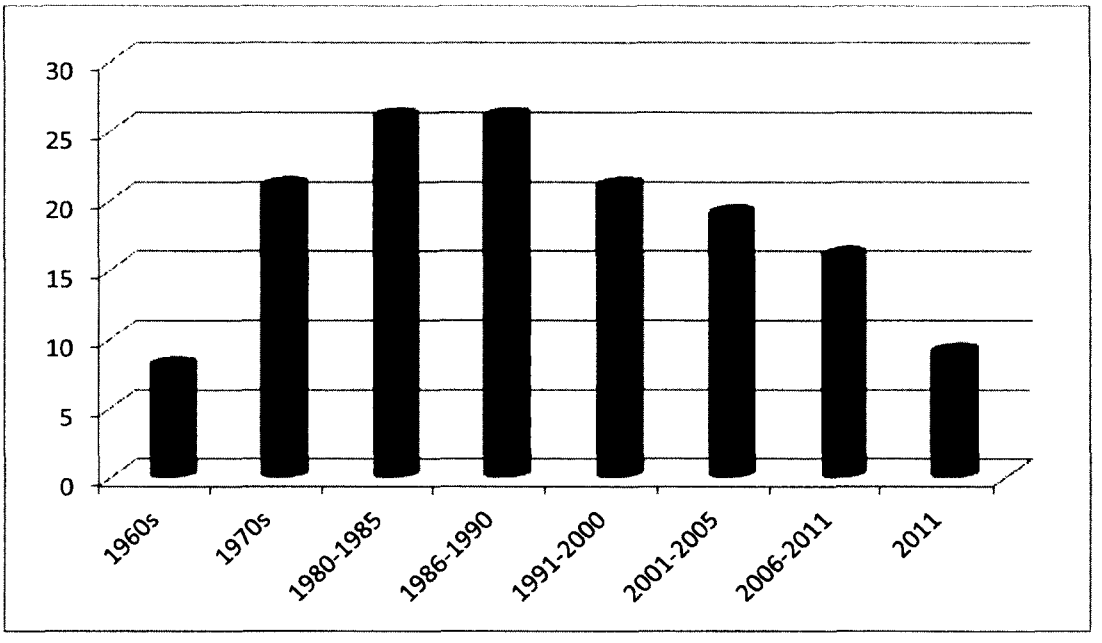

Figure 10: Number of Reactors in Operation in Germany, 1960-2011.[37]

[37] Data compiled by author from German Energy Agency DENA

Since 1990, the number of reactors in operation in Germany has steadily decreased due to a variety of reasons. Several plants that opened in the 1960s closed in the 1980s on schedule, but were replaced with other power generating stations that came online in the same decade. In 1988, two reactors, Mülheim-Kärlich and Hamm-Uentrop, were closed after inspections revealed structural unsoundness and utility companies determined the cost of correcting these were too high. During the period of German reunification in 1990, several East German nuclear stations were closed due to concerns about inadequate Soviet designs and safety standards. The Würgassen reactor closed in 1994[38], followed by two other reactors in 2003 and 2005[39], but no other reactors would close in Germany until 2011 after Fukushima. These trends reveal that the heyday of nuclear pursuance in terms of building a greater reactor capacity peaked in the 1980s and then steadily decreased throughout the 1990s. This is partly due to the scheduled closures of old reactors brought online in the 1960s, but also to the wave of Eastern German closures as a result of reunification. Fewer and fewer reactors were replacing those that closed in the 1990s, a trend that was compounded by anti-nuclear policy in the late 1990s.

The German Green Party, or Der Grünen, grew out of the anti-nuclear movement of the 1970s and was formally founded in 1980 to give the movement political and parliamentary representation. In addition to anti-nuclear goals, the party also supports anti-pollution laws, environmental protection, reproduction and immigration rights, and were strongly against NATO efforts to place Cold War weapons systems in Western

[38] Though the utility operating company PreussenElektra cites economic reasons as the cause for the shutdown, other sources report there was a flaw in the cooling system that was economically infeasible to correct.
[39] Scheduled closures

Germany in the 1980s. Though the Greens had some success in state-level elections and received large enough percentages of votes to gain seats in the lower house of Parliament, they would not enter the Federal Parliament until 1998, when they formed a Red/Green coalition with the Social Democrats led by Gerard Schröder, an alignment that would last for seven years until 2005. Once in Parliament, however, the Green Party's anti-nuclear agenda was challenged by the SDP, and negotiations between the Green-led environmental ministry and the power companies dragged on for a year before a compromise was reached to shut down all of Germany's nuclear reactors by 2020.[40] Though the nuclear phase-out was a policy gain for the Greens, this was hardly what anti-nuclear activists who had supported the party had envisioned after three decades of protest. Many left the party in frustration, arguing that the compromise was weak and left the door open for Conservatives to repeal it, which they formally did in 2010. Table 2 illustrates these voting trends:

[40] Paul Hockenos, "Red-Green Germany: Joschka Fischer on the hurly-burly of the Red-Green Years," German Council on Foreign Relations, Accessed October 10, 2013. https://ip-journal.dgap.org/en/ip-journal/topics/red-green-germany.

Year	Percentage of Party List Vote	# of Overall Seats Won
1980	1.5	0/497
1983	5.6	27/498
1987	8.3	42/497
1990	5.0	8/662
1994	7.3	49/672
1998	6.7	47/669
2002	8.6	55/603
2005	8.1	51/614
2009	10.7	68/662

Table 2: Percentage of Votes for German Green Party, 1980-2009.[41]

Even if it can be concluded that anti-nuclear opinion grew in the 1980s and 1990s (though not necessarily that it became the majority opinion) the effects of that opinion on policy are still debatable. The anti-nuclear agenda of the Greens only received real policy attention when they joined a Parliamentarian coalition, and even then the SPD left the Green-led environmental ministry to fight its own battle with the utility companies operating the nuclear power plants. Even when they were able to pass policy to phase-out nuclear energy, it was a gradual phase-out over the course of decades and had little staying power in the event of an election loss to the Christian Democrats. Only two

[41] Paul Hockenos, "Red-Green Germany: Joschka Fischer on the hurly-burly of the Red-Green Years," German Council on Foreign Relations, Accessed October 10, 2013. https://ip-journal.dgap.org/en/ip-journal/topics/red-green-germany.

reactors closed between 1998 and 2005, and this was not a result of policy but of economic reasons related to flaws in reactor designs. Accordingly, as these reactors closed in the 1990s and 2000s and no new reactors came online to replace them, nuclear energy's overall percentage share decreased. The relationship between this decrease and negative public opinion, however, is weak. Old reactors closed because they were scheduled to close or because it was not an economically sound decision to repair design flaws or damages to infrastructure. New reactors were not constructed because other energy sources were cheaper, and with the policy-phase out passed in the late 1990s, utility companies were not looking to invest.

The strongest case that can be made about a correlation between public opinion and nuclear pursuance concerns cost. In the case of the US, analysis reveals that public protest against nuclear construction was successful when citizens could persuade states to intervene on their behalf (which also worked in the case of Wyhl) and when citizens could pose enough of a roadblock with delays, requests for additional environmental reports, unfavorable media coverage, etc, to make the project too expensive to continue. This also seems to be the case in Germany, where the capital required for construction was similarly high. Reactors license applications were numerous throughout the 1960s and 1970s, but would decrease in the 1980s as the costs of nuclear construction increased and the cost of coal and gas decreased.

Angela Merkel, the CDU, and Fukushima

In the early 2000s, several events coalesced that would ultimately effect the Christian Democratic Union's nuclear policies after they regained the Parliamentary majority in the 2005 elections. First, in 2002, Germany signed and ratified the Kyoto

Protocol, which committed it to reducing emissions from greenhouse gases. Angela Merkel, who would later become Chancellor, aided in negotiation terms of the Protocol as Minister for the Environment and Nuclear Safety. This predicated a move away from using coal, Germany's largest domestic energy resource but also dirtiest form of energy, and a move toward more renewable energy and nuclear, which produces less harmful emissions than other non-renewable sources. However, a move away from coal also signaled a move toward more natural gas, the largest supplier of which to the European market was Russia. Fearing high gas prices, both in real terms and in political terms, nuclear began its comeback through CDU policy in the late 2000s.

In 2007, Chancellor Merkel began laying the foundation for nuclear's return at an energy summit in Berlin where, despite criticism from industry, she insisted Germany stick closely to its ambitious clean energy goals. Among the options she presented for reaching these goals, one was extending the lives of existing nuclear reactors beyond the 2020 deadline set by the Green/SPD coalition. In 2010, this reactor extension was made policy when Merkel announced the existing reactors would continue operating into the 2030s, an average life extension of 14 years for older reactors. Around this same time, it seemed Germans were somewhat split on the issue of the nuclear extension as a way to pursue clean energy. In 2007, a TMS Enmid poll found that 48 percent of Germans polled favored nuclear energy, compared to 43 percent of Germans who did not, a slim majority. Additionally, the same poll found that 48 percent of Germans polled thought the lives of existing reactors should be extended while 44 percent opposed this move.[42] Germans were split, but it seemed there was still substantial support for continuing

[42] "Emnid Survey: Majority for Further Use of Nuclear Power," German Atomic Forum, June 27, 2006, Accessed October 20, 2013,http://www.kernenergie.de/kernenergieen/press/pressemitteilungen/2007/2007-06-27_emnid_umfrage.php.

nuclear energy with the existing reactors well into the late 2000s. This would all change in 2011.

In February of 2011, five federal German states, lead by opposition parties, filed a lawsuit against the extension in Germany's federal court. The lawsuits would not have to wait to go to court, however, when the Fukushima explosion on March 11 of 2011 prompted the government to shut down its seven oldest nuclear reactors, declare a moratorium on the nuclear extension plan, and launch a safety probe into the other German reactors still in operation. Immediately following Fukushima, German citizens congregated in Berlin and other major cities to protest nuclear power and the reactor extension, and activists formed a 27-mile chain around the Neckarwestheim power plant. In the largest anti-nuclear demonstration in German history, people gathered across Germany to protest under the slogan "Fukushima Reminds: Shut Off All Nuclear Plants." Polling at the time reflected a growing anti-nuclear sentiment as well. In early 2011, a Globescan survey found that opposition to building new nuclear reactors in Germany had grown from 73 percent to 90 percent.[43]

Initially, it seemed the Merkel government was unclear in how to respond to the Fukushima disaster. The event had breathed new life into the pre-existing anti-nuclear movement that was fighting the nuclear extension plans of the previous year. It had also galvanized much of the remaining half of German citizens who seemed divided on nuclear energy into a solid anti-nuclear stance. But German nuclear pursuance had survived public criticism before—throughout the 1970s and 1980s, even post-Chernobyl—and Merkel's CDU had won a majority in 2005 running on a pro-nuclear

[43] "Opposition to Nuclear Energy Grows: Global Poll," Globescan, November 25, 2011, Accessed October 21, 2013, http://www.globescan.com/news-and-analysis/press-releases/press-releases-2011/94-press-releases-2011/127-opposition-to-nuclear-energy-grows-global-poll.html.

reactor extension platform. Immediately announcing a nuclear shut-down, however, would bring its own problems, as Merkel's government well knew, among these, finding other energy sources to compensate for nuclear's generation share, increased energy dependence on neighbors, and unavoidable lawsuits from the utility operators such as Swedish-owned Vattenfall demanding compensation for early shutdowns of their facilities. The 3-month moratorium was only ever a temporary measure, but it was never clear immediately following Fukushima that a nuclear phase-out was inevitable.

The deciding blow to Merkel's nuclear pursuance policy was a historic CDU loss on March 27 in Baden-Württemberg, a state that had been a stronghold for the party for 58 years, to the Green Party. The Greens won 24.2 percent of the vote in that election, and the SPD 23.1 percent of the vote, thus giving their coalition 47.3 percent majority over the CDU/FDP's 44.3 percent and securing the Green Party a state premier spot for the first time.[44] On the same day in the state of Rhineland-Palatinate, the election results were similar as the Greens managed to attract 15.4 percent of the vote whereas in the previous election they failed to even break the 5 percent threshold for representation. It became clear that voters considered the moratorium a weak response to the Fukushima disaster: a Forsa poll reported that 71 percent of Germans surveyed considered the moratorium a measure implemented for pure election engineering.[45] The same poll found that a majority of CDU supporters also found the abrupt nuclear policy shift unacceptable and considered Merkel "untrustworthy."[46]

---

[44] "CDU Suffers Historic Loss in Baden-Wurttemberg," *The Local,* March 28, 2011, Accessed 4 October 2013, http://www.thelocal.de/politics/20110327-34003.html.
[45] "Poll: Voters Push Union From Nuclear Course," Der Spiegel, March 23, 2011, Accessed October 15, 2013, http://www.spiegel.de/politik/deutschland/umfrage-waehler-strafen-union-fuer-atomkurs-ab-a-752631.html.
[46] Ibid.

At the end of the three month moratorium, in May of 2011, the German government announced plans to shut down all of the nuclear reactors in the country by 2022 and expand the use of renewable resources to compensate for the energy lost from nuclear. The disaster at Fukushima pushed a policy of nuclear abandonment that neither Chernobyl nor Three Mile Island had been able to. In questioning this line of causality, however, we have to wonder if it was a governmental response to the disaster itself—that is, the German government genuinely felt Fukushima had effectively demonstrated nuclear energy was unsafe—or if the nuclear turn-around was a response to the turning tide of public opinion that nuclear energy was unsafe? Would Merkel's CDU and the rest of the government have chosen the same anti-nuclear path had the shift in public opinion not carried real electoral consequences? It is difficult to say with certainty, especially considering Merkel's past position as a minister for nuclear safety.

There are multiple ways to analyze the relationship between public opinion, nuclear disasters and nuclear pursuance in Germany. First, it is clear that Three Mile Island had little effect on either public opinion or nuclear pursuance. There was already an anti-nuclear movement in Germany underway, and this nuclear incident in the United States was relatively small. Those who did not support nuclear energy continued to not do so, but polling revels the effects on population in general were negligible. By 1979 there were multiple reactors already in operation and more were being built. Chernobyl increased both protest intensity in the months following the explosion in former-USSR Ukraine as well as increased German resistance to building new reactors, though slim majorities of the population continued to support using the reactors already in existence. To a small extent, there seems to be a correlation between opinion and pursuance—

support for and continued operation of existing reactors, but opposition to and reticence to build new reactors after Chernobyl. However, when considering other externalities, a clear correlation between nuclear pursuance and public opinion is impossible as a variety of other variables could also explains a decline in new reactor applications—cheap oil, expensive coal, market privatization, etc.

The first actual policy shift in nuclear energy did not come until the late 1990s. If it can be assumed that the voting behavior is a tangible outcome of public opinion, then this election signals the first practical impact of growing anti-nuclear sentiment for the anti-nuclear Green Party. Still, it is unclear whether this policy shift reflected an opinion majority as the shares won by the Greens were relatively small, and even members of the Green Party felt the 2020 phase-out was a weak compromise. Eventually, even this decision was overturned by the Merkel-led CDU because extending the lives of existing reactors satisfied other demands on German energy and environmental goals. Real change to nuclear energy policy did not happen until 2011 after Fukushima when nuclear support clearly plummeted in Germany. It still remains unclear, however, whether the same nuclear phase-out would have happened had the Green Party been unable to capitalize and ultimately squeeze an electoral win from the nuclear frenzy. Also unclear is to what extent the decision to phase out nuclear energy was in response to actual fears about nuclear safety or public opinion in general. Polling shows that most Germans believe the decision to be a carefully calculated political move on the part of Merkel and the CDU in response to a Green Party win in a CDU state stronghold and fears of larger Green wins throughout Germany. Though a case can be made for a correlation between

public opinion and nuclear policy after Fukushima, the case is still somewhat weak, as distinct lines of causality difficult to distinguish.

Access to Other Resources

Whereas the previous section sought to determine to what degree public and nuclear disasters influence pursuance of nuclear energy, this section will examine supply of other electricity-producing resources with the hypothesis that the greater the percentage of overall energy consumption that comes from other electricity-producing resources, particularly coal and gas, the less a country will pursue nuclear energy. In concurrence with the previous hypotheses tested in the US, the hypotheses to be tested in this section are that the greater extent that coal makes up an overall energy supply, the less likely a country will be to pursue nuclear; likewise, the greater the supply of natural gas, the less likely a country will be to pursue nuclear. In the case of Germany, petroleum makes up such a small percentage of electricity production that it will not be considered here.

The most recent data on Germany's electrical energy mix reveals that, in 2011, Germany's main energy resource was coal, which alone accounted for 43.5 percent of German electrical production in 2011; Renewable sources (including biomass, solar, wind, hydropower and domestic waste) made up 19.9 percent; nuclear, 18 percent; and natural gas, 13.7 percent. In terms of domestic energy resources, Germany has the second largest coal reserves in Europe and Eurasia, second only to Russia.[47] Germany's natural gas reserves are trapped in shale, and they have no naturally occurring oil reserves, but it does produce far more energy from biofuels than any other Eurasian country and

[47] "BP Statistical Review of World Energy, June 2103," British Petroleum, Accessed November 2, 2013, http://www.bp.com/content/dam/bp/pdf/statistical-review/statistical_review_of_world_energy_2013.pdf.

produces 12 percent of all wind and 35.8 percent of all solar energy generated in the world.[48]

These numbers reveal interesting trends in German energy. First, that it relies heavily on coal for electricity, yet since the early 1980s, it imports most of its coal, a move rationalized by the US coal market's consistently cheaper price than that of European coal markets.[49] Second, almost ironically, that in addition to using the least "clean" energy source, Germany leads Europe in clean, renewable energy production through the solar, wind, and biofuel industries. Perhaps one reason Germany felt more confident phasing out nuclear is because of this previously well-established foothold in renewable energy, greater than any other regional country, to be sure. The problem of dirty coal consumption, however, remains.

German coal exports decreased in the 1990s. In 2013, however, German coal began to make a comeback in the wake of the turn from nuclear. First, German electricity exports actually increased in the first quarter of 2013, an event explainable only by increased production from coal-fired plants.[50] Second, two of the largest German utility companies, RWE AG and EON SE both reported increased coal imports of up to 25 percent in the same quarter.[51] By this token, Germany is both importing more coal to create energy, and then exporting the energy created by the imported coal. Of course, the government has faced harsh criticism for this choice that will produce more greenhouse

---

[48] Ibid.
[49] "BP Statistical Review of World Energy, June 2103," British Petroleum, Accessed November 2, 2013, http://www.bp.com/content/dam/bp/pdf/statistical-review/statistical_review_of_world_energy_2013.pdf.
[50] Paul Hockenos, "German Export of Coal Power Way Up," German Council on Foreign Relations, August 21, 2013, Accessed October 1, 2013, https://ip-journal.dgap.org/en/blog/going-renewable/german-export-coal-power-way.
[51] Stefan Nicola, "Merkel's Green Shift Backfires as German Pollution Jumps," *Businessweek,* July 29, 2013, Accessed October 30, 2013, http://www.businessweek.com/news/2013-07-28/merkel-s-green-shift-backfires-as-german-pollution-jumps-energy.

gas emissions than in previous years, especially considering she is a former environmental minister who helped negotiate the carbon emission standards of the Kyoto Protocol.

This section hypothesized that the greater extent coal made up overall energy consumption, the less likely a country would be to pursue nuclear energy. Coal consumption decreased in the 1980s and 1990s as the reactors built in the 1970s came online in the 1980s, though the decrease in coal consumption would level off in the early 1990s until the recent increase in 2013. Though coal consumption decreased, it still consistently made up the majority of energy production in Germany from the 1990s until present time. Both natural gas and nuclear consumption increased in the same time periods, accounting for the decreased coal consumption. Similarly, as nuclear production began decreasing in 2011 and will continue to decrease indefinitely, coal production and imports have both increased. Germany has natural gas reserves of its own, but the gas is trapped in shale and the state has currently placed a moratorium on developing the shale fracturing technologies needed to extract the resources. Germany has, however, been linked to plentiful Russian gas by the Nord-Stream Pipeline, which moves gas from Vyborg in Russia to Griefswald in Germany, since 2011 when 60 percent of its gas imports came from Russia.[52]

When Germany announced in May of 2011 that it would shut down all of its nuclear reactors by 2022, there was much speculation as to how it would make up the roughly 20 percent share of electricity that nuclear power provided. There were predictions that Germany would resort to importing nuclear energy from France, a move

[52] "Germany Marches East, Russia Moves West: Energy Diplomacy," Natural Gas Europe, March 13, 2012, Accessed November 3, 2013, http://www.naturalgaseurope.com/germany-russia-energy-diplomacy.

that would not only seem hypocritical but would also increase their energy reliance on their neighbors. Others spoke of energy blackouts and brownouts from unreliable renewable energy supplies. So far, neither of these scenarios has been realized, and in the cold winter of February 2012, Germany actually exported energy to France when heating energy ran low. Granted, this energy came from a coal-fired plant, a sticking-point that has not gone unnoticed as running counter to Germany's clean energy goals and Kyoto Protocol obligations. Normative judgments aside, the nuclear turn-around announcement came as a surprise to many, though considering Germany's numerous energy options, it should not have.

First, Germany has long lead Europe in renewable energy technologies. In 2011, renewable energy sources accounted for roughly equal amounts of energy production as nuclear. Of course, there is little practicality in the assumption that Germany could turn off all of its nuclear reactors tomorrow and immediately substitute that loss with renewable sources. The grid system has to be converted to become compatible with renewable feed-ins, and all renewable sources have to be expanded to compensate for the nuclear gap. However, if government funding were to move from nuclear technology to renewable technology, this expansion could be possible. The decision to move away from nuclear had to have been influenced by the knowledge that renewables were already viable in Germany and that expansion was an option. In fact, in 2010, Germany amended its Atomic Energy Act to align with an "energy concept" where nuclear power would serve a "bridging function" until the infrastructure for renewable technologies were in

place.[53] While this amendment did not set a specific time-line for the nuclear phase out, it does indicate that moving away from nuclear energy toward renewable sources was a well-established part of the Germany' future energy plan as early as 2010.

Second, though it runs counter to clean energy goals, the increased use of coal is also a viable nuclear substitution option for Germany. Coal is Germany's biggest domestic resource, and even if it continues to import coal, those imports will consistently be priced cheaply. A consequence of increased American gas production and consumption has been low coal prices and increased exports to European markets. Even if coal is only a temporary solution to a long-term problem, it can buy Germany time to expand the renewable sector without increasing the price of energy to consumers.

In addition to coal, natural gas is also a viable option, and not just in the short-term. The Nord-Stream Pipeline was criticized for many for increasing German dependence on Russian gas. As do many Eastern European countries, Germany is almost solely reliant on Russian gas exports to make up its natural gas needs. This does not necessarily have to be a problem, though. While Germany is dependent on Russian gas, Russia is also dependent on the German gas market and the revenue it will bring. Rather than see this relations as one of dependence, it can be viewed as an interdependent relationship which may create cooperation rather than conflict. Moreover, Russia is not the only gas supplier in the market. In June of 2013, German EON announced that it would begin tapering its dependence on Gazprom, Russia's state-owned gas company, and instead develop ties to the Canadian company Pieridae Energy. Pieridae says it will build Canada's first Liquid Natural Gas (LNG) export terminal in Nova Scotia by 2020

[53] "Countries' Regulatory Bodies Have Made Changes in Response to the Fukushima Daiichi Accident," United States Government Accountability Office, Report to the Chairman, Subcommittee on Transportation and Infrastructure, Committee on Environment and Public Works, U.S. Senate. March 2014.

now that they have secured reliable shipping client in Europe. Similar developments are also happening the US, as the US Federal Energy Regulatory Commission continues to approve ports across the US and Mexico for shipments of LNG. Even if dependence on Russian gas becomes problematic, the price of gas will remain stable with the presence of multiple suppliers and as Canada and the US continue developing the infrastructure to ship to a European market, gas consumers have supply options. Since natural gas is cleaner than coal, it may also present a long-term option for German energy in addition to renewable expansion.

Chapter Conclusions

As is the case in the US, it is difficult to draw clear conclusions as the genuine relationship between public opinion and nuclear pursuance. The moratorium on nuclear licensing from 1979-1982 to create a system where public input was less valued in the licensing process seems to point to a lack of concern on the part of government and the industry. Green Party electoral gains could also be interpreted as an indicator of public opinion efficacy, but their overall electoral percentages remained quite low in comparison to other parties. Reactor approval and construction continued throughout the 1970s and even into the 1980 until the last reactor came online in 1989 though, granted, reactor approvals slowed significantly in the 1980s. This slowing could be a result of anti-nuclear opinion (though it still difficult to determine that anti-nuclear opinion was the majority opinion of the time) but could also be linked to other factors such as low coal and oil prices, rising capital costs, and the privatization of energy markets. Ultimately, it is impossible to draw clear lines of causality between public opinion and nuclear pursuance in Germany, at least until 2011 and Fukushima.

Though Three Mile Island had little effect on public opinion or nuclear pursuance in Germany, Chernobyl did cause a clear shift in opinion that lasted into the 1990s and contributed significantly to the growing popularity of the Green Party, which was able to form a Parliamentarian coalition in 1998 and make real moves toward anti-nuclear policy. The policy was weak, however, and was eventually overturned. Anti-nuclear protest movements are most successful when states or municipalities become involved on behalf of citizens. Though organizations cannot be involved in the official public input mechanism, the decentralized nature of the German state-based licensing approval process makes it possible for cities or states to refuse to grant site licenses for reactors. It is still unclear, however, what specifically motivates these actors to do so. At times, cities are swayed by the promise of industry, employment, and utility company perks; other times, the state may own part of the utility company and have a vested interest in licensing approval (though this does not happen now since the privatization of the market). But sometimes, as was the case with the Wyhl plant, Administrative Courts can intervene to deny construction permits. This makes the Germany system fundamentally different from the federally centralized NRC approval system, and creates conditions in which intervention to stop reactor construction may be easier.

The only clear relationship between public opinion and nuclear pursuance involves cost. Reactors are expensive to initially build, and if citizen groups can make the process longer by creating roadblocks like physical confrontation, media coverage, damage to facilities, etc., then utility companies are less likely to finish reactor construction or apply to construct new reactors.

Fukushima does seem to present a turning point in German energy policy, more so than any other event that preceded it. Similar nuclear phase out policies have been passed and have failed before, but they were conceived by a weak coalition that was replaced shortly after the policy shift. We currently lack the hindsight to know if the current nuclear phase out policy will stick, but the current Merkel government plan will remain policy at least for the foreseeable future, considering the recent German federal elections in September 2013 that solidly returned a CDU majority. At this point, Germany has also created such a strong, normative narrative around moving away from nuclear energy that returning to nuclear would be seen as a weak political move. The question of why Fukushima was different from Chernobyl has to be asked and answered, especially considering Chernobyl was so geographically close to Germany and Fukushima happened on the other side of the world.

Part of the explanation for the impact of Fukushima can be found with an already weakened nuclear energy sector. The mid-1980s was the peak operating time for nuclear reactors in Germany. In 2011, however, the circumstances surrounding nuclear were much different. In 2010, the Merkel government passed legislation that allowed for a 14 year life extension of existing reactors. Barring another life extension, those reactors would be only be safe for operation for another thirty years, meaning they would be scheduled for decommission beginning in 2040. Without new reactors to replace the aging ones (and a new reactors has not been approved in Germany since 1982) nuclear energy was never really a long, long-term energy option. The same legislation also increased energy company payments to fund renewable energy technology. By

Fukushima in 2011, it was clear that nuclear energy was only a stop-gap measure on the way to greater renewable capacity, anyway.

Other Fukushima explanatory power lies in the momentary revitalization it added to the anti-nuclear movement and subsequent Green Party electoral gains, especially in the historically CDU dominated area of Baden-Württemberg. The Green party has been more effective at influencing nuclear policy in Germany than in the US, even with low representation numbers, not just because it has stronger voter support but because it operates in a system of Parliamentarian proportional representation.

However, it remains unknown whether the impact of Fukushima truly had anything to do with genuine safety concerns. Surely this is what spurred citizens to disapprove of nuclear energy in record numbers, but to what extent that same concern was a factor influencing policy is unclear. Would the Merkel government have made the same decision about nuclear energy if it made up 50 percent of their electrical energy needs rather than just 25 percent? Or if there was not an already established renewable sector? Or if the CDU had won in Baden-Württemberg rather than the Greens? Of course, these "what-ifs" are impossible to answer, but important to consider. Again, the relationship between the post-Fukushima nuclear phase out and public opinion is unclear.

What is clear is that German has well-established and affordable energy options, and this may be the most important explanatory variable for its nuclear phase out. With a well-established renewable sector already in operation and access to cheap coal and natural gas, the move away from nuclear was not as drastic as many interpreted.

CHAPTER 5

NUCLEAR ENERGY IN JAPAN

Objective

Following the structure of the preceding chapters, this case study will first offer a brief history on the development of nuclear energy policy in Japan before turning to an examination of public opinion, past disasters and access to other energy resources. "Nuclear energy pursuance" is again operationalized as the overall percentage nuclear provides to the electrical energy supply and public opinion is measured by using polling data from both before and after 2011. Quantitative polling data will be supplemented with a brief qualitative discussion of nuclear energy protest activity in Japan, which is supplemented by a discussion of the limitations placed on protests by traditional Japanese political culture. The hypothesis is that in countries where nuclear approval is low, nuclear pursuance will be low as well. Next, this chapter will analyze data over time that helps examine to what extent public opinion and nuclear energy pursuance have changed in response to the nuclear disasters at Three Mile Island, Chernobyl, and Fukushima. This chapter will also include a discussion of nuclear incidents in the 1990s and 2000s that were specific to Japan and the impact these had on public perceptions and nuclear pursuance. Lastly, this chapter will examine the share nuclear power currently makes up of total Japanese energy consumption with the hypothesis that if Japan has greater access to other affordable energy resources, its pursuance of nuclear will decrease. The chapter will end with conclusions based on these findings.

Before the Fukushima nuclear disaster in 2011, Japan was the second largest nuclear energy generating country in the world behind France. Figure 11 illustrates Japan's overall electrical energy sources in 2011, before Fukushima, when nuclear still provided a large share of overall electricity generation with 54 reactors:

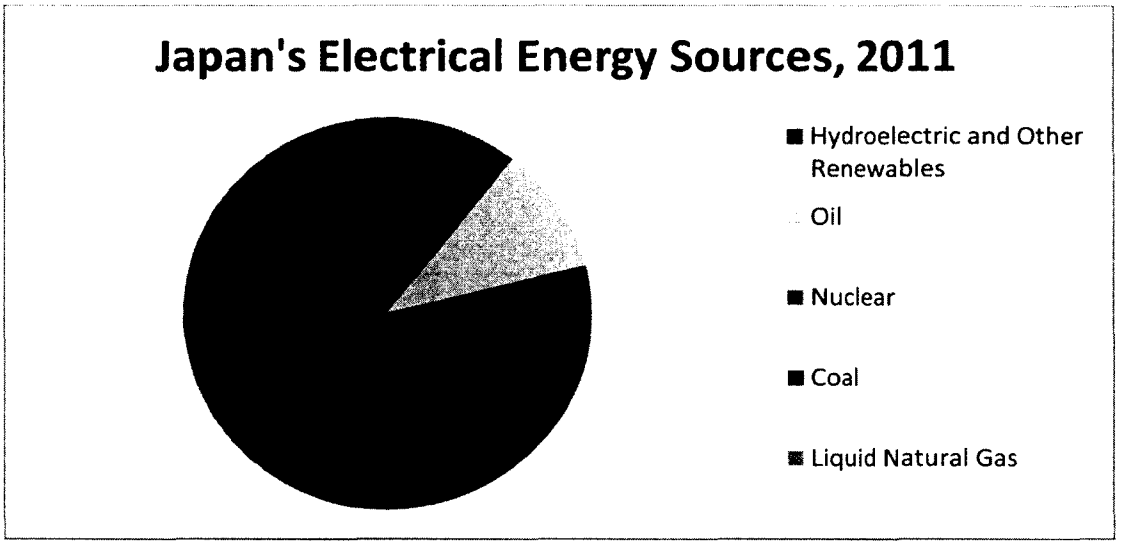

Figure 11: Japan's Electrical Energy Sources, 2011.[1]

Before March of 2011, Japan had a varied mix of electrical energy sources, depending on no one source for more than 30 percent of its energy needs. Coal, liquid natural gas (LNG), and nuclear each made up roughly 25 percent of the electrical energy needs (though some estimates place nuclear with a 30 percent share in 2011) with oil, hydroelectric and other renewables such as solar, wind and biomass comprising around 18 percent combined. When the Japanese government shut down the majority of the

[1] Data compiled by author from Japan Profile, US Energy Information Administration.

country's nuclear energy generating plants after the Fukushima disaster in 2011, nuclear's percent share generation was primarily compensated for with LNG and oil. Japan's Ministry of Economy, Trade and Industry (METI) reports that in 2012, LNG and oil's shares rose to 48 percent and 16 percent, respectively, as nuclear's power share fell to 2 percent.[2] Japan's coal consumption only increased from 25 percent to roughly 28 percent. By May of 2012, Japan had no nuclear generation for the first time in over 40 years, though current Prime Minister Shinzo Abe's plan for economic recovery includes reintroducing nuclear energy to meet at least 15 percent of generating capacity over the next decade. Japan is extremely resource poor, importing 80 percent of its primary energy requirements.[3] Before Fukushima, the target was to increase nuclear generation from 30 percent to 41 percent by 2017 and 50 percent by 2030 with the construction of additional reactors.

Development of Early Energy Policy in Japan

Japan has been impacted by nuclear technology more than any other country in the world. The atomic bombings of Hiroshima and Nagasaki in 1945 that ended World War II and obliterated these two cities set Japan on a staunch course of nuclear arms non-proliferation coupled with a desire to use nuclear technology for peaceful energy-generating purposes. A decade after these bombings, Japan would pass the first piece of legislation that would eventually make it one of the biggest consumers of nuclear energy in the world, an act which perhaps signifies remarkable tolerance of nuclear disasters. With few natural resources of its own and import dependence coming at both real and

---

[2] "Country Profile: Japan," Energy Information Administration, Last Updated October 29, 2013, Accessed December 13, 2013, http://www.eia.gov/countries/cab.cfm?fips=JA.

[3] Toshihiko Nakata. "Nuclear Energy Development in Japan," *Nuclear Energy Development in Asia: Problems and Prospects,* Ed Xu Yi-Chong, (New York: Palgrave McMillan, 2011), 98.

security-related costs, Japan's plan for rebuilding and recovery after WWII was built around using nuclear power for peaceful energy.

Japanese nuclear energy policy began, ironically enough, with a trip to the US. Japanese Diet member Yasuhiro Nakasone first introduced the budget for nuclear energy research and development after visiting nuclear facilities in the US in 1953 and receiving advice from Dr. Ryokichi Sagane of Lawrence Berkeley National Laboratory in California. Dr. Sagane advised Nakasone to introduce nuclear energy to Japan with a three-pronged approach: establish a national long-term strategy for nuclear energy; back up nuclear research and development (R&D) with a liberal budget and enshrine the energy initiative in law; encourage the nation's top engineers and scientists to join the nuclear industry.[4] This advice would come to shape the development of early energy policy and initiatives in Japan when Nakasone, then head of the executive board members of the House of Representatives Budget Committee, returned to Japan and swiftly had the budget for nuclear R&D enacted through the Diet. Nakasone would later join the Kishi Cabinet as Minister of Science and Technology, and acted as the first chairman of the Atomic Energy Commission of Japan in 1956, eventually rising to become Japan's Prime Minister in 1982. With support from Nakasone, a member of the Liberal Democratic Party who would become increasingly influential in Japanese politics, nuclear energy had a viable start in Japan even in the midst of skepticism from a public who had not forgotten the dark side of nuclear technology. Even very early on, there is clearly a strong relationship between the LDP-controlled government and the bureaucracy machine that would make nuclear energy viable.

---

[4] Nakata, "Nuclear Energy Development in Japan," 99.

Atomic Energy Basic Law of 1955

In 1955, the Japanese Diet passed the Atomic Energy Basic Law, which was established to "contribute to enhancing the welfare of human society and improving the standard of living by promoting the research and development and utilization of atomic energy."[5] The 1955 Atomic Energy Basic Law also created the legislative bodies that would oversee regulation and safety standards, the Japanese Atomic Energy Commission and the Nuclear Safety Commission as well as the Japan Atomic Energy Research Institute. The law promoted a three-part mission statement for the development of nuclear energy: democratic methods, independent management, and transparency.[6] The first test reactor in Japan was commissioned in 1963, and the first commercial reactor to generate electricity began operating in 1966. The early nature of reactor construction was marked by a unique system of horizontal integration by private utility companies which would purchase designs from American vendors and then contract other Japanese companies like Mitsubishi and Hitachi to build the reactors in Japan. Later, these same companies would develop the capability to design and then construct reactors themselves, and by the end of the 1970s, there was a thriving nuclear construction industry in Japan that supplied the majority of domestic nuclear construction as well as exported reactors and reactor designs to other East Asian countries and even the UK.[7] [8] Exporting nuclear energy technology continues to be an important part of Japan's economy, and one that current Prime Minister Shinzo Abe is keen to promote.

---

[5] "Legal System for Nuclear Safety Regulation in Japan," Japanese Ministry of Education, Culture, Sports, Science and Technology, Accessed January 15, 2014, www.MEXT.go.jp.

[6] "Nuclear Power in Japan." World Nuclear Association, Accessed December 5, 2013, http://www.world-nuclear.org/info/Country-Profiles/Countries-G-N/Japan/.

[7] Ibid.

[8] From 2011-2013, Japan did not export any nuclear reactors, though they will supply Turkey with one reactor and Vietnam has recently ordered two reactors. These will be the first reactor exports since the Fukushima disaster.

Japan was one of a handful of countries following this horizontally integrated business model at the time, when most publicly-owned utility companies followed a more vertically integrated model that allowed the same company to supply chain the reactor construction from start to finish. At a time when the bureaucrat-led economic model favored anything "made in Japan," this system worked well in avoiding tighter regulations or restrictions from the regulatory bodies overseeing approval and construction. This further illustrates the early involvement of the government in Japan's nuclear energy development. It was very clear that a strong relationship existed not just between bureaucrats and regulatory bodies, but also between the government, nuclear construction industries and utility companies. The manufacturing industry received advice from the Ministry of International Trade and Industry (MITI, which would later become the Ministry of Economics, Trade and Industry [METI] that would oversee nuclear energy); transportation advice from the Ministry of Transportation; financial advice *and* subsidies from the Ministry of Finance, and so on[9]. This very close integration of governmental bodies and the nuclear industry was beneficial during the early years of nuclear development, but would later come to be seen as an aspect of the industry that violated the pillar of Transparency set forth in the original 1955 Atomic Energy Basic Law.

The Oil Crises and Economic Growth

In the mid-1970s, Japan generated 66 percent of its electricity from oil.[10] Like many oil-consuming nations of the world, the adverse effects of the oil embargo in 1973 and the Iranian Revolution in 1979 caused Japan to reconsider its dependence on oil,

---

[9] Nakata, "Nuclear Energy Development in Japan," 99.

[10] Steve Austin, "Japan Seeks Resilient Energy Policy," Oil-Price.net. Accessed December 10, 2013, http://www.oil-price.net/en/articles/japan-seeks-resilient-energy-policy.php.

particularly from the Middle East. The government began taking new measures to deal with oil rising oil prices, such as dimming the lights on Tokyo Tower or prohibiting late night television shows across the country to save electricity.[11] Japan also continued aggressively pursuing nuclear energy by approving and bringing new reactors into operation throughout the 1970s and 1980s, though pursuing nuclear energy was part of Japan's national development strategy well before the oil shocks of the 1970s. From 1970-1979, 20 reactors became operational in Japan, the majority of which were applied for and approved for construction in the 1960s, well before oil prices rose in the 1970s. If anything, Japan continued an already aggressive nuclear policy by bringing another 15 reactors online in the 1980s and 15 more in the 1990s.[12]

Japan's reasons for this aggressive pursuance beginning in the 1960s had much to do with its need to industrialize quickly. Economically devastated and occupied after defeat in WWII, Japan was playing "catch-up" to the rest of the modernizing world. After WWII, the country began a period of rapid industrialization, with growth especially heavy in industries like steel, chemicals and machinery, and advanced technology. This rapid period of growth raised the per capita income, increased standards of living, and worked to reestablish Japan's place in the international community, but it came at a high price. Pollution was rampant, and the first cases of mercury poisoning surfaced in Minamata and Niigata in the 1950s. In Toyama prefecture, another debilitating disease that affects the nervous system and is associated with cadmium waste was discovered. The locals named it "itai-itai byo" or "it hurts-it hurts sickness".[13] Both instances are long

---

[11] Nakata, "Nuclear Energy Development in Japan," 100.
[12] "Nuclear Reactors in Japan." Citizens' Nuclear Information Center. Accessed December 8, 2013. http://www.cnic.jp/english/data/nucreactors.html.
[13] Schreurs. *Environmental Politics in Japan, Germany and the United States*, 36.

and sordid stories involving a corporate cover-up that was aided and abetted by government officials who made it possible to prolong the chemical dumping, even as the number of victims increased.[14] It would not be until the 1970s that those affected by itai-itai byo would begin filing lawsuits that trickled through the court systems and even later in the 2000s when the Japanese government would officially acknowledge these industrial pollution-related poisonings and offer the victims limited monetary compensation.

Another primary cost of this rapid economic development was increases in electricity and energy use in general, a phenomenon which, for Japan, a country with limited natural resources, meant increased energy imports and dependence. At the peak of Japan's development between 1960 and 1974, the average annual growth rate of electricity consumption per capita exceeded 10 percent, which was much higher than that of many European and North American countries at the time.[15] For this reason, aggressively pursuing nuclear energy after WWII became intrinsically linked to economic development. In addition, the government was also able to create an effective narrative that linked economic development to restoring national pride, an attitude which would persist throughout the 1970s and 1980s as Japan continued to grow, eventually becoming the world's second largest economy from 1978-2010. The 1970s and 1980s were the decades when nuclear energy gained full "citizenship rights" to secure Japan's energy supply and fuel their economic growth, but without significant input from the public or debate about the environmental impacts of nuclear power.[16] When the demand

---

[14]Kingston, *Contemporary Japan,* 188.
[15] Yi-Chong Xu, "Nuclear Energy in Asia: An Overview," *Nuclear Energy Development in Asia: Problems and Prospects,* Ed Yi-Chong Xu, (New York: Palgrave McMillan, 2011), 5.
[16] Ibid, 100.

for public and private electricity decreased with the economic downturn in the 1990s, so would the demand for new nuclear reactors.

Energy Policy of the 2000s

The cornerstones of Japan's energy efficiency policies include the Basic Act on Energy Policy of 2002, the New National Energy Strategy (NNES) in 2006 and the Basic Energy Plan (BEP) in 2010. These directives together set the general direction for Japan's energy policy. They specifically identify securing stable supply, environmental sustainability, and the utilization of market mechanisms as key policy directions.[17] A key point of this energy plan is the increased attention paid to energy efficient measures in the commercial, resident and transport sectors. Japan also adopted a front-runner plan that set forth specific measures for achieving its goal of improving energy consumption efficiency by at least 30 percent by 2030 compared to 2003.[18] Nuclear energy became a natural part of the strategy to pursue these energy priorities of stable supply, energy conservation and environmental goals.

Development of the "Nuclear Village"

Any discussion of nuclear energy in Japan would have to include reference to the "nuclear village," or "genshiryoku-mura," which is the term commonly used in Japan to refer to the institutional and individual pro-nuclear advocates who comprise the utilities, nuclear vendors, Japanese Diet, bureaucracy, financial sector, media and academia. This "village" is bound by a shared solidarity to promote nuclear energy, which it has successfully done since the 1950s. The village significantly overlaps with the "Iron Triangle" of big business, bureaucracy, and the Liberal Democratic Party (LDP) which

[17]"Energy Policies on IEA Countries, Japan: 2008," International Energy Agency, Accessed December 1, 2013, http://www.iea.org/publications/freepublications/publication/Japan2008.pdf.
[18] Ibid.

has been in power almost consistently since the 1950s except for brief periods between 1993 and 1996 and 2009 and 2012. This interdependence of government, industry and bureaucracy created "Japan Inc." during the period of economic growth following the 1950s. Though the practices of Japan Inc. are now largely discredited (primarily by the economic recession of the 1990s and 2000s) these same practices were the accepted status quo from the 1950s through the 1980s, practices that allowed nuclear energy to grow unfettered by variables like public opinion or environmental impacts.[19]

Over the years, as Japan's nuclear energy sector grew, so did the influence of the nuclear village and the benefits associated with being a member. Vested interests in nuclear power development ranged from construction companies to lenders and investors in energy firms, extending down to grant-seeking academics and even journalists. Though there are disagreements on policy within the nuclear community, they are the "squabbles of a gated community where cooperation and reciprocity prevail."[20] While exclusion from the community has been the stick of cooperation, access to vast resources and power have been the carrots. Those who don't support the Village consensus on the need for, safety, and economic logic of nuclear power are denied access to grants and are passed over for promotions. Similarly, journalists who criticize nuclear power are denied access to press junkets or politicians seeking re-election on an anti-nuclear platform suddenly lack campaign contributions. Media outlets eager for a portion of the utility companies' massive advertising budgets adjust their reporting accordingly. Just as crossing the nuclear village carries severe consequences, support for their pro-nuclear agenda also carries perks. The chairman of the Tokyo Electric Power Company (TEPCO,

---

[19] Jeff Kingston, "Nuclear Village" *The Asia-Pacific Journal.* Accessed December 15, 2013, http://www.japanfocus.org/-Jeff-Kingston/3822.
[20] Ibid.

the utility company responsible for the operation of the Fukushima nuclear plant) first heard of the Fukushima crisis while in China treating favored members of Japan's largest media organization to a luxury junket.[21] Though Japan Inc. is defunct, the nuclear village lives on as a short-hand description of a powerful interest group with a very specific agenda.

Regulatory Capture and the Practice of Amakudari

Understanding the nature of the nuclear village in Japan at least partly explains the phenomenon of regulatory capture that has historically been so prevalent in the Japanese nuclear industry. Regulatory capture is a form of political corruption that occurs when a regulatory agency tasked with acting in the public interest instead advances the commercial or special concerns of interest groups that dominate the industry or sector the body is charged with regulating. The institutions created to regulate the nuclear industry in Japan were housed within the Ministry of Economy, Trade and Industry (METI), a sprawling organization that is responsible for promoting nuclear energy as it was deemed critical to Japan's economic development. In the context of the Iron Triangle, the cooperative ties between the industry and the regulators were standard operating procedure. In short, nuclear regulators have long been regulating in the interests of the regulated, meaning that policies and regulatory implementation were carried out in ways that supported utility interests.[22] This culture of regulatory capture nurtures practices that promote solidarity and group-think and marginalizes dissenting opinions.

---

[21] Jeff Kingston, "Nuclear Village" *The Asia-Pacific Journal.* Accessed December 15, 2013, http://www.japanfocus.org/-Jeff-Kingston/3822.

[22] Mark J. Ramseyer, "Why Power Companies Build Nuclear Reactors on Fault Lines: The Case of Japan," *Theoretical Inquiries in Law.* 13:2, (2012), 459.

This practice is, of course, not limited only to Japan. Frank von Hippel, a nuclear physicist and expert on nuclear energy policy at Princeton University, said in 2011 that the process of regulatory capture has long been at the heart of US nuclear energy, as first introduced in this study within the US case study.[23] This revolving-door employment and regulatory capture practice is intensified in Japan through and culturally reinforced by the practice of amakudari (descent from heaven), in which senior government officials secure post-retirement, well-paying jobs at companies they previously supervised in carrying out their official duties.[24] This conflict of interest has long raised suspicions that officials exercise their oversight authority and discretionary powers with an eye toward landing a lucrative job at companies they regulated in an official capacity. Jeff Kingston claims that "amakudari is a notorious hotbed of corruption that costs taxpayers considerable sums in subsidies and inflated government contracts."[25]

This brief history of the development of the nuclear energy sector in Japan illustrates, above all, that pursuing nuclear energy has primarily been a decision made by the Japanese state, codified into law by the Diet, protected by bureaucracy, and enshrined into a national policy of greater energy independence. Since the beginning of the Meiji Restoration period in 1868, the "public good" came to equal the "official good" or the national interest.[26] Equating nuclear energy with economic growth and then promoting the two as the path to a restoration of national pride allowed nuclear energy to develop relatively free of public input. The Japanese people have historically refrained from

---

[23] Frank von Hippel, "It Could Happen Here Too," *New York Times,* March 23, 2011, Accessed December 14, 2013, http://www.nytimes.com/2011/03/24/opinion/24Von-Hippel.html?pagewanted=all&_r=0.
[24] Kingston, *Contemporary Japan,* 31.
[25] Ibid, 31.
[26] Mindy L. Kotler and Ian T. Hillman. "Japanese Nuclear Energy Policy and Public Opinion." The Institute for Public Policy at Rice University Japan Access Information Project (May 2000), 3.

challenging authority, instead expecting Japan's central governments and bureaucrats to protect and advance the national interest as a matter of course. Pursuing nuclear energy at all costs has been made easier by the processes of regulatory capture and amakudari, both practices working to strengthen the ties between the nuclear industry, the Nuclear and Industrial Safety Agency (now the Nuclear Regulatory Agency, renamed and reorganized and housed in the Ministry of Environment since Fukushima) and the LDP.

The oil crises of the 1970s gave full citizenship rights to nuclear energy to secure a reliable and affordable energy source for Japan to fuel its post-WWII period of rapid economic growth, though the country was already pursuing an aggressive nuclear energy strategy well before the 1970s. It seems the advice Dr. Ryokichi Sagane gave to Yasuhiro Nakasone in 1953 would prove successful, though a series of nuclear accidents in the 1990s (resulting from lax safety standards and regulatory oversight) began to erode public trust and fuel public skepticism of nuclear energy. Incestuous business and government relationships that are openly questioned as unethical in other places in Japan were defended as sound and efficient governance, at least until Fukushima uncovered the industry's dirty secrets to a global audience in 2011.

Public Opinion in Japan

Traditionally, public opinion has played a smaller role in policy formation in Japan than in other democratic societies, especially in the immediate decades after WWII, when many Japanese generally refrained from challenging authority. Though a post-war shaming era is thought to have created at least a temporary culture of consent in Germany, Japan's culture of "haji," or shame, has its roots well before WWII. Haji restricts many actions including the expression of emotions, especially when those

emotions run counter to the official line of "what is best for the country". People fear being embarrassed or being shamed in public by choosing to do something that is different from the mainstream and may turn out to be "wrong," so many find comfort and safety in conformity as it limits their exposure to shame. Social harmony, or "wa," is the societal norm, and those who disturb that harmony are punished socially. Similarly, civil society organizations such as non-profits have few opportunities to participate in policy-making at the national level.[27] Labor restrictions and a serious shortage of funds create an environment where few people want to work for these types of organizations. The result is that most political activity, such as protests, was initially restricted to the local level throughout the 1950s and 1960s and even then seemed to have little impact on policy decisions.

Operating in tandem with this cultural emphasis on conformity and harmony was the long-standing belief that government officials knew what best for the country. Since the establishment of a modern government system in 1868 with the Meiji Restoration, the public good equaled the official good or national interests. Officials were to be looked up to with the attitude of kanson mimpi (officials honored, public despised).[28] Well into the 20th century and even after WWII, many Japanese continued to equate the national interest, which was based on pursuing nuclear to advance economic development, with the public good. Of course, this worked well for politicians, who were able to pursue their own agendas free from public scrutiny or criticism inherent in most democratic societies. However, political scandals, mismanagement and the quick resignations of a handful of

---

[27] Kawata Yuto, Robert Pekkanen and Tsujinaka Yutaka. "Civil Society and the Triple Disasters: Revealed Strengths and Weaknesses," In *Natural Disaster and Nuclear Crisis in Japan.* Ed Jeff Kingston, (New York: Routledge, 2012), 80.

[28] Kotler and Hillman, "Japanese Nuclear Energy Policy and Public Opinion," 4-5.

prime ministers in the early 1990s began eroding an already shaky trust in modern government. Polls conducted by the *World Values Survey* reveal that, in 2005, at least half of those surveyed did not trust the government "very much at all" and fourteen percent did not trust the government "at all".[29] To what extent this erosion of public trust affected decision-making power is unclear, especially in regard to decisions about nuclear energy, which have historically been made separate from public input. Bureaucrats hold decision-making authority but accountability for their decisions has not been rigorous or transparent. Professionalism and expertise overrode the need for transparency, citizen input or discussion of local concerns.[30]

Though the Japanese model of nuclear regulation and industry was closely modeled on the American market-based system, Japan departed from this model early in the development of its site approval process. Rather than allowing private utility companies to handle the issues of siting and public acceptance on their own, the Japanese government developed an "...extensive array of policy instruments and soft social control techniques designed to bring public opinion in line with national energy goals."[31] Some examples include pep talks and rallies for new reactors in communities from the central government, the development of pro-nuclear science curricula for school-aged children, Nuclear Power Day, and an annual fair where local farmers and fishermen could sell their products so they would not feel a nuclear plant was taking away their livelihoods. The government would additionally provide information to help utility companies locate

---

[29] World Values Survey 1981-2008, Official Aggregate v. 20090901, 2009. World Values Survey Association, Accessed December 20, 2013, www.worldvaluesurvey.org. Aggregate File Producer: ASEP/JDS, Madrid.
[30] Kotler and Hillman, "Japanese Nuclear Energy Policy and Public Opinion," 2.
[31] Daniel P. Aldrich, "Post-Crisis Japanese Nuclear Policy: From Top-Down Directives to Bottom-Up Activism," Asia Pacific Issues, Analysis from the East-West Center (January 2012), 3.

possible sites with the necessary logistical elements for a reactor, such as access to cooling water and existing electrical power grids. The government would also provide information that helped utility companies map the social characteristics of local communities in order to determine locations that would be most likely to be approved for reactors. Internal documents from the Japan Atomic Industrial Forum (JIFA) show that planners of the late 1960s and 1970s were well aware of the dangers posed by well-organized and motivated local opposition groups, especially fishermen's cooperatives. To avoid these groups, planners placed projects in rural communities which were less coordinated and more fragmented and hence less likely to mount anti-nuclear campaigns.[32] To overcome any remaining opposition, the government often offered jobs and financial assistance to local fishermen so the nuclear plant would not be seen as causing financial damage to individuals.

The 1970s, however, brought about a period in which many previously ineffective local opposition groups would organize into national movements. Yasumasa Kuroda wrote in 1972 that the nationalization of many local groups during that decade would represent the second phase of growing democracy in Japan, spurred by two previous decades of economic growth and what Kuroda calls "the people's awakening," or the development of an active political culture.[33] As several anti-nuclear umbrella organizations began to mobilize nationally, the government responded with increased pressure to gain approval for new reactors. As a result of this new push, the system that developed to allocate benefits to potential nuclear host communities became so complex that the central government had to create a new agency, the Agency for Natural

[32] Aldrich, "Post-Crisis Japanese Nuclear Policy: From Top-Down Directives to Bottom-Up Activism," 5.
[33] Yasumasa Kuroda, "Protest Movements in Japan: A New Politics," *Asian Survey*, 12:1 (Nov 1972), 949.

Resources and Energy, to manage it. The central government also organized workshops for local officials to educate them on what had worked or not worked in other places in terms of getting approval from the public for nuclear plants. Eventually, the government would provide up to $20 million per year to communities to accept nuclear power in what became a tremendously well-funded policy instrument that funneled hidden taxes on electricity into a pooled account that bureaucrats would then divide among communities in rural and coastal Japan.

The Three Power Source Development Laws, also known as the Dengen Sanpo, provide enormous subsidies for communities that agree to host nuclear power plants. By 2002, a community agreeing to host a 1.35 million kilowatt reactor could expect to receive up to 450 billion yen from the government.[34] This obviously represents an enormous sum and an enticing offer for local cities that regularly struggle with deficits. This system, however, has only been partly successful. Of the total amount of money collected for the Three Power Source Development Laws through an invisible tax levied on all power consumption, the government has only been able to spend a small amount. In 2001, for example, despite budgeting 2.5 billion yen for nuclear power plant siting, the government only spent 1.5 billion.[35]

The very existence of this system of exploitation and manipulation seems to suggest that government officials eager to have new reactors approved did fear the possible adverse effects of pushback from the public, a fear that motivated them to pay local residents off in exchange for their silent consent. Perhaps maintaining the façade of harmony that is so fundamental to Japanese society was well worth the price of creating

---

[34] Daniel P. Aldrich, "Japan's Nuclear Power Plant Siting: Quelling Resistance," *The Asia-Pacific Journal,* Accessed February 6, 2014. http://www.japanfocus.org/-Daniel_P_-Aldrich/2047.
[35] Aldrich, "Japan's Nuclear Power Plant Siting: Quelling Resistance".

the illusion that people were happy having reactors in their communities when, in reality, they were likely far more happy with the subsidies and perks that came with those reactors. As negative public opinion against nuclear energy increased in the 1980s, so did the money funneled to keep people happy. However, decreases in the 1990s in the actual money the government would be able to spend on siting incentives coupled with an increase in the time it takes to get reactors approved suggests that citizens may be becoming increasingly immune to these techniques. According to Danile Aldrich, the lead times necessary for negotiation and construction of new power plants in a greenfield situation has tripled over the past three decades.[36]

Japan does have formal procedures for licensing nuclear reactors that allow for public involvement, but, as in many other countries, the proceedings seem to be a routine part of procedure with little actual value. Before the official approval of a reactor establishment license, there are two public hearings at which concerned citizens can request more information or voice their dissent. For the purpose of public involvement, the most important step comes when the operating utility company has to first obtain a local agreement to begin the process of reactor approval from the mayor of the local municipality, the governor of the prefecture and from the municipal and prefectural assemblies. The sooner in the approval process citizens can voice their opposition, the more likely they are to halt reactor approval. However, it is precisely in these preliminary stages that access to information about the proposed nuclear plant in question is limited, especially if the local authorities are keen to receive subsidies from utility companies for hosting a nuclear plant or to bring reactor construction and operating employment to their towns and prefectures. The only publicly available information is simple explanatory

[36] Aldrich, "Japan's Nuclear Power Plant Siting: Quelling Resistance".

material provided by the power company, but power companies sometimes prepare detailed documents for members of the local council and influential people in the local community. There are a few instances in which local residents have exerted considerable power over the reactor approval process, such as with the abandoned Ashihama site in 2000 or the cancelled project in Miyama in 2001, but these cases have tended to be the exceptions rather than the rules. Residents of neighboring towns are also without opportunity for input into the approval process, nor do they receive any incentive subsidies from the utility company while shouldering equal risk should the reactor malfunction. Public hearings and public commencements tend to be proforma in nature and if residents are not successful in blocking the initial agreement between the local and prefectural authorities and the utility company, the approval process gains momentum that is difficult to stop.[37]

The government discovered early on that the best way to circumvent any possible challenges to siting would be to manipulate public compliance through many of the techniques previously mentioned. While effective, these soft policy tools did not guarantee success when it came to siting approval. Of the 95 attempts to site nuclear power plants in Japan over the postwar period, only 54 were actually completed.[38] That represents only a 57 percent success rate. Well organized and informed anti-nuclear groups fought citing approval in many well-publicized battles, and it seems the conclusion is that even the best soft policy incentive techniques cannot assure siting success in an era of increasingly active and concerned citizenry. Despite ongoing opposition, the combined force of the government, bureaucracy, and utility companies

[37] "Public Involvement in Japan's Nuclear Licensing System," Citizens' Nuclear Information Center, Accessed January 3, 2014, http://www.cnic.jp/english/newsletter/nit135/nit135articles/licensing.html.
[38] Aldrich, "Japan's Nuclear Power Plant Siting: Quelling Resistance".

continued moving nuclear power forward in Japan well into the 1990s when 15 new reactors were approved. A string of domestic nuclear accidents in the 1990s, however, would contribute to altering nuclear power's future viability in Japan.

Current Opinion Polling

In 2006, approval of nuclear energy at 40 percent of those surveyed outweighed disapproval at 35 percent for the first time in Japan since 1986.[39] In 2009, a poll carried out by the Prime Minister's Office revealed that roughly 60 percent of respondents approved of increasing the country's number of reactors.[40] This modest trend continued until 2011 when approval of nuclear energy slowly began to decrease after the Fukushima incident. Polling in late 2013 indicated that the majority of people in Japan no longer support turning the country's reactors back on. Though it would seem that the decision to turn off all nuclear reactors after Fukushima for inspection, evaluation and maintenance correlates with a rise in public opposition to nuclear energy, this relationship is actually quite unclear. In September of 2012, the Japanese government under the leadership of PM Yoshihiko Noda and the Democratic Party of Japan (DPJ) released the "Revolutionary Energy and Environment Strategy" which called for a complete nuclear phase out by 2040. This nuclear phase-out plan satisfied few people. In a reaction that echoes those heard in response to Germany's first proposed nuclear phase-out in the late 1990s, anti-nuclear proponents said the strategy did too little in allowing reactors to operate another thirty years while the business and industry lobby were unhappy to lose

---

[39] "Public Attitudes to Nuclear Power," Organization for Economic Cooperation and Development, Report, 2010, NEA no. 6859.

[40] Daniel P. Aldrich. "Post-Fukushima Nuclear Politics in Japan, Part 3: Empowering Anti-Nuclear Sentiment." *The Monkey Cage.* Accessed January 31, 2014, http://themonkeycage.org/2013/04/03/post-fukushima-nuclear-politics-in-japan-part-3-empowered-anti-nuclear-sentiment/.

money on their nuclear investments.[41] This plan would prove to be short-lived, however, when the DPJ was defeated by the LDP party in December of 2012 and Shinzo Abe, a pro-nuclear advocate, was again appointed PM. The policy shifts that followed were a part of Abe's plan to jumpstart the Japanese economy with nuclear technology exports and increasing nuclear energy reliance to limit foreign dependence on imported energy. The current plan is to restart the country's commercial reactors when they have cleared the new safety standards implemented after Fukushima. Construction is also on-going at many sites that were approved for new reactors before 2011, in Shimane Prefecture, for example, where citizens have collected thousands of signatures to present to the prefectural assembly to challenge the reactor.

Overall, it is difficult to determine whether current plans to restart nuclear reactors and continue pursuing nuclear energy are in line with public opinion or not. In Germany, Angela Merkel and her CDU-lead government was prompted by Green Party wins to announce a phase-out of nuclear power that correlated to high levels of public opposition to nuclear post-Fukushima. The CDU was rewarded with popular wins in the next general election. In Japan, however, the DPJ decision to phase out nuclear resulted in a DPJ majority loss in the Diet and a return to majority for the pro-nuclear LDP. It is impossible to know for sure, however, whether voters put the LDP back into power or just ensured the DPJ stayed out of majority power, considering there was rampant public criticism over PMs Naoto Kan and then Yoshihiko Noda's handling of Fukushima. On one hand, polls indicate that the majority of Japanese polled want to move away nuclear energy; on the other, voters returned the pro-nuclear LDP to office in 2012.

---

[41] Hiriko Tabuchi, "Japan Sets Policy to Phase Out Nuclear Power Plants by 2040," *New York Times.* September 14, 2011, Accessed February 1, 2014, http://www.nytimes.com/2012/09/15/world/asia/japan-will-try-to-halt-nuclear-power-by-the-end-of-the-2030s.html?_r=0.

Response to Disasters

This section will examine to what extent past nuclear disasters impacted the decision to pursue nuclear energy as well as the impact these disasters had on public approval for nuclear energy. In addition to examining the cases of Three Mile Island, Chernobyl and Fukushima, I will also include an analysis of a series of nuclear accidents in Japan during the 1990s that revealed serious lapses in security measures and cover-ups undertaken by the nuclear industry.

Three Mile Island and Chernobyl

Opposition to nuclear energy did exist in the 1970s and 1980s, but it was localized rather than national in a NIMBY response, and was usually temporary and lead by left-wing groups or local trade associations.[42] Local protests often gained immediate attention but rarely had any long-term effects on policy-makers' decision to pursue nuclear energy. Little legitimacy was given to the public concerns over nuclear safety. Public officials were unrelenting in their assertion that they knew what was best for the nation. In addition, opinion polls throughout the 1980s and 1990s showed that the majority of Japanese found nuclear plants to be "safe" or "somewhat safe" (which is not necessarily to say they supported building more reactors) and that the majority of people who supported nuclear energy did so because they viewed it as the only way to escape from the dependence on oil and coal.[43] In the end, central authority almost always overruled local opposition.

The events nuclear incidents at Three Mile Island and Chernobyl did not affect the nuclear industry in Japan as greatly as in other countries. This is evident in the

---

[42] Kotler and Hillman, "Japanese Nuclear Energy Policy and Public Opinion," 4.
[43] Ibid. 5.

increase of nuclear energy production beginning in the 1980s that continued uninterrupted through the 2000s. Figure 12 demonstrates Japanese electricity production from nuclear power from 1980-2005:

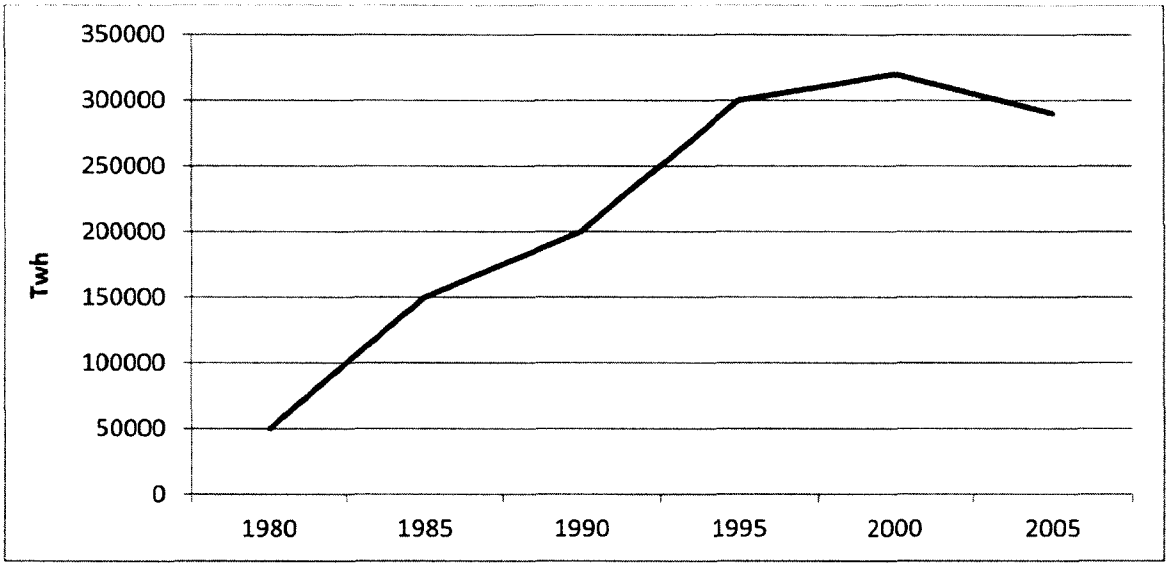

Figure 12: Percentage Share of Nuclear Energy Generation in Japan, Terrawatt Hours, 1980-2005.[44]

For a side-by-side comparison, the Figure 13 demonstrates public opinion on nuclear energy during the same period:

[4444] Data compiled by author from International Energy Agency.

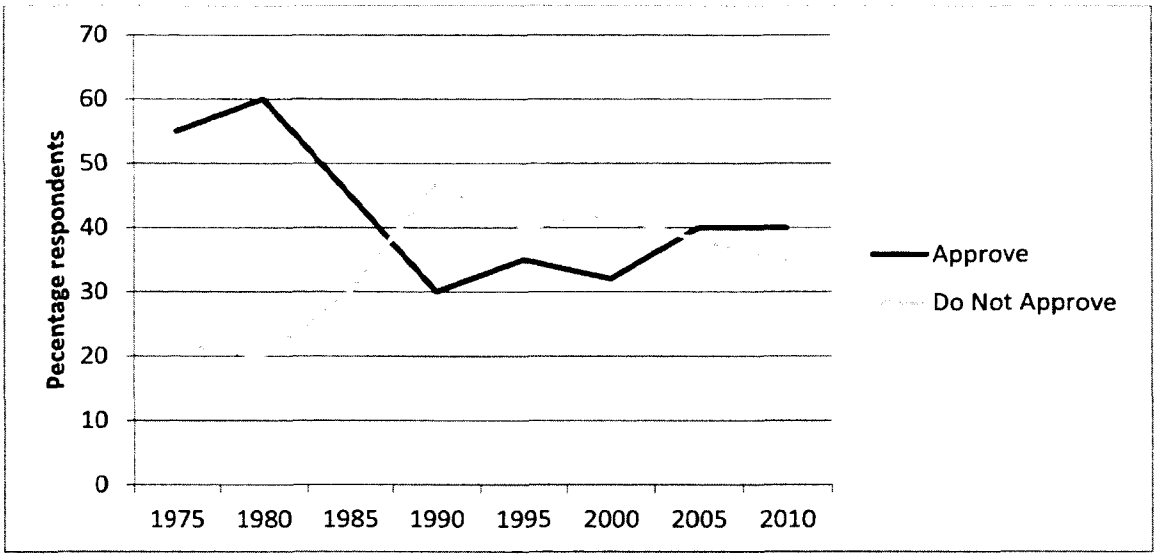

Figure 13: Approval for and Opposition to Nuclear Energy in Japan, 1975-2010.[45]

These graphs demonstrate two things. First, that neither the Three Mile Island incident in 1979 nor the Chernobyl incident in 1986 had any measurable effect on nuclear energy pursuance as defined as power coming from existing reactors in terawatt hours, which increased after each of these disasters. Nor did Three Mile Island or Chernobyl have any discernible effect on nuclear pursuance as defined by number of reactors approved in the 1980s and 1990s. In fact, in the 1980s, 15 new reactors were approved for construction and an additional 15 more in the 1990s. Second, these graphs demonstrate that despite a marked increase in disapproval of nuclear energy in the late 1980s, there are no correlating changes in nuclear energy pursuance. The lone indicator that would suggest effective push-back from citizens is the lead time necessary for reactor approval and construction that tripled from the 1970s to the 1990s as citizen groups were able to at least delay approval if not outright halt it.

[45] "Public Attitudes to Nuclear Energy, OECD, 2010.

Domestic Nuclear Incidents, 1990-2011

Often referred to as the "Lost Decade," 1990-2000 was the time after the asset bubble burst and the Japanese economy slumped. GDP growth slowed and deflation increased as people began saving their money thereby creating a liquidity trap that reinforced the economic slump. Officials surely thought that the recession was temporary and growth would return. In preparation, 15 reactors were approved during this period, though a series of highly publicized and badly managed nuclear incidents would create a backlash that would carry into the 2000s.

Tokai-mura Criticality Accident, 1999

The criticality accident at Tokaimura occurred at a uranium processing facility operated by JCO, formerly the Japan Nuclear Fuel Conversion Company. The accident occurred as technicians were preparing a batch of fuel for the reactor when the solution in the tank, reaching past the fill line, created a self-sustaining reaction that began emitting gamma and neutron radiation. The three technicians immediately became sick and two would eventually die, but the workers were able to contain the reaction once the fuel had cooled the next morning. In the meantime, almost 200 people were evacuated from their homes in a 350 meter radius around the plant and people in a 10 kilometer radius were advised to stay indoors. Dozens of workers and residents were hospitalized for radiation exposure well above what is considered safe. The following investigation by the International Atomic Energy Agency concluded that the cause of the accident was human error and serious breach of safety principles, considering the technicians preparing the

fuel for the reactors seemed to not have had any specific training for their tasks and were unfamiliar with safety protocol in the event of an accident.[46]

Shika Nuclear Power Plant Cover-Up, Monju Cover-Up, 1995

During a 1999 inspection of the Shika reactors, due to improper rod inspection techniques, one reactor was in a state of criticality for 15 minutes. This, in itself, would not have been sensational. The Hokuriku Electric Power Company cover-up of the incident, however, was quite sensational when the news of the incident was leaked to the public in 2007. The chairman of the Japan Nuclear Safety Commission inspected the rod housings in the reactor and determined that the incident was due to cutting corners and unnecessary pressure on reactor operators. A lower court had ordered the entire plant to be shut down, but a higher Nagoya court overturned that ruling and the unit returned to operation in May of 2009.[47]

In 1995, molten sodium leaked from the cooling circuit of the Monju reactor, resulting in a fire that made headlines across the country. Following the fire, officials at the government-owned Power Reactor and Nuclear Fuel Development Corporation downplayed the extent of the damage and the seriousness of the fire at the Monju reactor. They also denied the existence of a videotape showing the sodium spill, and the reactor was closed in 1995 for maintenance. Ten years later, in 2005, that same video would come back to haunt them when it was leaked to the public following an announcement the Monju reactor would be restarted. This video showed men in "space-suits" walking

---

[46] Nathalie Cavasin, "Citizen Activism and the Nuclear Industry in Japan," *Local Environmental Movements: A Comparison of the US and Japan,* Eds Pradyumna P. Karan and Unryu Suganuma, (Lexington, KY: The University Press of Kentucky, 2008), 65.
[47] Cavasin, "Citizen Activism and the Nuclear Industry in Japan," 66.

around as sodium crystals hung from above, in a scene straight from a post-apocalyptic movie. The Monju reactor would eventually come online again in late 2000s.[48]

Mihama, 2004

The Mihama steam explosion of 2004 occurred when a broken pipe could not contain the hot water and steam emitted in a building at the plant used for housing cooling turbines. The steam killed 4 workers and resulted in the injury of 7 others, though the accident was found to have not released any hazardous radioactive contaminants into the environment. The accident had been called the worst nuclear accident in Japan until the Fukushima disaster in 2011. After this highly publicized string of nuclear incidents, citizen trust was further eroded as the safety culture in Japan's nuclear industry came into question. [49]

Fukushima, 2011

By the time of the Fukushima nuclear disaster, the most extensive in Japan's history and certainly the most expensive since Chernobyl, the Japanese public had already seen a decade of mistakes, mishandlings, and cover-ups. Leading up to 2011, polling reports showed that a large percentage of the population, or 87 percent of those polled, knew about the Tokia-mura incident from ten years previous and 68 percent of respondents feared another nuclear accident would happen.[50] Figure __ further demonstrates that public support for nuclear power had declined to below 40 percent for the first time since the mid-1980s. Opinion polls conducted by the *Asahi Shimbun* following March of 2011 show that disapproval for nuclear power was immediately slow

---

[48] Cavasin, "Citizen Activism and the Nuclear Industry in Japan," 67.
[49] Ibid, 68.
[50] "Ten Years Since the Criticality Accident at Tokai-mura: Fear Lingers," NHK Broadcasting Culture Research Institute, January 2010, Accessed October 10, 2012. http://www.nhk.or.jp/bunken/english/reports/summary/201001/02.html.

to respond to the Fukushima disaster. Figure 14 illustrates approval ratings for nuclear energy, as reported by the *Asahi Shimbun*, from April of 2011-October of 2012:

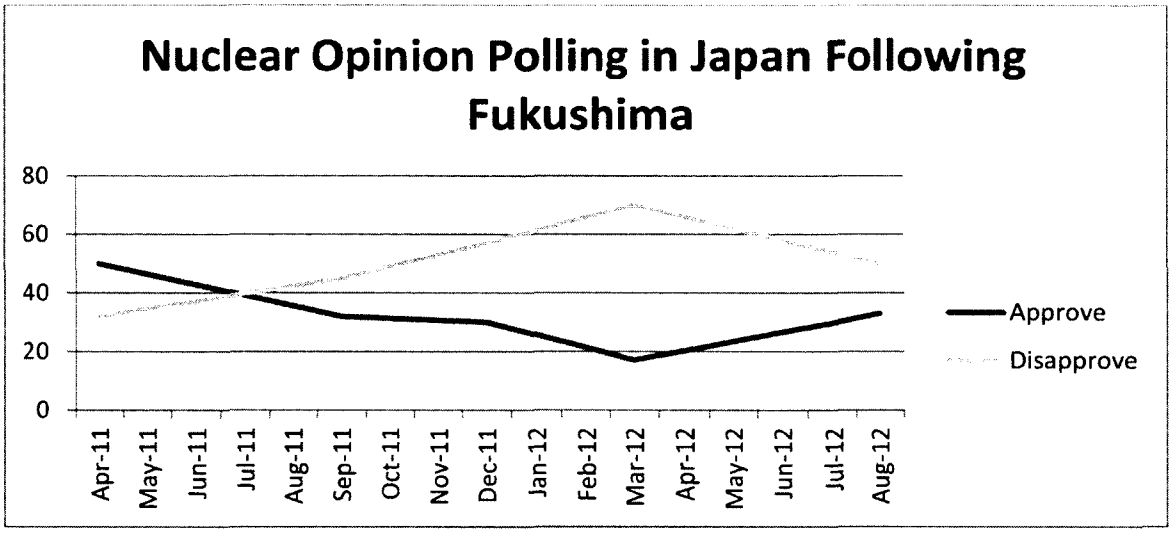

Figure 14: Nuclear Opinion Polling in Japan Following Fukushima.[51]

Many possible explanations exist for the public's slow response to Fukushima inside Japan. Large numbers of people were directly affected by the earthquake or tsunami in ways not related to the nuclear disaster, and so many were preoccupied with their own problems of structural damage or flooding. Though the international press was reporting constantly on the nuclear disaster, with comparisons to Chernobyl and dooms-day scenarios the most popular headlines, the nature of the reporting inside Japan was more controlled. The Nihon Hōsō Kyōkai (NHK), Japan's national broadcasting corporation, has faced serious allegation in 2014 that it deliberately controlled the flow of

[51] Data compiled by author from *Asahi Shimbun* Weekly Opinion Polls, 2011-2012.

information to the public following Fukushima in accordance with what the then-current Democratic Party of Japan (DPJ) government allowed. For example, rumors have circulated since 2011 that the NHK complied with government efforts to conceal the extent of the radiation release.[52] In December of 2013, the chairman of the NHK, Masayuki Matsumoto, announced he would be stepping down from his position, claiming he had been driven out by Abe administration criticism that he had allowed current NHK nuclear coverage to become too critical. There are further allegations that Abe's LDP is stocking the NHK's governing board with political appointees that will stifle the NHK's criticism of the conservative party, which supports a policy of nuclear reactor restarts. Though an official investigation is yet to take place, a explanations for the public's sluggish immediate concerns about safety following Fukushima are likely tied to a lack of information about what was precisely going on in Fukushima Prefecture.

It became increasingly difficult to hide the evacuation of residents from Fukushima or to conceal the reasons for displacing so many people. Though many residents in the immediate vicinity of the Fukushima reactors were evacuated immediately, the radius of evacuations continued widening until September of 2011 when residents within fifty miles of the reactors were ordered to move out of the radiation zone, totaling, at one point, approximately 100,000 people. The misplacement of 100,000 people is difficult not to notice, and it seems as time wore on after Fukushima, and as people were able to access more information on the status of the Fukushima reactors and the damage they had caused to property and in terms of safety to residents, approval for nuclear power dropped with disapproval peaking in 2012 at 70 percent of respondents.

---

[52] "Widespread Public Distrust of NHK Over Fukushima Radiation Cover-Up," EnergyNews, Accessed March 28, 2014.

All plants were shut down immediately following Fukushima for regular safety inspections until June of 2011 when the Kansai Electric Power Company (KEPCO) utility was allowed to restart its reactor at Oi, a move that was controversial among the public. In June of 2012, 46 percent of respondents claimed they were against restarting this reactor while 37 percent opposed the move. However, in July of 2012, opinion was split when 41 percent responded that they thought it was right to restart the reactor and 42 percent opposed the restart, though only 35 percent of people approved of restarting reactors other than Oi. In August of 2012, the support for restarting reactors other than Oi dropped to 31 percent. In October of 2012, construction resumed at the Ooma nuclear power plant in Aomori Prefecture. 25 percent of respondents agreed with this, while 55 disapproved.

While respondents seemed to be split regarding the restart the Oi plant, it seems most respondents do not want new nuclear power plants in Japan and do not want to restart most of the existing reactors. By June of 2012, energy prices had increased nearly 30 percent throughout the country, a result of increased imports of coal and natural gas to compensate for losses in nuclear.[53] The public may have thought that restarting Oi would alleviate some of this energy price increase, especially heading into a warm Japanese summer. In fact, in March of 2012, 75 percent of respondents reported that they were either very concerned (20 percent) or moderately concerned (55 percent) about how the suspension of nuclear energy would impact the economy. In December of 2012, voters would return the pro-nuclear LDP back to a majority in the Diet, a move away from the DPJ that has been seen as largely reflective of concerns about the economy. In 2014, the

[53] "Japan Halts Last Reactor at Ohi," BBC News, September 15, 2013, Accessed January 4, 2014, http://www.bbc.co.uk/news/world-asia-24099022.

Tokyo Governor's race became heated between candidates running on pro and anti-nuclear platforms. Though anti-nuclear former Prime Minister Junichiro Koizumi tried to turn the election into a referendum on nuclear power, a Yomiuri poll found that most respondents (84 percent) thought medical and welfare policies were the most important issue of the election and disaster preparedness and unemployment as second most important.[54] In the end, voters elected the pro-nuclear LDP candidate to the gubernatorial position as weak anti-nuclear candidates split the opposition vote.

In a country long seen as lacking a political culture of protest, it seems the Fukushima incident pushed citizens to a point of criticality. Immediately following Fukushima, hundreds of thousands of people would amass in Tokyo's political district every Friday to protest nuclear power and the government's decision to restart nuclear reactors. Though there were also mass demonstrations in the 1960s over the US-Japan Security Treaty, the participants were primarily college students and the activity ended after approximately two months. The anti-nuclear demonstrations' demographics now seem to represent many different cross-sections of society, from young people to senior citizens, men, women, professionals and working-class citizens. In a 2012 interview, Eiji Oguma, professor at Keio University, says he believes this is a result of a growing distrust of the government resulting from 20 years of economic stagnation. Further, he says that the reasons demonstrations in Japan have been limited in the past are related to decades of stability in people's lives and jobs as well as a lack of knowledge or experience with protests. Now, however, people are worried about the economy and globalization has brought knowledge about other cultures of protests to Japan. For

---

[54] E. Tammy Kim, "Tokyo Governor's Race Puts Nuclear Power to Electoral Test," Al Jazeera, February 7, 2014, Accessed February 28, 2014, http://america.aljazeera.com/articles/2014/2/7/in-tokyo-electionreferendumonnuclearpowerandnationalpolicies.html.

Oguma, this symbolizes a major political shift in Japan, away from a consenting and comfortable public to one in which people will demand more of a voice in their government.[55] As of yet, however, an organized, national opposition to nuclear energy has yet to emerge in Japan, though that is not to say that local opposition is incapable of blocking or stalling reactor restarts in the coming months.

Current Nuclear Politics in Japan: The New Basic Energy Plan

In 2012, the incumbent majority DPJ ran its Diet candidates on a promise that they would make a nuclear phase-out into policy in Japan. In the December of 2012 General election, voters returned the LDP party to a majority and the LDP returned Shinzo Abe to the office of Prime Minister. The LDP, long a supporter of nuclear energy, has announced plans to restart most, if not all, of the now dormant reactors after they have been tested and are found to pass new, stricter safety guidelines. Shinzo Abe has publicly stated that continuing to rely on nuclear energy while also pursuing other forms of renewable energy are primary components of his "Three Arrows" plan for economic revitalization, a plan known popularly as "Abenomics." In the Japanese electoral system of one-party dominance, the likelihood of the LDP's return to majority was always high, and after the immediate mishandling of so many elements of the triple disaster in 2011, the majority held by the usual opposition DPJ party became increasingly tenuous. Considering the LDP's vast array of networks within business, the nuclear industry, and bureaucracy, it is no wonder the party is pro-nuclear. Nor is their rise from defeat and return to Parliamentarian majority a surprise.

---

[55] "Anti-Nuclear Protests Show Japan is Becoming an Ordinary Nation, Scholar Says," *Asahi Shimbun,* July 19, 2012, Accessed March 1, 2014, http://ajw.asahi.com/article/0311disaster/opinion/AJ201207190080.

In February of 2014, the Abe administration released a draft of the New Basic Energy Plan that outline Japan's energy plans for the next 20 years and include keeping nuclear power at the core of baseload[56] power production along with coal-fired and hydroelectric plants.[57] The draft plan is cautious about providing an estimated energy mix, it does allow room for both restarting existing reactors and building new reactors. The most recent approval ratings for Abe and his administration are, for the first time in Diet history, higher now than when he took office in 2012.[58] Abe's approval ratings are likely linked more to forward progress in the Japanese economy, however, than to his policies on nuclear energy, though, in Japan, it is often difficult to separate one issue from the other.

Access to Other Resources

Whereas the previous section sought to determine to what degree public and nuclear disasters influence pursuance of nuclear energy, this section will examine Japan's energy options by examining its access to other electricity-producing resources, either through natural endowments or through reliable and affordable trading options. In concurrence with the previous hypotheses tested in the US and German case studies, the hypotheses to be tested in this section are that the greater the endowment of coal, oil or natural gas, the less likely a country will be to pursue nuclear; likewise, the greater the access to resources through trading options, the less likely a country will be to pursue nuclear. In the case of Japan, petroleum makes up such a large enough percentage of

---

[56] A baseload power source is one that can produce energy at a constant rate and lower cost than the alternatives.

[57] Mari Iawata, "Japan Sees Key Role for Nuclear Power," *Wall Street Journal,* February 25, 2014, Accessed February 15, 2014, http://online.wsj.com/news/articles/SB10001424052702304610404579403741256563088?mod=dist_smartbrief.

[58] "Asahi Poll: Abe Cabinet Breaks Trend, Increases Support Rate to 62%," *Asahi Shimbun*, February 18, 2013, Accessed February 24, 2014, http://ajw.asahi.com/article/behind_news/politics/AJ201302180099.

overall electricity generation (16 percent) that it will also be tested with the hypothesis that the greater the supply of or access to oil, the less likely a country will be to pursue nuclear as a power source.

In 2013, Japan was the second-largest net importer of energy resources, second only to China.[59] In 2013, the electrical energy mix in Japan included a significant reliance on LNG at 48 percent of overall consumption, with coal making up approximately 28 percent, oil an increased 15 percent, and other renewables contributing roughly 10 percent of overall electricity generation. Japan ended its own domestic coal production program in 2002 and has since steadily increased its coal imports, primarily from Australia. In fact, Japan takes 40 percent of Australia's black coal exports, comprising Australia's largest share going to a single country in 2013.[60] Unlike Germany, Japan has been able to compensate for nuclear without significantly increasing coal imports, a move likely linked to its clean energy and reduced carbon emission goals and an abundant regional supply of LNG.

Rather than relying on coal, the Japanese government has declared its preference for LNG as a short-term substitute for nuclear energy. About a third of Japan's LNG imports come from regional suppliers, though the country's overall portfolio is reasonably balanced with no one provider supplying more than 20 percent of overall LNG. Australia surpassed Indonesia and Malaysia to become Japan's largest LNG exporter in 2012 and, in 2013, Shinzo Abe began talks with the United Arab Emirates that were continued in Tokyo in February of 2014. The 2014 bilateral agreement reached

---

[59] "Japan is the Second Largest Net Importer of Fossil Fuels in the World," Energy Information Administration, November 7, 2013, Accessed January 31, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=13711.

[60] "Exports," Australian Coal Association," Accessed February 18, 2014, http://www.australiancoal.com.au/exports.html.

between the two countries will enhance cooperation on energy development in the two countries, giving Japan the chance to renew its interests in the UAE's oil and gas fields. In return, Japan will export nuclear technology to the UAE to aid the country in developing its own civilian nuclear energy program. Currently, Qatar, Australia and Malaysia are Japan's most significant suppliers of LNG, though additional future supplies could come from projects in Papua New Guinea or from US LNG exports once the American terminals are approved for exports.[61]

Though Japan's supply of LNG is relatively steady and reliable, the most significant problem the past few years has primarily been associated with cost. Historically, natural gas prices have been tied to oil prices, and after oil prices rose in 2008, the demand for natural gas rose as well, resulting in an overall higher LNG price. One prong of Abe's economic stimulus plan has been to engage in quantitative easing to increase the monetary base and depreciate the value of the yen to fight deflation and make Japanese exports more competitive. While this plan has begun working to reverse deflation, it has also meant paying more for energy imports, particularly natural gas. Higher global demand for LNG has resulted in an increased gas price for Asian buyers, an increase from $9/MMBtu in early 2008 to $16/MMBtu in 2012. Japan and other LNG importers have been in the process of negotiating contracts for lower LNG prices that are tied to US gas market prices rather than international crude oil prices. Kansai Electric, for example, reached an agreement on a long-term contract with BP in 2012 that links LNG prices with the lower US Henry Hub spot price that, in 2014, hovered around

[61] "Japan is the Second Largest Net Importer of Fossil Fuels in the World," Energy Information Administration, November 7, 2013, Accessed January 31, 2014, http://www.eia.gov/todayinenergy/detail.cfm?id=13711.

$4/MMBtu.[62] These advances are merely reactionary, however, may not take effect immediately, and cannot compensate for high prices of LNG from 2011 to the present.

Even with some of the lowest electricity demand growth rates in the developed world and a high level of energy efficiency (electrical energy demand actually decreased 8 percent after the 2011 Tohoku earthquake, no doubt partly due to higher than normal energy prices[63]), importing almost all of its natural resources since 2011 has taken a financial toll on a Japanese economy that has been limping along since he 1990s. Abe's plan to depreciate the Yen to make Japanese exports more competitive has only marginally been effective. According to the World Bank, the export of goods and services as a percentage of GDP rose in Japan from 13 percent in 2009 to only 15 percent in 2013.[64] A successful plan to increase exports with currency devaluation would also be balanced with a strategy to control increases in imports, but imports to Japan actually increased 25 percent from 2012 to January of 2014, reaching an all-time imports high of 8044.06 JPY billion.[65] 34 percent of those imports are mineral fuels, which include coal, natural gas and petroleum. This increase in imports without a correlating increase in exports is further fueling a Japanese debt-to-GDP ratio that is already the highest in the world at 230 percent.

For years, nuclear energy formed the cornerstone of Japan's energy plan, a power source that was abundant, domestically-produced, and created the opportunity for Japan to export nuclear technology. Without nuclear, Japan must continue to import LNG and

---

[62] "Henry Hub Natural Gas Spot Price," Energy Information Administration, Last Updated March 26, 2014, Accessed March 27, 2014, http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm.
[63] "FY2012: Energy Supply and Demand Report," Japanese Ministry of Economy, Trade and Industry, October 2, 2013, Accessed February 6, 2014, http://www.meti.go.jp/english/press/2013/1002_01.html.
[64] "Exports of Goods and Services as a Percentage of GDP," The World Bank, Accessed March 7, 2014, http://data.worldbank.org/indicator/NE.EXP.GNFS.ZS.
[65] "Japanese Imports," Trading Economics, Accessed March 10, 2014, http://www.tradingeconomics.com/japan/imports.

coal, which, even at lowered negotiated prices, will stall the economic revitalization the country needs to fight its debt-to-GDP ratio. The lone bright spot in this energy scenario is a significant increase in renewable energy investment. Japan saw investment in renewable renewable energy (excluding research and technology) increase 73 percent to $16 billion in 2013, thanks to a surge in small-scale photovoltaic investment on the back of a new feed-in tariff subsidy for PV installation.[66] With the new subsidy, developers are now finding that they can get a reasonable return on PV investment as prices continue to all for PV and wind resources. Even more impressively, utility-scale investment in renewable energy sources jumped 230 percent in Japan between 2011 and 2014 as the feed-in tariff for large-scale projects likewise makes investment attractive. The general hope is that eventually the market will reduce the cost and increase the return on renewable energy investment to the point that the government will no longer need to provide subsidies which, while they encourage beginning investment, will only continue to increase government budgetary expenditures and the staggering overall debt. A practically challenge will be pursuing a PV and wind renewable policy that is aggressive enough to compensate for nuclear energy, especially considering these energy sources require space for installation and Japan is a country that is not land-abundant. Hydroelectric power, which made up barely 7 percent of Japanese electrical energy portfolio in 2011, has reached its maximum output as the locations that are appropriate for such installations have all been utilized.

---

[66] "Global Trends in Renewable Energy Investment, 2013," Frankfurt School of Finance and Management, 2013.

Chapter Conclusions

One of the hypotheses tested in this section was that the greater the public opposition to nuclear energy, the less likely a country would be to pursue it as an energy source. If this study only compares opinion for and against nuclear energy with levels of nuclear energy generated or number of reactors approved, then the conclusion is that there is an unclear relationship between public opinion and nuclear energy pursuance. There has always been public opposition to nuclear energy in Japan which was reflected in polling throughout the 1970s and 1980s. Public support for nuclear energy vacillated in the 1990s and 2000s, as people were unsure whether the reported incidents happening across Japan at various nuclear plants such as Tokai-mura were more important than the economic stagnation that was gripping a country quite proud of their previous decades of "miraculous" economic growth. It is also unclear whether Three Mile Island in 1979 or Chernobyl in 1986 had any significant, lasting impact on public opinion in Japan, though, by some reports, support for nuclear energy reached an all-time low in 1990. If that is a response to Chernobyl in 1986, it is a delayed response.

Similarly, measuring protest activity and intensity in Japan may be a misleading methodological tool considering the heavy cultural emphasis placed on social harmony which may hinder marching in the streets. It is a far more likely scenario that, even if and when people do not approve of nuclear energy, they will not participate in a protest and may even be reticent to voice their dissenting opinion in polls. Fukushima may have changed these social norms to a certain extent, especially among younger generations, but it still too soon to determine the extent or duration of any impact on political culture in Japan.

However, if this study measures public efficacy toward stopping nuclear energy in terms of reactors that were not approved, constructed or brought into operation over the decades of nuclear investment, then the issue becomes even murkier. Previous studies have shown that despite the use of flexible and adaptive institutions and incentives in the siting approval process, even the best designed techniques could never guarantee siting success, a reality that is especially poignant in an era of increasingly active and concerned citizenry within Japan. Citizens have been able to mobilize in organized and effective ways to stop nuclear reactor construction in their communities, but these cases tend to be the exception rather than the rule. The Iron Triangle and nuclear village have always had resources to offer that incentivized siting approval, and a pro-nuclear LDP in majority office and a pro-nuclear utility and construction industry are difficult opponents to fight. In the end, as with any issue and any place or time, citizens are most effective in stopping nuclear construction when they can dis-incentivize the investment by making the approval process longer or the construction more costly. To what extent opposition groups will be able to do this in the future is unclear, as is whether the majority of citizens even want to stop nuclear power from expanding in Japan. On one hand, opinion polls show that people are opposed to restating dormant reactor and to building new ones; on the other, the pro-nuclear LDP enjoyed a majority win in 2012, returning a Prime Minister and Diet to office that has since created a future Basic Energy Plan based heavily on utilizing nuclear power.

The clearest conclusion is that neither public opposition nor Three Mile Island/Chernobyl dampened the Japanese government's enthusiasm for nuclear energy. Ever since Nakasone travelled to the US in the 1950s and received advice about how to

institutionalize nuclear energy in Japan, the government has consistently insisted that nuclear power is an imperative ingredient in the recipe for Japanese independence from energy imports and economic success. The LDP and the DPJ both encouraged nuclear investment and reliance until 2011, and even though the DPJ in majority at the time of Fukushima approved a plan to phase out nuclear, the LDP has since been returned to office and is enjoying high approval ratings while promoting a pro-nuclear economic plan.

It is perhaps on this point that the clearest explanations behind nuclear pursuance in Japan can be found. From early on, nuclear energy was efficiently linked to economic growth in Japan, and especially after the destruction of WWII, economy recovery and growth were also linked to the restoration of Japan's place at the table of the international community. The early establishment of the nuclear village created and then perpetuated this narrative, rewarding those who climbed aboard the nuclear platform and punishing those who spoke out against nuclear energy. The close integration of business, the LDP and the bureaucratic structure it created, and the utility and construction industries (known broadly as the Iron Triangle) has allowed the state to effectively pursue nuclear energy by channeling incentivizing subsidies from utility slush funds to proposed reactor sites, while bureaucracy simultaneously created policies that were beneficial to the approval, construction and safety regulation processes (a process reinforced by the practice of amakudari). All of these mechanisms working together created a system in which nuclear opposition, either from the public or from interest groups, found it difficult, if not impossible, to gain a foothold in stopping the advance of nuclear power in Japan leading up to the 2011 disaster at Fukushima.

In the context of Japan's current post-Fukushima landscape, it is doubtful that the same opposition, though now perhaps larger and marginally stronger, will be able to gain that elusive foothold to stop the comeback of nuclear energy. Japan can do nothing to change its lack of domestic energy sources, and, as always, will be forced to import energy from other countries. Even with an abundance of trading partners and negotiations to lower energy prices, this reliance on other countries leaves Japan vulnerable to international price fluctuations, changing security relationships, and infrastructural demands. This dependence places Japan in the unique position that requires it prioritize nuclear energy far more heavily than other energy resources. Even with the memory of Fukushima only 3 years old, the Japanese public has responded to higher electrical bills and economic depression in ways that seem to convey a tolerance for returning to nuclear energy. Though opinion polling support for nuclear energy remains relatively low, pro-nuclear candidates are returning to office and garnering high approval ratings for their economic recovery plans. One could conclude that people in Japan seem to be more concerned with economic recovery as it is linked to unemployment, deflation, and decreasing social benefits, and since the economy has historically been positively linked with nuclear energy, the logical conclusion is that the public realizes it will have to accept nuclear energy, even at the price of the possibility of future disasters. And while trust in the government has steadily decreased in Japan, perhaps official assurances of new safety regulations and structural adjustments will be enough to convince the public that nuclear energy is safe, even in a country located on massive earthquake fault lines. In the end, with or without public approval and left with few energy options, it is likely that Japan will continue their path of nuclear pursuance into the future.

CHAPTER 6

CASE STUDY ANALYSIS

Objective

This chapter will integrate the three previous case studies on the United States, Germany and Japan with comprehensive analysis and then draw conclusions based on the original hypotheses of this study. Each variable will be discussed, beginning with public opinion, protest activity, and voting patterns; continuing with responses to the disasters at Three Mile Island, Chernobyl and Fukushima; and concluding with a section on access to other energy resources either through endowments or affordable and reliable trading options. Findings are divided into primary and secondary categories. Primary findings are conclusions drawn in direct response to the original hypotheses of the study for each variable. Secondary conclusions are findings discovered in the process of research that do not directly relate to an original proposed variable or hypothesis but are nonetheless significant in explaining nuclear energy pursuance.

Public Opinion: Polling

The original hypothesis of this study was that nuclear energy pursuance would be higher in countries where public approval for nuclear energy is also higher and that nuclear energy pursuance would be lower in countries where public approval for nuclear energy is lower. Current opinion polling in each case study reveals that, in the US, approval for nuclear energy tends to be higher than approval in Germany or Japan; according to one Gallup poll, 57 percent of respondents approved of using nuclear energy

as one way to generate electricity while 40 percent were opposed.[1] These numbers alone would indicate that most Americans approve of nuclear energy, a sentiment reflected in the US's consistent pursuit of nuclear energy since the first commercial reactor came online in Illinois in 1960. However, when asked specifically about support for increasing the number of nuclear power plants in the US, respondents' support decreased from 57 percent to 46 percent and opposition increased from 40 percent to 48 percent, resulting in an almost even split in favor and opposed.[2] Even with the decreases in support for new reactors, American citizens seem to generally approve of nuclear energy more than citizens in Germany or Japan.

If the proposed hypothesis were true, one would expect the US to have the highest percentage of electrical generation from nuclear power of the three countries. At the current rate of 20 percent of overall electrical generation, the US does, in fact, rely more heavily on nuclear energy than Germany (currently at 18 percent, down from 25 in early 2011 and expected to decrease to 0 percent[3]) and Japan (currently at 0 percent with no operable reactors, but expected to increase to 15 percent within the next year[4]), especially considering the approval of the first new reactor since 1978 is meant to increase nuclear energy's overall share of electricity generation. In this respect, it does seem that current nuclear energy pursuance is more or less in line with the prevailing approval of nuclear

---

[1] "Americans Still Favor Nuclear Power a Year After Fukushima," Gallup, March 26, 2012, Accessed July 1, 2012, http://www.gallup.com/poll/153452/Americans-Favor-Nuclear-Power-Year-Fukushima.aspx.
[2] "Americans Still Favor Nuclear Power a Year After Fukushima," Gallup, March 26, 2012, Accessed July 1, 2012, http://www.gallup.com/poll/153452/Americans-Favor-Nuclear-Power-Year-Fukushima.aspx.
[3] "Nuclear Power in Germany," World Nuclear Association, Last Updated March 13, 2014, Accessed March 29, 2014, http://www.world-nuclear.org/info/country-profiles/countries-g-n/germany/.
[4] "Nuclear Power in Japan." World Nuclear Association. Last Updated March 25, 2014. Accessed December 5, 2013. http://www.world-nuclear.org/info/Country-Profiles/Countries-G-N/Japan/.

energy, though whether that approval extends to the building of new reactors is difficult to discern.

Examination of the relationship between approval for nuclear energy and nuclear pursuance over time, however, suggests a different story. According to polls conducted by Cambridge National Samples between 1974 and 1990, approval for building new nuclear power plants has varied considerably over time in the US. This report suggests that approval for new plants decreased to less than 30 percent of respondents in 1982 and never recovered. Though the last reactor approved in the US was prior to this public opinion downturn, reactors approved before 1978 were under continued construction throughout the 1980s and 1990s until the last reactor came online in Tennessee in 1996. Consequently, nuclear pursuance (as defined by the percentage of overall electricity generation that comes from nuclear energy) steadily increased throughout the 1970s, 80s and 90s as these new reactors came into operation until reaching the current 20 percent share. When viewed across time, the data on nuclear pursuance and public opinion shows less of a correlation considering the periods of wide variance in public approval for new power plants and consistently steady increases in nuclear energy production. With this steady increase in nuclear production, we would expect to see steady approval for nuclear energy, which is not clear from the polling results; while Gallup does report high numbers of approval for nuclear energy since 1994, other studies show less enthusiasm for building new power plants.

There has been a strong anti-nuclear sentiment in Germany since the 1960s, when nuclear energy began taking off as an electricity-generating resource. In 2010, even before Fukushima, 64 percent of Germans surveyed reported being either opposed or

strongly opposed to building new nuclear power plants.[5] After Fukushima, 90 percent of Germans responding to a Globescan survey reported they strongly opposed building new reactors and 52 percent surveyed supported the policy of shutting down all existing reactors.[6] By again looking at this data alone, it seems there is indeed a correlation between public approval and nuclear energy pursuance. The only country of the three to commit to a complete nuclear phase-out, Germany is also the country with the highest numbers of citizen opposition to nuclear energy, especially since 2011. As with the US, however, data gathered over time suggests less of a clear relationship. Polling data from the 1970s and 1980s suggests that there was approval for nuclear energy in Germany until 1986 when the disaster at Chernobyl reversed approval and opposition, with opposition to nuclear energy peaking at just over 80 percent of respondents in June of 1986.[7] Also similarly to the US, nuclear energy's percentage of the overall energy share of electricity generation steadily increased during the same time period until a peak in 2000. Though current high opposition to nuclear energy is simultaneous with a vow to abandon nuclear energy altogether, there are likely intervening variables that explain Germany's nuclear energy-180, especially considering high levels of public opposition to nuclear energy have not seemed to matter much in the past.

Prior to the Fukushima nuclear disaster in Japan, public opinion on nuclear energy was a difficult variable to capture. Some reports say that in 2006, 40 percent of respondents favored nuclear energy, while a 2009 survey conducted by the Prime Minister's Office reported 60 percent of respondents favor nuclear energy (though the

---

[5] "Large Majorities in US and Five Largest European Countries Favor More Wind Farms and Subsidies for Biofuels, but Opinion is Split on Nuclear Power." *PRNewswire.* October 13, 2010.
[6] "Poll: Germans Support Abandoning Nuclear Power." The Journal.IE. Accessed September 11, 2013. http://www.thejournal.ie/poll-germany-nuclear-power-644340-Oct2012/.
[7] Joppke, *Mobilizing Against Nuclear Energy,* 147.

PM survey may have skewed the results in favor of nuclear energy for its own purposes). A survey by the OECD conflictingly reports that approval for nuclear energy has not been above 45 percent since 1975. The most recent polling data collected from the *Asahi Shimbun* reported that opposition to nuclear energy peaked in 2012 at 70 percent, but has steadily declined since then. A 2014 Fuji TV Network poll found that 53 percent of respondents were opposed to restarting the country's reactors.[8] Even with conservative estimates, at least half of respondents seem to be against nuclear energy, though Japan has publicly vowed to restart most of its reactors and pursue safer nuclear technology. Similarly, despite questionable public approval for nuclear energy in the decades following World War II (and the atomic devastation of two Japanese cities) nuclear energy production steadily increased as new reactors were approved throughout the 1980s, 1990s, and even into the 2000s.

Based on data from these three case studies comparing patterns of public approval and opposition to nuclear power with nuclear energy pursuance as a percentage of total energy generation, the first primary finding of this study is that there seems to be no clear correlation between the two variables. In each country, regardless of variances in public approval, nuclear energy generation increased steadily throughout the 1970s, 1980s, and 1990s as more reactors were approved, constructed and then began operation. However, polling data alone may not capture the full story of citizen participation in the nuclear energy issue. It seems that results can vary dramatically based on what organization or institution is conducting the opinion poll and in response to the way specific questions are phrased. Many of the institutions conducting polling on nuclear energy opinion prior to

[8] Mari Iwata, "Japan Sees Key Role for Nuclear Power." *Wall Street Journal.* February 25, 2014.

Fukushima were contracted to do so on behalf of a government, utility company or pro-nuclear organization, each with incentives to produce results in favor of nuclear energy. Historically, the pro-nuclear lobby has been generally better funded than the anti-nuclear lobby, and were thus better capable of creating a layer of insulation comprised of scientists, technicians, academics, and other supportive "expert" figures around nuclear energy. For this reason, studying other variables that portray citizen participation (rather than just opinion) may be a more fruitful method to capture an accurate picture of the relationship between state decisions to pursue nuclear energy and the society on behalf of whom those decisions are being made. Therefore, this project proceeded to include a qualitative analysis of protest activity and voting patterns in each country, two actions that are representative of public approval or opposition, with the idea that because these two methods of participation are direct and confrontational, they may have a greater impact on state decisions to pursue nuclear energy.

Public Opinion: Nuclear Protest

Similar to the national/local split in public opinion on nuclear energy and building more reactors, protest activity in the US has also seemed to have separate focuses at the national and local levels. Large-scale demonstrations in New York City and Washington D.C. in the late 1970s and early 1980s, which ranged from 200,000 people to 1 million people, were organized around the theme of nuclear disarmament rather than solely nuclear energy. Twenty-plus years later, in May of 2005, 40,000 demonstrators marched past the United Nations building in New York City. Though this demonstration took place in the year of the 60th anniversary of the Hiroshima and Nagasaki atomic bombings,

the content of the demonstration was decidedly anti-war rather than anti-nuclear, a direct response to the 2003 American invasion and subsequent presence in Iraq.

Rather than look for effective anti-nuclear citizen demonstrations at the national level in the US, this study focuses on protests at the local level in communities where reactors have been proposed for construction. The body tasked with regulating the nuclear industry and approving new reactors, the Nuclear Regulatory Commission, includes a formal mechanism for public input during the reactor application review process. Though concerned citizens consistently attend these input meetings to share their concerns and often contradictory scientific research[9], the NRC has consistently approved each reactor application. In fact, the NRC has never not approved a reactor application that successfully completed the application procedure; that is, reactors are always approved by the NRC given the utility company does not cancel the application during the approval process. Therefore, in the US, lobbying the nuclear industry's regulatory body through the formal process of citizen input during the reactor approval process has been an ineffectual way to for citizens to exert influence over nuclear energy pursuance.

Rather than work from within the formal system, the anti-nuclear movement in the US has been more successful at stopping nuclear plant construction when it can create costly barriers for utility companies to finish construction and begin operation. These barriers include traditional acts of citizen dissent (protests, sit-ins, even more radical actions like destroying property at proposed nuclear sites), legal contestation, involvement in civil society organizations, and referendum voting. For example, the first nuclear plant was originally proposed at Bodega Bay in California, but through the

[9] To be fair, pro-nuclear citizens and civil society organizations also consistently attend these public input meetings.

organized involvement of the Sierra Club and the Northern Californian Association to Preserve Bodega Bay, both of which submitted approval appeals to federal and state bodies, the Bodega plant plans were cancelled before substantial money could be spent on construction. The proposed Black Fox Plant in Oklahoma was cancelled after extended protests and the utility company was overwhelmed by legal action, the cost of which to fight in lengthy court battles would have increased the cost of construction. The anti-nuclear group Clamshell Alliance occupied the construction site at the approved Montague plant; after $29 million was spent on construction, the Montague plant was cancelled 7 years after approval without operation. The Rancho Seco plant in California was closed as a result of negative community referendum voting.

In a few instances, citizens have also been successful at closing nuclear plants even after they have been built or started operation. The Trojan Plan in Oregon was in operation for 16 years before it was closed for good in 1993. Local referendums to close the facility had been voted on in 1986, 1990, and 1992, but were defeated each time. This defeat came at a cost to Portland General Electric (PGE), which spent $4.5 million on positive public relations for the plant during this period.[10] In 1992, the plant closed because of safety concerns. PGE inspections later revealed that the utility company would have to replace the steam generators in the reactors, a costly and lengthy replacement process. The plant never reopened and, in this instance, it remains unclear whether it was citizen action that closed the plant or basic economic infeasibility that motivated PGE to decommission the plant. In more recent similar instances, Yankee Rowe closed early in 1992; the San Onofre reactors 2 and 3 in 2013; Crystal River 3 in

[10] "Anti-Nuclear Movement," The Oregon Encyclopedia of Portland State University, Accessed March 30, 2014, http://www.oregonencyclopedia.org/entry/view/anti_nuclear_movement/.

2013; and Kewaunee in 2013 all closed early because the combined pressure of decreases in electrical demand and falling energy prices made continued operation too expensive and unprofitable.

Though citizens have had some luck with protests, civil society organizations and legal action, they have been most effective when states intervene in the approval process. For example, the Shoreham plant in Long Island was completely built by 1984, but never came into operation. After Three Mile Island in 1979, the NRC began enforcing stricter guidelines for evacuation plans on utility companies which required the utility company to work together with local and state officials to create sound evacuation measures in case of an emergency. In the case of the Shoreham plant, local officials concluded that there was no sound way to evacuate citizens from the area surrounding the nuclear plant, and then New York governor Mario Cuomo ordered state officials not to approve any evacuation plan proposed by the operating utility company. In 1989, the utility company agreed to sign over the plant to the state for decommissioning, which would be paid off through resident rate hikes in the amount of $6 billion. The more current example of the Indian Point facility, which is facing an NRC relicensing intervention by both the states of New York and Connecticut, demonstrates that citizen action is more effective when coupled with the involvement of states exerting pressure on the NRC.

In addition to these instances of successful nuclear pursuance reversal, there are equal numbers of unsuccessful citizen lobbying efforts. The same sorts of lobbying, demonstrating, and organizational involvement took place at the Seabrook plant and Diablo Canyon plant in the 1980s and 1990s, and both of those plants are currently in operation. Ultimately, between 1953 and 2008, of the 253 nuclear reactors ordered, 48

percent were cancelled and 11 percent have shut down prematurely.[11] However, it is difficult to say how many of these blocked plants or early shut-downs are the direct result of citizen dissent and how many are the result of economic factors that made nuclear investment unattractive to utility companies, though, at times, it was the citizen groups who created these economic obstacles themselves. Decreased electrical demand and low natural gas prices, however, have also likely been strong deterrents to nuclear investment.

Because the structure of the Japanese federal regulatory and licensing system is similar to that of the US (a structure that reflects the US's early input into the Japanese nuclear industry and the US-led governmental restructuring after WWII), the story of Japanese citizen involvement will sound familiar. Anti-nuclear protests in Japan have been somewhat limited compared to the US and Germany, though Fukushima in 2011 galvanized many citizens in previously unseen numbers. Though the regulatory system in Japan is similar to that of the US, there are additional forces operating in Japan that further limit citizen input into the nuclear debate. The combination of the nuclear village and the Iron Triangle of the LDP (back in Parliamentarian majority power), Bureaucracy and Industry have created an almost iron-clad system in which nuclear energy has been able to grow. Local communities where nuclear plants are proposed, chosen by utility companies specifically for their weak civil society organizations and relative poverty, are incentivized by subsidies provided by the government, which are really just funds channeled through utility companies made from the profit of electricity rates, to buy consent. Local protests, when they occurred prior to 2011, were often led by left-wing trade associations and, while they may have gained temporary attention, rarely had any impact on policy decisions about nuclear energy in Japan. Exceptions to this general rule

[11] Al Gore, *Our Choice*, (NY: Bloomsbury, 2009).

include the abandoned Ashihama site in 2000, the cancelled Miyama plant in 2001 and the Suzu and Maki plants in 2003. Anti-nuclear civil society organizations have historically been under-funded and under-staffed. Legal action has also been ultimately unsuccessful. Since the late 1970s, small groups of local residents with support from lawyers and scientists filed 14 major lawsuits against the state or power companies. Many of these lawsuits sought to shut down operating nuclear power plants by demonstrating new research on fault lines, earthquakes, or safety inadequacies. The plaintiffs have not won in any of these 14 cases, and even when 2 lower courts ruled in favor of the plaintiffs, a higher court overturned those rulings.[12]

Over the post-war period, the nuclear industry in Japan had a 57 percent success rate with siting approval, though, again, it remains unclear how many of those cancelled plants were the result of citizen intervention or other economic factors.[13] In a centralized system of regulation and approval where collaboration between the nuclear industry, bureaucracy and government is solidly entrenched, there exist few opportunity points through which citizens can hope to influence energy policy.

This point about regulating structure leads to two important secondary findings of this research, the first of which is that the post-Fukushima anti-nuclear movement may prove to be more successful than previous groups at reversing Shinzo Abe and the LDP's plan to restart existing reactors and continue constructing new plants, perhaps by utilizing the techniques that have proven successful to the American anti-nuclear movement. The approval period for new reactors in Japan tripled from 1970 to 1990, a phenomenon

---

[12] Yuko, et al, ""Civil Society and the Triple Disasters," 82.

[13] Daniel Aldrich. "Post-Fukushima Nuclear Politics in Japan, Part 3: Empowering Anti-Nuclear Sentiment." Accessed January 31, 2013, *The Monkey Cage.* http://themonkeycage.org/2013/04/03/post-fukushima-nuclear-politics-in-japan-part-3-empowered-anti-nuclear-sentiment/.

which indicates increasing difficulties for utilities to gain site approval. This approval period before official licensing and construction takes place is the ideal time for citizens to reverse the nuclear course, that is, before the utility company has invested so much capital that their economic incentive to operate the plant is too high. Though legal roadblocks have proven ineffective and anti-nuclear civil society organizations have been weak (but are strengthening in membership and funding since 2011) Japanese citizens could focus on imposing costly barriers to plant construction. Opposition groups could also attempt to solicit local governmental or prefectural intervention on their behalf, though this option may be limited if these offices are staffed with LDP politicians and bureaucrats who are hesitant to go against pro-nuclear party goals.

The second finding is that centralized nuclear regulation and approval systems such as those found in the US and in Japan are more susceptible to the problem of regulatory capture while a de-centralized approval and regulation system such as that of Germany seems to offer more opportunities for citizen influence. The resemblances between the US and Japanese systems should come as no surprise, considering Yasuhiro Nakasone's early visit to the US created the framework for nuclear energy in Japan. Initially, both the Atomic Energy Commission in the US and the Nuclear and Industrial Safety Agency (NISA) under the Ministry of Economy, Trade and Industry (METI) in Japan were dually tasked with regulating and promoting nuclear energy. This dual function created conditions where the line between creating an environment where nuclear energy would be safe and where nuclear energy would be attractive to investors often became blurry.

The 1974 US Energy Reorganization separated these two functions between the NRC and the Department of Energy, but by that time, a system and network had already formed between regulators and the nuclear industry that reinforced regulatory capture. By the time of the development of the NRC in the mid-1970s, however, most of the reactors in operation in the US had already been approved. Though the NRC is independent from the responsibility of nuclear energy promotion, it still receives 90 percent of its funding from industry fees, which compromises its independence.[14] This confirms earlier findings of James M. Jasper in his work *Nuclear Politics: Energy and the State in the United States, France and Sweden* when he claims that the pro-nuclear movement had far more access to resources and political structures such as government agencies and politicians than did the anti-nuclear movement and, as a result, anti-nuclear movements had little effect of nuclear energy policies in any country.

Furthermore, nearly half of all NRC employees surveyed in 2002 said they feared raising safety concerns might undermine their career.[15] There have also been isolated cases of NRC regulators accepting gifts from or making decisions in favor of future employers prior to leaving the NRC for the private sector.[16] Beyond the NRC, the nuclear sector is also connected to the legislative process through lobbying efforts and campaign contributions. In 2010, the nuclear sector spent $54 million to lobby Congress and employed 12 former members of Congress as lobbyists. Some of the top legislative supporters of nuclear energy, such as the Energy and Commerce Committee Chairman

[14] Daniel Kaufmann and Veronica Penciakova, "Preventing Nuclear Meltdown: Assessing Regulatory Failure in Japan and the United States," Brookings Institute Brief, April 1, 2014.
[15] Kaufmann and Panciakova, "Preventing Nuclear Meltdown."
[16] Ibid.

and the House Minority Whip, were the largest recipients of campaign contributions from Exelon, one of the US's largest nuclear operating companies.

In Japan, NISA was not an independent regulator and was thus even more susceptible to outside influence than the NRC. This has, to some extent, been acknowledged and an attempt made at correcting this conflict of interest with the creation of the Nuclear Regulatory Authority in 2012 under the Ministry of the Environment. Prior to 2012, however, METI's close connections to the nuclear industry were well known, and they have been charged with allegations of distorting information to public officials on nuclear energy and orchestrating the defeat of alternative energy legislation.[17] Regulatory capture is further perpetuated in Japan by the revolving-door cultural practice of amakudari. It is not uncommon for the same individuals to participate in the licensing, rulemaking and inspections process at different times. In 2010, for example, Toru Ishida left his post as the former Director General of METI to be hired by the Tokyo Electric Power Company (TEPCO) just 4 months later.[18] The problem of regulatory capture is compounded in Japan with lax regulatory standards based on outdated risk-assessment methodologies as well as a reluctance to punish private sector deception.

In Germany, however, the processes of approval and regulation are divided at three levels: the state (Länder) level, the national level, and through the independent regulatory process of the European Nuclear Safety Regulation Group established in 2007. The licensing authorities are the Länder (usually competent State ministries) where the plant is planned to be installed. There are therefore different geographical regulators

---

[17] Kaufmann and Panciakova, "Preventing Nuclear Meltdown."
[18] Kevin Krolicki and Ross Kerber. "Special Report: Fuel Storage, Safety Issues Vexed Japan Plant," Reuters, March 22, 2011, Accessed March 20, 2014, http://www.reuters.com/article/2011/03/22/us-japan-nuclear-idUSTRE72L2E820110322.

which are integrated into various federal states. Safety regulations were issued by the federal government until 1986 when the Ministry for the Environment, Nature Conservation and Nuclear Safety (MENCSF) was established to take over this purpose. In the most recent system, both the Länder and the MENCSF had equal veto power in any siting decision. At all times, safety regulations have been executed by the individual Länder, and reactor approvals were decided on a case-by-case basis according to the specifics of each location. The Länder had full control over water use and the German system was notorious for conducting extensive consultations with environmental experts, technical engineers, and labor authorities before approving a site for a nuclear plant.[19]

These differing systems of approval and regulation were institutionalized early on in the development of nuclear energy in both the US and Japan. When then LDP Diet member Nakasone visited the US and was advised to liberally fund nuclear research and development, enshrine the nuclear initiative in law and encourage top scientists and engineers to promote nuclear energy, he returned to Japan and set out to do just that. The veil of national security allowed nuclear energy to develop in relative secrecy in the US for decades following WWII, and by the time of the 1974 Reorganization Act, the reinforcing system of regulation, legislation and industry was already in place and most of the reactors that would come into operation in the coming decades were already approved. This centralized approval and regulation structure allows few opportunities for citizens to challenge the approval or extension of nuclear plants through most forms of citizen participation, whether anti-nuclear protests, organizational opposition or legal challenges.

---

[19] Alexandre Bredimas and William J. Nuttall, "A Comparison of International Regulatory Organizations and Licensing Procedures for New Nuclear Power Plants," Judge Business School, University of Cambridge, EPRG Working Paper.

The German system, in contrast, has been more open to local societal input and generally offers more opportunity points of access for citizen participation in the licensing process. One may expect just the opposite to be true, that an independent regulatory body would be more open, fair and responsive to citizen action and less corruptible by power politics. However, it seems that a government-led, de-centralized system of approval and regulating is generally more sensitive to outside influences on initial plant approval decisions. For instance, the plant proposed at Wyhl was protested and occupied so intensively by individuals and organizations that the state government did agree to negotiations with local opposition groups, though it was ultimately the intervention of the Frieburg Administrative Court that shelved the plans for good. Similarly, the administrative court of the state of North Rhine-Westphalia halted construction of the plant at Kalkar in 1986 in response to the state's anti-nuclear protests. While an independent approval and regulating body sounds good in theory, in practice, a system where approval rests in the hands of local governments seems to inspire more of a response to citizen opposition, given the government officials could theoretically be voted out of their jobs come the next election cycle for approving an unpopular nuclear plant.

This difference in reactor approval systems explains why German citizens have historically been more successful at stopping new reactors or plants *at the approval stage.* While there have been some successes in the US and Japan in terms of stopping new reactors from construction or halting existing reactors, citizen groups alone have been largely unsuccessful at stopping the NRC or NISA from approving new reactors and plants. The sooner these plants can be halted or delayed, before utility companies invest

critical sums of money, the better chance citizens have in stopping the plant from construction altogether. Without a significant restructuring of this approval process, citizens in the US and in Japan will continue to be less likely to halt new nuclear construction at the early, critical stages of the process.

Public Opinion: Voting

This open system of site approval and safety regulation in Germany is further enforced by a democratic system of parliamentarian proportional representation and a variety of viable political parties, particularly, a strong anti-nuclear Green Party. The first nuclear phase-out was legislated in the 1990s when, following Chernobyl in 1986, the German Green Party gained popularity. The Greens were then able to translate that growing support into electoral votes and ultimately form a majority coalition with the Social Democrats in the German Parliament in 1998, a coalition majority that would create the first nuclear phase-out policy. This Red/Green coalition lasted until 2005 when the Christian Democrats retuned to majority and reversed the nuclear phase-out policy. In 2011, during the months immediately following Fukushima, the German CDU/Angela Merkel-led government made no mention of a nuclear phase-out in response to Fukushima, only placing a moratorium on nuclear energy until further investigations could be made. In fact, it was just a year earlier in 2010 that Parliament had voted to actually *extend* the lives of existing reactors. In March of 2011, however, the CDU suffered a historic loss at the hands of the Green Party in their historic stronghold of Badem-Württtemberg, giving the Greens their first state premiership. In other state and local elections in Germany, the Greens made similar (though not as symbolic) representational gains as nuclear energy became an important electoral issue and post-

Fukushima anti-nuclear sentiment continued to grow. In May, Merkel announced the nuclear phase-out policy which garnered high numbers of public support.

There are a few key characteristics of the democratic Germany system of representation that distinguish it from both the US and Japan. First, it is a Parliamentarian style of government with proportional representation rather than a Presidential one, distinguishing it from the US's winner-take-all system. This difference is significant for Green Parties, which may be unable to best a dominant party with a majority of votes but may be able to at least reach the threshold for representation in Parliament where it could possibly form a coalition, such as the Red/Green coalition formed in the 1990s. The American Green Party has not yet achieved even 1 percent of overall votes in a national election, which means it is highly unlikely the party will be able to achieve the majority numbers required for a Congressional seat or Presidential Office in the near (or even perhaps distant) future. Since the US system is not based on proportional representation, electoral majorities are the only chance the Greens have of national representation.

Second, the German system offers a number of *viable* parties running for any given office, at least one of which is anti-nuclear. This means the Green Party has options for forming coalitions with even relatively like-minded parties reasonably close to them in the political spectrum. Perhaps more importantly, it means that anti-nuclear voters have an incentive to cast their vote for an anti-nuclear "third" party like the Greens because there is the legitimate possibility the Green Party could receive enough votes to garner parliamentary representation and subsequently influence nuclear policy. In the US's two-party system, voting for a third party anti-nuclear candidate is not incentivized because there is little chance that candidate will achieve the required electoral majority.

Third-party voters are told they are "throwing away their votes." Furthermore, within this American two-party system, there is no viable anti-nuclear party. In the 2012 presidential election, both the Republican and Democratic candidates were pro-nuclear as a part of their "all of the above" strategy to energy. In the end, American voters are left without options for using the democratic process of voting to influence nuclear energy policy.

The Japanese system does resemble the German parliamentarian system in most key respects as a hybrid style of proportional and direct representation in the Diet; however, Japan's democratic process has long been hampered by a pattern of one-party dominance since the pro-nuclear LDP's founding after WWII. In fact, the conservative LDP has consistently been in power in Japan since 1955, except for a brief 11-month stint in between 1993 and 1994 and for three years before 2009 and 2012, when it was returned to power in the most recent general election. There is no lack of opposition parties, such as the Democratic Party of Japan (DPJ), which gave the LDP its longest run as Diet opposition party between 2009-2012; the Social Democratic Party (SDP); the neoliberal Your Party (YP); the Japan Communist Party (JCP), the oldest functioning party in Japan; or the New Komeito Party, with which the LDP is currently in a coalition. Even given the presence of these multiple parties on ballots, the political machinery of the LDP ensures it is a consistent winner. Japanese voters did not even have an anti-nuclear Green Party voting option until the Green Wind Party was formed in 2012 in a direct response to Fukushima. That is not to say that other parties have not taken an ant-nuclear stance since Fukushima, even though opposition to nuclear energy is not a consistent part of their party's doctrine. The recent 2014 Tokyo gubernatorial election saw two candidates run on anti-nuclear platforms, one from the DPJ (interestingly

enough, backed by a former LDP Prime Minster) and one backed by a JCP/SDP cooperation.[20] The media slated the election as a referendum on nuclear energy. In the end, the pro-nuclear LDP candidate won in a land-slide victory that the LDP hoped would signal to opposition parties that a Japanese nuclear phase-out is just not going to happen.

So, while Japan has a parliamentarian, proportionally representative style of government (like Germany) it has historically been dominated by one pro-nuclear party, the LDP, which has a strong connection to and interests in the nuclear industry. Without viable anti-nuclear voting options, citizen participation in nuclear policy through the direct election of legislators continues to be limited in Japan. Similarly, the US's winner-take-all presidential system of two-party pro-nuclear dominance also leaves voters with few options for electing anti-nuclear representation and subsequently influencing nuclear energy policy. Based on this analysis, the third secondary finding of this research is that citizens are more capable of influencing nuclear energy policy in a parliamentarian system of proportional representation where there are a variety of parties and at least one viable anti-nuclear candidate. This type of system is found in Germany, where a Green Party parliamentarian coalition in the 1990s legislated the first nuclear phase-out and Green Party gains in 2011 state and local elections likely created concern among the ruling CDU and precipitated a post-Fukushima nuclear phase-out.

Based on the previous discussion, an additional secondary finding can be presented in this section. This research on the relationship between public approval or opposition to nuclear energy seems to indicate a generally weak relationship between

[20] Strategically speaking, having 2 anti-nuclear candidates in the election was a flawed plan since it split the anti-nuclear vote.

society and state decisions to pursue or not pursue nuclear energy, especially in the US and Japan where citizen opportunity structures are limited. Even in Germany, where the relationship is strongest and citizens have the best opportunities for input, nuclear policy has not always been aligned with public opinion. This observation may initially lead one to the realist, state-centric conclusion that states tend to do what they want to preserve their own power and pursue their national goals despite domestic constraints. Even the CDU's post-Fukushima nuclear phase-out could just as legitimately be viewed as a move to preserve its own power as to respond to its public. However, this research also seems to point to a constructivist argument that would explain why the American, German and Japanese publics feel differently toward nuclear energy and are therefore either more or less accepting of state initiatives to pursue it. The way in which the issue of nuclear energy is constructed within a state matters, at least to the extent that states find it easier to gain public acceptance of nuclear energy and then actively pursue that energy when it is constructed as an imperative or, at the very least, not constructed negatively.

In the US, this "nuclear narrative" is largely absent, though nuclear energy has been historically insulated from negative construction, at least at the state level. Beginning with President Eisenhower's Atoms for Peace speech in 1953, nuclear energy has been largely (though not completely) decoupled from the separate issue of nuclear weapons. 10 years later, in 1963, President John F. Kennedy would also speak out in favor of nuclear energy in what became known as his "Best of the Above" speech. A string of subsequent pro-nuclear presidents further contributed to the positive image of nuclear energy. The lone anti-nuclear exception, President Jimmy Carter, had the bad luck to be in office during the 1970s energy crises and following the Three Mile Island

incident in 1979. President Ronald Reagan, in office for Chernobyl in 1986, used the nuclear incident as an opportunity to generate Cold War rhetoric aimed at the Soviet Union's poor handling of the disaster and what he perceived to be its unwillingness to be forthright about the extent of the damage. No public statement was ever issued that linked what happened at Chernobyl with American nuclear energy safety. Though some polling reports indicate that public approval for nuclear energy declined precipitously in 1982 in response to the Cold War arms build-up, Americans may have been more risk-tolerant of nuclear safety issues (weapons or energy) perhaps because of the Cold War and the US's perceived role as the "leader of the free world" and counterbalance to what lay behind the Iron Curtain.

The following Bush, Clinton, Bush and Obama administrations have likewise all been pro-nuclear. The official narrative coming from Washington has largely been about the employment and economic benefits associated with nuclear energy, while the official line coming from the Department of Energy has played to nuclear energy's clean, environmentally friendly electricity production. I would ultimately argue, however, that the nuclear narrative is absent in the US because there have never been any serious nuclear accidents comparable to Chernobyl or Fukushima that directly impacted US citizens; because most Americans who would be actively anti-nuclear are currently more concerned with the environmental impacts of hydraulic fracturing technology and the controversial Keystone Pipeline; because the prevailing narrative in the US right now is about the economic recovery; because nuclear energy seems like a topic one has to be "qualified" to talk about; and, finally, because of comparative demographic constraints. The US covers almost 4 million square miles with 314 million people. The vast majority

of reactors in operation are concentrated in the electricity demand-heavy Eastern coast and in some southern and mid-western states. People in Montana, Idaho, or Colorado, however, may not live within hundreds of miles of a nuclear reactor and are therefore likely to be ambivalent about nuclear energy. When compared with a German population of 82 million people within 138,000 square miles and a Japanese population of 127 million people within 146,000 square miles, the location of nuclear reactors is important to everyone because, effectively, they are in everyone's back yards. Nuclear energy is just not an issue that has been commonly discussed in the US, for whatever reason. To offer a personal anecdote, I recently asked my 400-level political science class at Old Dominion University if they knew how many nuclear reactors were in operation in the US. Guesses ranged from 2 reactors to 300 reactors, indicating to me that they had no idea that the number is closer to 100 or that there is a nuclear reactor in the neighboring community of Chesapeake. This prevailing national apathy toward nuclear energy is the reason a countervailing "nuclear narrative" has never really had to emerge. As far as the US as a state that wants to pursue nuclear energy has been concerned, maintaining this status quo by marginalizing references to nuclear energy has been effective enough. In other words, if ain't broke, don't fix it.

In contrast, nuclear weapons and nuclear energy have always been closely linked in Germany, a country that found itself negotiating and adapting to a new self-identity after WWII. Following the Second World War, Western Germany was forbidden by the Treaty of Brussels from developing nuclear weapons, yet it was allowed to develop nuclear technology for civilian purposes. Even though Western Germany was a non-nuclear power, as the Cold War progressed, nuclear weapons were deployed in Western

Germany by the United States and other NATO powers under NATO's "nuclear sharing policy" and in Eastern Germany by the Soviet Union. When NATO powers began honing their short-range missile systems, Western Germany came to the realization that it would serve as a likely battlefield where East meets West should the Cold War reach a point of criticality. After the establishment of the 1957 European Atomic Energy Community, Western Germany expressed a desire to develop a weapons program in tandem with France and Italy. In 1958, however, Charles de Gaulle became president of France and both Italy and Western Germany were quickly excluded from the nuclear weapons project. Therefore, throughout the years of the Cold War and the nuclear arms race, Western Germany found itself in the uncomfortable position of being denied access to "self-defense weapons," and instead relying on NATO forces for protection from its USSR neighbor, all with the knowledge that if the nuclear detente between West and East deteriorated, its geographic location would on the border between the two powers would be a likely spot for militarized action. Essentially, Western Germany was rearmed during the Cold War, but not with weapons over which it had much decisive control.

Beyond the national security goals of the state, domestically speaking, there was a strong citizen anti-proliferation sentiment developing from the demilitarization campaign. As German citizens dealt with the lasting psychological impact of WWII and the Holocaust, this sentiment grew and civil society groups consistently campaigned for a nuclear-free Germany. The two opposing forces of demilitarization/anti proliferation and Cold War weapons concerns created an environment where an effective anti-nuclear Green party could grow and further shaped the negative narrative about nuclear weapons and nuclear energy that had begun with the peace movement. When the Chernobyl

nuclear disaster transpired in 1986 just 800 miles from Berlin, many of the worst aspects of nuclear technology were confirmed. When the Red/Green coalition in the 1990s moved to legislate a nuclear phase-out, it seemed the state now agreed that nuclear technology was unsafe. All of these factors—geopolitical location, Cold War tensions, the psychological legacy of WWII, demilitarization, NATO nuclear sharing, nonproliferation goals, and Chernobyl—contributed to the creation of the prevailing "negative nuclear narrative" in Germany.

The example of Germany shows that while states may not necessarily participate in the creation of the nuclear narrative (it may be caused by historical, geopolitical or international forces) they do have to operate within and are constrained by them. In the US, the absence of a strong nuclear narrative works in the favor of the state, while in Germany, the negative nuclear narrative made the post-Fukushima nuclear phase-out more feasible, especially given the cost sharing that would fall to rate payers.

In Japan, however, the state actively worked to create a positive nuclear narrative among citizens toward nuclear energy separate from that of nuclear weapons. Japan is the only country in the world to directly experience the devastation wrought by atomic weapons. In this context, it is not difficult to understand citizens' initial reluctance toward accepting nuclear technology of any kind, even if it was for peaceful purposes. Part of nuclear power's success in Japan is owed to Yasuhiro Nakasone, who was as a sailor in the Imperial Japanese Navy during WWII and later began his political career as the Diet member who visited the US in 1953 and learned about the potential of peaceful nuclear technology. In 1954, at Nakasone's urging, the government granted the equivalent of $14 million dollars to the Agency for Industrial Science and Technology for early-stage

nuclear research. Nakasone would later rise in the ranks through different positions, most notably the Minister of Science in 1959, Minister of International Trade and Industry in 1972, and finally, Prime Minister from November 1982 to November 1987. Throughout his rise, Nakasone was continually promoting nuclear energy at every legislative level, citing a lack of natural resources as the most critical issue Japan faced after WWII.[21] He was a member of the first budget committees to specifically allocate money to nuclear energy, had a large hand in writing the first Atomic Energy Laws in Japan, and he created supra-partisinal nuclear committee dedicated to nuclear energy promotion. Even in late March of 2011, after Fukushima, he said in an interview that he still believes nuclear energy is the future of power generation.[22] Without the early willingness of Nakasone to visit and learn from the US's peaceful nuclear program and then work within the Japanese legislative and financial process to institutionalize energy pursuance, nuclear energy may not have been as successful in Japan's post-war nuclear reluctant society.

Nakasone's enthusiasm also spurred government initiatives to actively work to create a positive nuclear narrative. As mentioned earlier in the case study on Japan, nuclear energy was promoted through community festivals, propaganda literature, popular culture such as the widely read manga series *Astro Boy*[23], an annual celebration of Nuclear Power Day, and even pro-nuclear science curricula built into the primary and secondary educational system. Most importantly, the government effectively linked nuclear power with economic recovery after WWII and portrayed nuclear energy as imperative for Japan's energy security and independence. This official message was

---

[21]Takafumi Yoshida, "Interview with Yasuhiro Nakasone: Learn Lessons From Fukushima and Continue to Promote Nuclear Energy," *Asahi Shimbun,* May 23, 2011, Accessed March 30, 2014, http://ajw.asahi.com/article/0311disaster/opinion/AJ201105232599.

[22] Takafumi, "Interview with Yasuhiro Nakasone."

[23] *Astro Boy* is about a young protagonist named Atom who lives in a nuclear powered "wonder world".

promoted relentlessly by the government and the utility companies, and throughout the 1970s and 1980s, they had the country's exponential (and, according to some accounts, "miraculous") economic growth to reinforce their message. Without this economic growth (and the reactor community subsidies that came with, perhaps) it is unlikely their positive portrayal of nuclear energy would have been as accepted as it was, considering it was only marginally accepted in the first place and created generally ambiguous feelings about nuclear energy among a citizenry that tolerated nuclear technology because it felt it was left with little choice.[24]

Despite early lingering reluctance from the Hiroshima and Nagasaki bombings and recent reluctance and public opposition to nuclear energy as a result of the Fukushima disaster, the government has again been able to revive this pro-nuclear rhetoric to begin recreating the positive image of nuclear energy in Japan. Following the DPJ majority's post-Fukushima decision to close the country's reactors and phase out nuclear energy, voters returned the pro-nuclear LDP party to a majority in the 2012 general election. Similarly, in the recent Tokyo gubernatorial elections (which were slated by close followers as a referendum on nuclear energy since it would essentially decide control of one of the largest utility companies in Japan, TEPCO, the utility company also responsible for operating the Fukushima Daiichi reactor) voters chose the LDP candidate in a land-slide victory.

Can these electoral victories be accepted as general approval for nuclear energy? The answer is not so simple. Throughout the tenuous DPJ Diet majority period from 2009-2012, most people assumed that it would only be a matter of time before the LDP

[24] The French government was successful at a similar campaign, promoting the slogan, "no coal, no oil, no gas, no choice."

flexed its political-machine muscle and regained control of the Upper and Lower Houses of the Diet, which they did in December of 2012. This was no small-scale victory, either. The LDP took 114 of the 242 House of Councillors seats and 294 of the 480 House of Representatives seats, sealing a solid majority win. After the bungled DPJ response to Fukushima and 3 new DPJ Prime Ministers in as many years, the LDP's victory was almost expected; however, this victory cannot be linked solely to the issue of nuclear energy. The LDP has always been a party known for strong economic performance. It was the LDP, after all, that led Japan through two decades of unprecedented growth in the 1960s and 70s. When LDP party leader Shinzo Abe used his economic plan that came to known as "Abenomics" as a general platform for the 2012 election, the likely scenario is that the hope of an economic upswing trumped voter concerns over nuclear energy, which Abe again promoted as part of a solid economic recovery and energy independence plan. Abe furthermore linked nuclear energy to energy independence from imports, a theme which resonated with voters who were paying triple the regular utility rates since 2011. As luck would have it for Abe and the LDP, and in a situation eerily similar to the one in which the same party found itself promoting nuclear energy after WWII, Abenomics seemed to initially work when, in February of 2013, deflation reversed and the Nikkei stock exchange grew for the first time in decades. If economic improvement trends continue, it is likely that the LDP will also continue to enjoy unchallenged majorities and will proceed with its nuclear restart plan.

By again returning to the positive narrative of nuclear energy's pivotal role in economic growth and energy independence, the LDP has again been able to persuade a society that is reluctant (at best) about nuclear energy to return them to majority power

with full cognizance of the return to nuclear that electoral decision would bring. Rather than assume that the Japanese society is openly accepting of nuclear energy, it is more likely the LDP was able to rely on and re-galvanize a well-established "positive nuclear narrative" that positively linked the economy (an issue most voters care deeply about) with nuclear energy (an issue most voters are skeptical, ambivalent or increasingly negative about). In this case, the state actively participated in the formation of a nuclear narrative that ran directly counter to the one that would have likely developed naturally after the atomic bombings in WWII. The state also used Japan's unfortunate geopolitical lack of resources to further establish nuclear energy as an imperative part of security. Lastly, by successfully linking nuclear energy with economic growth and then delivering on promised growth, the state established and then used this positive nuclear narrative to pursue the nuclear policy initiatives it wanted to pursue all along.

To summarize, the primary finding of this section in relation to the study's original hypothesis is that the relationship between public opinion and nuclear pursuance seems to be weak. However, solely comparing opinion polling information and nuclear pursuance does not tell the entire story of citizen participation in nuclear energy pursuance. Further analysis of protest activity and voting patterns is a better way to learn to what extent citizens are willing to act on anti- or pro nuclear sentiments and to what extent those actions are effective. This analysis revealed four secondary findings, the first of which is that anti-nuclear citizen involvement is most successful when it can pose costly or legal barriers to early nuclear construction or it can involve the intervention of states on its behalf. Second, citizens are best able to pose these barriers in de-centralized, government-led reactor approval and safety regulation systems, like in Germany.

Conversely, citizens are least likely to be able to pose costly barriers to construction in a centralized system where the reactor approval and safety regulation body is independent (like in the US and Japan) and where the problem of regulatory capture developed early within regulating bodies that were dually tasked with regulation and promotion. Third, citizens are most likely to be able to influence nuclear pursuance through voting in a system of proportional representation where there are numerous viable parties, at least one of which is anti-nuclear. Lastly, while the realist argument seems to explain state pursuance of nuclear energy even when confronted with citizen opposition to nuclear energy, a constructivist analysis reveals that states do have to work within prevailing "nuclear narratives." These narratives are created through a variety of state and non-state influences, but are most successful at gaining citizen acceptance (or tolerance) of nuclear energy if they effectively link nuclear energy with economic success and energy independence.

The simple fact that states employ agencies that actively promote nuclear energy seems to point to the importance of public acceptance when crafting policies to pursue nuclear energy. While one would expect this in a strong democracy, the degree to which citizens have influence over the state varies widely among democratic nations. Even within these 3 case studies, all of which are classified as strong democracies, there is a variance in citizen influence over nuclear energy pursuance. Some of these factors are difficult, if not impossible to change, such as the structure of approval and regulating systems or the representative style of governments. However, post-Fukushima antinuclear movements will be most effective if they can create barriers to increase the cost of pursuing nuclear energy, especially compared to other available forms of energy.

Nuclear Disasters: Three Mile Island, 1979

By solely comparing nuclear output as a percentage of electrical energy generated before and after 1979, the clearest conclusion is that Three Mile Island had little effect on nuclear pursuance in the US, Germany or Japan. All three countries increased nuclear output throughout the 1980s as reactors approved in the 1960s and 1970s came online and began generating energy. If nuclear pursuance is measured by new reactors approved, then Three Mile Island had a negative effect only in the US, which approved no new reactors after 1978 until 2012. Germany continued approving new reactors until 1982, and actually revamped nuclear approval process in the late 1970s to limit opportunity for public approval. It is difficult to draw a clear relationship between reactor approvals in Germany after Three Mile Island, however, because the last group of reactors were approved in 1982 (after Three Mile Island) but before Chernobyl in 1986. Japan, a relative latecomer to nuclear development compared to the US or Germany, approved new reactors every decade into the 1990s. This reactionary decline in new reactors in the US, however, is not likely explainable by safety concerns or by negative shifts in public approval. Rather, utility companies were not applying for new reactor licenses due to the increased costs of operating a nuclear facility under tighter safety regulations.

The Three Mile Island incident did spur citizen action in the US and Germany. The anti-nuclear American Green Party was founded in 1984, though this party has ultimately had little influence on national nuclear energy policy considering representatives hold no national or state-level offices. In Germany, the incident at Three Mile Island further galvanized an already significant anti-nuclear movement. The Green Party of Western Germany was founded in 1980 (and would later merge with the same

party in Eastern Germany after reunification) and would grow throughout the 1980s and 1990s, eventually forming a majority coalition in Parliament and instituting anti-nuclear policy. Similarly, the last group of reactors was approved in Germany in 1982. However, it is difficult to say what direct influence Three Mile Island had on these party formations or whether they would have formed anyway without the Three Mile Island incident. Ultimately, the most significant impact of Three Mile Island was an increase the operating cost of nuclear plants resulting from tighter safety regulations, an increase which few utility companies were motivated to pay in the US.

Chernobyl, 1986

Of the three case studies, the Chernobyl disaster appears to have had the greatest impact on German nuclear energy pursuance, though the effects would not be immediately noticeable by looking at nuclear output numbers of reactor approvals alone. The number of reactors in operation peaked in the 1980s and 1990s as new reactors came online and older reactors approved in the 1960s were still in operation. Accordingly, nuclear pursuance defined by nuclear energy output as a percentage of electrical energy total was also high in the 80s and 90s, though it would not peak until 2000. By 1990, every reactor that would generate nuclear energy had already begun doing so with the last reactor approval happening in 1982.

However, Chernobyl added weight to an increasingly significant anti-nuclear movement in Germany in the late 1980s. The membership and support of the anti-nuclear Green Party increased, and the number of seats won in local elections increased from 0 in 1980 to 42 in 1987 and propelled the party to its first year of parliamentarian representation in 1998. Chernobyl also unified a national movement against nuclear

energy and, within the context of the Cold War, further shaped the negative nuclear narrative that was pervasive in Germany at the time. Of course, it is difficult to say whether the nuclear phase-out of the 1990s would have occurred without Chernobyl, though it may be accurate to say the Green Party would have been unlikely to reach the electoral threshold and have the opportunity to form a coalition without the anti-nuclear inspiration of Chernobyl. In the long-term, however, the fervor of Chernobyl would seem to be forgotten as the CDU reversed the nuclear phase-out policy in 2005.

In the US, the Chernobyl disaster was linked with the Cold War more than it was with concerns over nuclear energy generation, which increased throughout the 1980s and, even though no new reactors were approved and built, older reactors were relicensed for continued operation. According to one set of polling data, public opinion for nuclear energy shifted in the US in 1982 rather than in 1986 as a result of the arms buildup rather than Chernobyl. Japan continued approving new reactors throughout the 1980s and 1990s, thus steadily increasing its nuclear generation. It would not be until 25 years later that the course of Japanese nuclear pursuance would see any interruption.

Fukushima, 2011

The 2011 Fukushima disaster had significant impacts in both Germany and Japan, though these effects may only prove to be for the short-term in Japan. In 2012, the US approved the first new reactor since 1978 and President Obama publicly stated that, though the US sympathizes with the people of Japan, nuclear energy would remain a part of the US electrical energy mix. In Germany, after a brief moratorium on nuclear energy, Chancellor Angel Merkel announced Germany would again institute a nuclear phase-out that would be completed by 2022 and begin a transition to renewable energy. It is unclear

whether this policy was related to concerns about nuclear safety or to electoral worries after significant Green Party wins in the immediate month following Fukushima. The nuclear phase-out may most accurately be explained by Germany's access to other resources and its already well-established renewable energy sector. In fact, one may be able to assume that a nuclear phase-out was likely inevitable in Germany, and the 2010 policy of extending the lives of existing reactors for an additional 10 years was merely a stop-gap measure before allowing renewable sources to compensate for the electricity from future decommissioned, aging reactors. Regardless of the motivation, the Fukushima disaster provided the impetus for Germany to institute a long-term policy that is unlikely to be reversed even if the CDU loses majority in future elections considering the CDU is the least likely possible party to institute a nuclear phase-out in the first place.[25]

In Japan, it is yet unclear if the effects of Fukushima will only prove to be short-term in regard to nuclear energy pursuance. Though Japan would eventually shut down all of its nuclear plants by 2012 for safety inspections, reactors under construction continued after 2011 and the goal of the LDP-led Japanese government is to restart all reactors that adhere to new safety guidelines. Given Japan's lack of natural resource endowments and expensive trading options, it finds itself in a situation unlike that of the US or Germany. Even with increased operating costs related to required safety design improvements, it may still prove to be less expensive for Japan to pursue nuclear energy. Also, given the history of lax regulating standards and outdated risk-assessment methodologies, it may be that safety-related costs do not significantly increase, though it

[25] Consequently, Angela Merkel and the CDU had their best election results in the 2013 German Federal Election since 1990.

is unclear to what extent the newly formed Nuclear Regulation Authority will break from the negligent patterns of its predecessor, NISA.

This study's original hypothesis was that nuclear accidents would have a negative impact on state decision to pursue nuclear energy. It appears the relationship between disasters and state decisions to pursue nuclear energy is weak. Post-Fukushima nuclear energy policy remained positive in the US. Immediate nuclear energy policy in Japan did become negative as the country slowly shut down all of its reactors, but that may only prove to be a short-term response as there is a current campaign that shows all signs of success to restart those reactors and to build new ones. Germany presented the only instance of a negative post-Fukushima nuclear energy policy response, though it is unclear to what extent Fukushima created that policy or if a nuclear phase-out was inevitable and Fukushima only hastened its implementation.

The secondary findings of this section are that, first, domestic nuclear disasters may only have short-term impacts on decisions to pursue nuclear energy. In the US, no new reactors were approved after 1978, but increasing oil prices in the 2000s brought rumors of a "nuclear renaissance" in the US that may have begun with the first new reactor approval and construction in 2012. Though the Chernobyl disaster did not occur within Germany, Chernobyl was only 800 miles from Berlin, roughly the same distance from Middletown, PA, to Atlanta, GA. Considering the close geographic proximity, Western Germany would share in the consequences of the Chernobyl disaster. Even though Chernobyl mobilized voters to bring the Green Party to parliament and institute a nuclear phase-out policy, that policy would later be reversed in 2005. Similarly, though Japan immediately closed its existing reactors, the plan is for an eventual restart.

Germany's anti-nuclear response to Fukushima seems to be the outlying case in this study, and may be explainable with the idea that an anti-nuclear policy was already inevitable by 2011.

Secondly, nuclear disasters stimulate anti-nuclear movements by giving citizens evidence that nuclear technology may be unsafe, though increased opposition may not necessarily translate into policy change. The early development of the Green Parties in the US and Germany occurred after Three Mile Island, and the most recent Green Party in Japan similarly developed after Fukushima. This party development is a natural, democratic outgrowth of anti-nuclear sentiments. To what extent those movements are able to ultimately influence nuclear energy policy, however, is then either limited or enabled by the systemic structures in which they are operating, as discussed in the previous section. Even if nuclear disasters increase public opposition to nuclear energy, there is no guarantee that opposition will result in policy change.

Access to Other Resources

Of all variables tested, consideration of a state's access to other resources seems to offer the clearest explanatory power for nuclear pursuance. Fully capturing this aspect of state decisions to pursue or not pursue nuclear energy requires analyzing both current endowments of natural resources and the potential for future access to those resources as well as a country's current trading relationships and projected trading relationships with respect to energy resource price. The original hypothesis is that countries that possess endowments of natural resources will be less likely to pursue nuclear energy and countries that lack natural resource endowments will be less likely to pursue nuclear energy. Additionally, countries that are capable of obtaining electrical energy generating

resources from reliable trading partners at competitively affordable prices will be less likely to pursue nuclear energy. This variable attempts to capture current decisions about nuclear energy given other possible energy options as well as the projected future for nuclear energy in each case given these options.

The first primary conclusion of this section is that if countries possess natural endowments of energy generating natural resources, they will be less likely to pursue nuclear energy. Of the three cases, the US has the greatest endowment of natural resources. The US has always possessed vast coal reserves, upon which it has historically relied most heavily for electricity generation. It has only been in the past two years that coal consumption for electricity has decreased to proportions almost equal to natural gas used for electricity. New hydraulic fracturing and horizontal drilling technologies have granted access to reserves of oil and natural gas which were previously unreachable with existing extraction methods. By utilizing these new technologies, the US is predicted to be a natural gas net exporter by 2018. Already, natural gas imports from Canada have decreased and exports to Mexico have increased. Oil production has also increased, but the US uses relatively small amounts of oil to produce electricity. Such a large amount of available natural gas has reduced the price of natural gas in the US to the cheapest in the 21st century.

Previous analysis reveals that when natural gas prices decrease, so do applications for new nuclear reactors. Even though this study has characterized the US as a nuclear-pursuing country based on its first approved application for a new reactor in 2012 and consistent nuclear energy generation, future projections reveal that, without significantly more new reactors, nuclear energy generation will steadily decrease as aging reactors

from the 1960s and 1970s reach their decommissioning point. Already, 70 plants have applied for and been granted reactor life extensions, but those extensions will not continue indefinitely. It is currently impossible to know for sure how long reactors can operate safely since this generation constitutes the first wave of reactor extensions. Without new reactors to replace decommissioned ones, nuclear energy pursuance will inevitable decrease. However, if historical trends are any indication, continued low natural gas prices will discourage investment in nuclear energy since both the natural gas will be inexpensive and natural gas electricity generation plants are cheaper to build than nuclear or coal plants. The Energy Information Administration predicts that both nuclear and coal reliance will decrease in the future as natural gas use increases 16 percent by 2017.[26]

The increased construction and operating costs of nuclear plants and a natural endowment of inexpensive coal that can be used for electricity largely explains the lack of reactor applications in the US since 1978. Even without new reactors, the US has still consistently relied on nuclear energy for 20 percent of its overall electricity generation, a percentage share that places it among the biggest consumers of nuclear energy in the world. These deterrent operating costs have not decreased, and when coupled with natural gas abundance and historically low natural gas prices, nuclear reliance will continue to decrease. This phenomenon is already observable in the early closures of 4 fully functional and legally approved nuclear plants in 2013. In the US, it seems the market has largely made the decision about the future of nuclear for the state. With access to an abundance of other, cheaper options, it will be difficult to attract investment in nuclear

[26] "AEO 2014 Early Release Overview," Energy Information Administration, Last Updated December 16, 2013, Accessed April 1, 2014. http://www.eia.gov/forecasts/aeo/er/early_elecgen.cfm.

energy from utility companies, even if the state wanted to. Given these domestic options, the state also has little incentive to subsidize nuclear energy when it could instead invest in the country's potentially profitable future as a natural gas exporter.

The US is also the most geographically fortunate of these three cases. Both of its neighbors, Canada and Mexico, possess natural resources of their own and are both engaged with the US in the North American Free Trade Agreement. Additionally, the currently pending Keystone Pipeline would create further interdependence between the US and Canada and increase the two's energy cooperation.

Germany is not as fortunate, as natural gas prices are consistently higher in European and Asian markets than the Henry Hub North American spot price. Given Russia is the world's largest natural gas exporter, it would seem that Germany would have energy options; however, reliance on Russia, a country increasingly becoming a political pariah, is problematic at best. Luckily, Norway is the fourth largest exporter of natural gas in the world and German agreements with Canada (and talks underway with the US) also seem to indicate that it will continue to have access to natural gas without the politically problematic reliance on Russia, even if it is at higher prices. In a stroke of foresight, Germany has long been working to counter this problem by developing the world's leading renewable energy resource sector. The 2000 Renewable Energy Act incentivized corporate and individual investment in renewable energy technology and grid support. Now, Germany is among the leading countries in the world for solar, wind and biomass resources. The rolling electrical blackouts that many predicted would come after Germany began turning off their nuclear plants never materialized as the country increased its reliance on these renewable resources. The likely scenario is that German

leaders knew the infrastructure capability already existed to compensate for nuclear when it announced the nuclear phase-out in 2011. Even with renewed citizen opposition to nuclear energy, people would have likely been more upset about regular electrical outages that could have come from closing nuclear plants. For this reason, the nuclear phase-out is largely explainable by looking to German's long-term plans to only use nuclear as a bridging resource until renewable infrastructure was robust. Even though Fukushima accelerated this plan, leaders had to know that phasing out nuclear energy would have resulted in electrical shortages given the backlash widespread outages would have caused. Ultimately, though Germany has few natural resources of its own compared to the US, it does have abundant current and future trading options, even if resources are priced marginally higher than in the US. Additionally, Germany has created its own abundance of resources by developing the technology to harness renewable sources such as sun and wind power. Given these options, continuing to rely on increasingly unpopular nuclear energy would have been illogical for Merkel and the CDU, especially two years out from a national election.

With no natural resource endowments to speak of, Japan imports roughly 85 percent of its overall energy resources. Japan has many regional trading partners, but most are located far from the Northeast Asian island nation and transportation increases already elevated Asian market prices. Even though it is one of the most energy efficient countries in the world, it is also the most energy reliant, and with a national debt that currently tops 230 percent of GDP, importing expensive energy resources is not an ideal component of Abe's plan for economic growth. This explains Japan's continued pursuance of nuclear energy since WWII as well as the country's incentive to again

return to nuclear energy, even after Fukushima. Even though the Fukushima disaster will likely increase the operating cost of nuclear plants in Japan, nuclear energy is still a more affordable option than continuing to import 85 percent of energy resources. A second motivating factor for Japan is the desire to continue exporting nuclear reactor technology, an industry in which it has long excelled but has seen decreased profits since Fukushima. Their campaign to create "the world's safest nuclear energy technology" is no doubt to convince Japanese citizens as well as future buyers. Though this may only be a marginal concern, increasing security tensions in the region between China and Japan may also be a motivating factor for Japan to increase its energy independence.

To summarize the findings of this study, it seems that few factors influence decisions to pursue nuclear energy as directly as to what extent countries have other energy options. Closed opportunity structures in the US and Japan have and will likely continue to limit citizen participation in the process of nuclear policy decision making. Similarly, nuclear disasters have been shown to have little lasting, long-term impact on state decisions about nuclear energy unless they result in added costs that make nuclear investment more expensive than other energy options. The US will begin to very gradually phase out nuclear energy, a move partly due to the increased availability of natural gas and partly because of market considerations, though not necessarily as a response to Fukushima. Germany will also continue their nuclear phase-out, though at a much faster pace as it moves increasingly toward renewable energy sources. For the Germans, Fukushima did not necessarily force a reversal of nuclear energy policy; rather, it simply hastened a move away from nuclear that had already become inevitable. Lastly, the future of Japanese energy is as of yet unclear, though a complete restart of their

nuclear sector would not surprise many. Given its limited resources, limited options, and closed system of citizen influence, a return to nuclear is even quite likely.

CHAPTER 7

CONCLUSION

This concluding chapter will first examine the energy outlooks for the United States, Germany and Japan based on future projections of electricity demand, available supply and other geopolitical and economic factors. Second, this project will conclude by widening the scope to other countries that are currently pursuing nuclear energy, specifically, Russia, China and Ukraine. These three countries offer an opportunity to test the conclusions of this study in countries that do not possess all of the control variables found in the US, Germany and Japan; that is, they are not all democratic, Western, economically developed countries, but they are actively pursuing nuclear energy agendas. Lastly, this concluding chapter will end with final comments on what I consider this project's most significant findings and their broader applicability to the world of energy geopolitics.

Energy Outlooks: The United States, Germany and Japan

One of the longest established trends in energy is the increasing role of the power sector.[1] The most recent BP Energy Outlook predicts that, in 2012, 42 percent of primary energy was converted into electricity, up from 30 percent in 1965. In addition, by 2035, that share will increase to 46 percent[2]. The power sector is the one place in the global energy market that all resources compete. Therefore, as electrical energy demand increases globally, the interplay of availability and price of a variety of resources will

[1] "BP Energy Outlook: 2035," British Petroleum, Released January 2014. http://www.bp.com/content/dam/bp/pdf/Energy-economics/Energy-Outlook/Energy_Outlook_2035_booklet.pdf.
[2] Ibid.

dominate the energy conversation. Coal is projected to remain the primary energy-generating resource through 2035 when it is overtaken by natural gas. Projections also anticipate that renewable sources outpace nuclear as a source of power generation by 2028 and show no sign of approaching a limit to their market share.[3]

Overall electricity demand has decreased in the US since 2008, but is projected to rise as the American economy recovers. By 2040, projections place natural gas at 35 percent of total electrical generation in the US and coal at 32 percent.[4] Legislation passed at the beginning of 2013 to incentivize renewable energy investment is also expected to increase the market share of renewable resources such as solar and wind. Nuclear generation is projected to decrease in the short term as many plants continue early closures due to unprofitable economic conditions for nuclear energy when confronted with low market prices of natural gas. However, after 2025, natural gas prices will likely increase as production stabilizes; as a result, nuclear generation is expected to again increase through increased capacity generation at existing plants. By 2040, that output is again anticipated to decrease with scheduled nuclear plant closures. As the US moves to become a net energy exporter, the private sector will likely emphasize investment in natural gas extraction and exporting capacity and the public sector will likely further incentivize investment in natural gas rather than nuclear energy.

These projections supplied by British Petroleum and the US Energy Information Administration are really just guesses, even though they are educated guesses.

---

[3] Ibid.

[4] "AEO2014 Early Release Overview." Energy Information Administration. Last Updated December 16, 2013. Accessed March 23, 2014. http://www.eia.gov/forecasts/aeo/er/early_production.cfm?src=Analysis-b3.

Sometimes, if not most of the time, however, energy forecasting goes wildly wrong.[5] Even so, based on this research, it is plausible to assume that coal will continue to provide a significant amount of baseload electricity in the US considering the abundant supply of the resource and established infrastructure to generate coal into electrical power. Furthermore, it is also likely that natural gas prices will remain low until demand begins to approach supply, at which time natural gas prices will increase. This research has also shown that applications for nuclear reactors and nuclear output are correlated with the price of natural gas; that is, when prices are low, nuclear pursuance is also low, but when prices are high, there is renewed interest in nuclear energy. If and when this point is reached, the current existing reactors in the US may or may not still be operable (not shut down due to previously unfavorable economic conditions) to make up the difference in a market where the price of natural gas is higher. Beyond this gas/nuclear equilibrium point, which the US will likely reach in the next 10 years, it is difficult to say whether nuclear pursuance will continue or will reverse course as other forms of energy become too inexpensive for nuclear to compete.

The energy outlook for the US appears secure, but one of its biggest challenge will be gaining acceptance of the controversial hydraulic fracturing process from citizen populations where drilling is taking place. In a story very similar to that of nuclear construction plants, energy drilling companies stress the incentives of employment opportunities and general increases in local wealth that such industry brings, but many citizens and environmental groups remain opposed. This opposition is evidenced, for example, with the problematic construction of the Keystone Pipeline from Canada to the

---

[5] Steve Yetiv and Lowell Field, "Why Energy Forecasting Goes Wildly Wrong," *Journal of Energy Security*, October 2013.

Gulf Coast, the current phase of which is still bound in legal wrangling and faces opposition from multiple local governments, citizens and some US Congress members.

Germany is scheduled to have completed its nuclear phase-out that began in 2011 with the closure of its 8 oldest plants and increased with legislation that incentivized investment in renewable technology. A thriving German economy indicates that demand for electrical power is unlikely to decrease in the future and may even increase with renewed industrial production. New coal-fired power plants in Germany are predicted to continue placing coal as a cornerstone of the German electrical power supply in the medium-term while renewable infrastructure develops. New legislation has moved to phase out subsidies for coal production but the recent wave of new coal plants represent the biggest investment in coal energy sine the post-war reconstruction. These plants will have an operating lifetime until 2050[6]. The Nord Stream Pipeline has diversified Germany's already robust supply and storage infrastructure for natural gas. The current system can support a certain amount of future loss in nuclear-generated capacity, but the energy transition has come at increasing costs to consumers. The cost of transmission and redistribution infrastructure as well as research and development in new renewable technology has thus far been largely assumed by rate payers (though the industrial sector is largely exempt from these costs) and has increased significantly in the past 3 years. Increasing electrical bills and burdens on individual households have sparked a debate in Germany about the overall cost of the energy transformation. While the short and

[6] "Energy Policies of IEA Countries, Germany: 2013," International Energy Agency, Released January 2013.

medium-term projection for increasing renewable energy reliance in Germany is positive, the long-term outlook is still uncertain.[7]

Japan has been feeling the effects of Fukushima since 2011 and will continue to find dealing with its energy resources problematic. Electrical demand has been low in Japan since the economic downturn in the 1990s, and even further decreased after Fukushima in 2011. However, the promising economic recovery plan of Shinzo Abe may indicate an uptick in industrial electricity demand. Coal imports to the general Asian market have doubled since 2000, mainly from Australia, China and India. The Asian market for coal has generally expanded rapidly in the past decade and is now roughly 4 times the size of the European market.[8] Supply of coal is still greater than demand, which has maintained a stable price, but increasing coal usage will not further Japan's clean energy goals set forth in the Kyoto Protocol. Liquid Natural Gas (LNG) imports also increased significantly into Japan after 2011, but with a stable variety of regional supply options, increasing reliance on LNG should not pose a problem. The plan to restart the nuclear reactors in Japan gives all indications of progression, but that restart is still only a future possibility, not an inevitability. While importing almost all of their energy resources has been expensive in the short-term, Japan's primary long-term challenge will be balancing their need for resources with the needs of a growing Asian market in general. To deal with their domestic lack of energy resources, countermeasures have been taken which include developing a greater domestic supply of renewable energy, diversifying supply sources, independently conducting overseas development, and

---

[7] Ibid.

[8] Atsuo Sagawa, "Outlook for International Coal Market, 2014," 414th Regular Report Presentation to the Fossil Fuels and Electric Power Industry Institute, December 20, 2013.

strengthening companies as players.[9] South Korea has also initiated similar measures to increase their energy supply security and China has long been investing in African natural resources. These combined actions may increase the competition and hoarding of resources, destabilizing the regional and international energy markets.

Widening the Scope

General demand for electrical power is expected to increase in the coming decades, though much of that demand will move from OECD countries to developing, non-OECD countries. Accordingly, nuclear power capacity is steadily increasing worldwide with over 60 new reactors scheduled for construction in 13 countries, 120 new reactors are planned, and, by some estimates, 320 are proposed.[10] Most of the new reactors will be in the Asian region in countries with rapidly growing economies and increased energy demand. After Fukushima, the OECD's International Energy Agency projected a 60 percent increase in nuclear capacity in the world, a decrease from the previous year's 90 percent projection but a sizable increase nonetheless. In addition to new reactors, there has also been a general move to increase the operating capacity and to extend the operating lives of existing reactors in countries with established nuclear programs such as Finland. In the following section, I will briefly examine 3 cases where nuclear energy is expected to grow: Russia, China and Ukraine. These 3 cases offer an opportunity to test the various conclusions of this study in non-OECD countries that do not necessarily possess all the characteristics (democracy, economic development) that determined this project's initial case studies.

---

[9] Masakuza Toyoda, "Energy Security in North Asia," Report from The Institute of Energy Economics, Japan, March 2014.

[10] "Plans for New Reactors Worldwide," World Nuclear Association, Last Updated March 2013, Accessed April 3, 2014, http://www.world-nuclear.org/info/current-and-future-generation/plans-for-new-reactors-worldwide/.

Russia

Russia is the world's largest supplier of natural gas, providing the European Union alone with 27 percent of its total natural gas imports[11]. In addition to the world's largest natural gas reserves, Russia is also the largest oil supplier outside of OPEC. Despite these abundant endowments of natural resources, Russia is actively pursuing increased nuclear energy capacity with new reactors and expansion of existing plants. In 2010, the Russian government approved a program to create a new reactor technology program to the nuclear industry based on fast reactors. This program envisions nuclear energy providing up to 50 percent of Russian energy by 2050.[12] Based on this information, Russia provides an ideal case in which to test the theory that countries with greater endowments of natural resources will be less likely to pursue nuclear energy. Though one may assume that Russia offers a case in which this conclusion about nuclear energy and other resources is proven wrong, a closer examination reveals that this theory may need more refinement to incorporate considerations of natural gas prices and export capability.

Russia is currently faced with rapidly rising electricity demand after decades of economic stagnation. Resource supply to meet this increasing demand, however, is surprisingly constrained, especially considering Russia's vast supply of natural gas. The explanation lies in the Russian national gas company Gazprom's economic incentive to export Russian gas to its Western European neighbors at much higher prices and make five times the profits than by utilizing the same gas domestically for electricity. Russia currently delivers natural gas to Europe through 12 pipelines, one of which goes directly

[11] "Nuclear Power in Russia," World Nuclear Association, Last Updated March 2014, Accessed April 3, 2014, http://www.world-nuclear.org/info/Country-Profiles/Countries-O-S/Russia--Nuclear-Power/.
[12] Ibid.

through the Baltic Sea to Germany. As demand for natural gas has increased in Western Europe, so has the motivation to sell it at the resulting higher prices. Because there is an already established transportation infrastructure in place and an established market to which to sell, Gazprom plans to half its supply of natural gas to Russian electrical energy utilities by 2020.[13] Russia also has been known to use its exports of natural gas to Europe as an energy weapon for political control, most recently increasing the price of natural gas to Ukraine by 40 percent as a response to mounting strains between the two countries of Russia's March 2014 takeover of Crimea.[14] This increase is a direct reversal of the natural gas discount policy the two countries had agreed on just months earlier when relations between Ukraine and Russia were friendlier. This prospective economic payoff and tenuous political control from selling natural gas to Europe rather than consume it explains the Russian motivation to increase domestic nuclear energy. However, this Russian plan may backfire if Europe is able to find other supplies of natural gas that would give it independence from Russia, a supply that may just come from the US natural gas boom. Though Russia is the world's largest natural gas exporter, the US has risen to become the world's largest producer of natural gas, though it does not currently have the infrastructure for mass exports that Russia has in its pipeline system. This lack of export infrastructure explains the uniquely low gas prices in the US market compared to the Asian or European market—without many regional options to sell the glut of natural gas (Canada has its own) US companies have been selling within a supply-heavy domestic market. As this infrastructure continues to develop, however, the US State

---

[13] "Nuclear Power in Russia," World Nuclear Association, Last Updated March 2014, Accessed April 3, 2014, http://www.world-nuclear.org/info/Country-Profiles/Countries-O-S/Russia--Nuclear-Power/.

[14] "Gazprom Raises Gas Prices for Ukraine," Al Jazeera, April 1, 2014, Accessed April 4, 2014, http://www.aljazeera.com/news/europe/2014/04/gazprom-raises-gas-price-ukraine-2014417162367581.html.

Department has already incorporated American supplies of natural gas into its diplomacy policy to give Europe options for natural gas besides Russia. This may have two future consequences for nuclear energy is the US and Russia. First, as US natural gas becomes more competitive in a demand-heavy international market, prices will increase and, as this study has shown, nuclear energy pursuance also increases with natural gas prices. This will account for a medium-term increased reliance on nuclear energy within the next decade, though the long-term consequences are difficult to discern. Even if Europe turns to the US for natural gas to such an extent that it significantly damages Russian exports, there will likely always be other countries that will be willing to import natural gas from Russia, especially at special trade agreement prices. Russia is likely unworried about damage to its natural gas sector, and increasing nuclear energy to satisfy domestic demand will remain part of their energy strategy, regardless of what happens in the coming months with Ukraine and the rest of Europe. Consequently, Russia is also a leading exporter of nuclear technology, an industry from which it sees great profits and devotes much research and development monies.

To return to the original theory this brief discussion of Russia was supposed to test, does a greater endowment of other natural resources necessarily equal a decreased pursuance of nuclear energy? This analysis seems to suggest that may only be true when the prices of those other natural resources are relatively low. The incentive will be for nationalized or privatized energy companies to sell resources at prices that are higher in international markets than in the domestic market. If that results in subsequent increases in the price of that resource in the domestic market, then nuclear energy will again become competitive. This condition explains the future forecast for nuclear energy in the

US: as export infrastructure grows and demand for US natural gas increases, so will the domestic price of natural gas. Given this increased natural gas price, utility companies may find that investment in nuclear energy either by building new reactors or restarting old ones may again be comparatively profitable. The greatest explanatory factor, then, may not lie with access to other resources in countries where resources are abundant but in the relative price of those resources compared to nuclear energy on the global market. As renewable technology, investment and generated energy increase in the coming decades, domestic supplies of solar or wind energy may further alter this relationship that pits the power of resource abundance against the dependence of resource scarcity.

China

Public opinion and citizen dissent may not seem like a fitting variable to examine in China, considering its status as an authoritative regime that naturally limits public input into state decisions. Recent citizen dissent activities in China, however, and a generally increasing pattern of social mobilization through social networking sites may suggest that citizen opposition to nuclear energy could gain a foothold in this one-party regime. The world's second largest economy and one of the fastest growing economies, Chinese electrical energy demand has increased exponentially in the past two decades. In addition to massive investment in Africa and other parts of Asia, China also plans to increase its nuclear capacity four-fold by 2020 to counter a serious problem with pollution from coal-fired plants, which generate 80 percent of its electrical energy.[15]

In 2013, approximately 2000 residents of Jiangmen protested the building of a uranium processing plant that would have provided China with half of its nuclear fuel

[15] Charlie Zhu, "Public Trust Crisis Threatens China's Nuclear Power Ambitions," Reuters, July 18, 2013, Accessed April 4, 2014, http://www.reuters.com/article/2013/07/18/us-china-nuclear-protests-idUSBRE96H1BT20130718.

needs. Concerned with issues such as pollution and food safety, many local organizations also became involved. It was the official concern expressed by neighboring cities of Hong Kong and Macau, however, which finally inspired Jiangmen authorities to shelve plans for the uranium plant, though many local citizens report skepticism that the facility will not eventually be built, anyway, citing a lack of governmental credibility and responsibility to the people.[16] These protests come at a time when civil society is becoming increasingly organized in China, a fact that President Xi Jingping has acknowledge by saying the future survival of the Communist Party of China rests on attaining public approval.

The conclusions of this study in relation to public opinion and nuclear energy were that citizens are more successful at stopping nuclear pursuance when they had access to a variety of democratic opportunity structures, such as proportionally representative government and multiple viable-party voting options that include an anti-nuclear party. These options do not exist for Chinese citizens, who are left with only organization into protest movements and involvement of civil society organizations as tools to create costly roadblocks to facility construction. In this case, however, the theory that citizens are most successful at stopping nuclear pursuance when they can involve other governmental bodies (in this case, other cities) on their behalf holds true.

The integration of bureaucracy and industry in China, which is characteristic of a one-party regime, is not dissimilar to the close ties between industry and the LDP in Japan. This study has shown that Japanese citizens have been largely unsuccessful at slowing the government's pursuit of nuclear energy, and if public dissent has little effect

---

[16] Minnie Chan, "Jiangmen Uranium Plant Scrapped After Thousands Take Part in Protests," *South China Morning Post,* July 14, 2013, Accessed April 4, 2014. http://www.scmp.com/news/china/article/1281748/jiangmen-uranium-plant-scrapped-after-protest.

in Japan, a country the world considers a democratic nation, then it is unlikely citizens will have much of an effect on Chinese nuclear pursuance, either, though to what extent the Chinese Communist Party will have to satisfy increasing citizen demands to hold on to power is a developing issue. Examining other pro-nuclear energy, nondemocratic countries would offer some insight into this decision-making process in the context of nondemocratic governmental systems. Iran, for example, certainly has political and national interests vested in pursuing a "peaceful" nuclear energy program, even at great personal cost. Future studies could expand the findings of this study, especially those related to citizen participation, to countries without democratic government that are still marginally accountable to its citizens.

Ukraine

This study began with the hypothesis that nuclear disasters anywhere impact state decisions to pursue nuclear energy. The course of research revealed this relationship between disasters and anti-nuclear policies to be weak , though it does seem that there is an anti-nuclear reactionary phase in countries where nuclear disasters occur, even if the there is a subsequent, eventual return to nuclear pursuance. This theory is supported by the scholarly literature which was discussing this "rebound hypothesis," at least in terms of public opinion trends, in 1994.[17] Since the Chernobyl incident took place in current day Ukraine, it poses an interesting case to briefly examine in the context of this hypothesis.

Original Ukrainian nuclear energy was obviously tied to Russian technology. Even after the Chernobyl disaster in 1986, however, Ukraine/USSR continued operation

---

[17] See: Eugene A. Rosa and Riley Dunlap, "Nuclear Power: Three Decades of Public Opinion," *Public Opinion Quarterly*, 58:2 (1994), 295-324.

of nuclear reactors, operation which remained relatively stable even after independence from the collapsing Soviet Union. 2011 energy forecasts included an increased demand in electricity, and the Ukrainian government created policies to emphasize the role nuclear energy would play creating this electrical energy supply. By 2030, the hope is that half of the electricity supply in Ukraine will come from nuclear generation.[18]

This example of Ukraine seems to suggest that, in the long-run nuclear disasters have little impact on state decision to pursue nuclear energy, in the long or short term. The worst nuclear disaster in history happened within the borders of present day Ukraine, and it is still actively pursuing a nuclear energy program. The United States, Germany and Japan would suggest similar support for the same argument. The lone outlier to this conclusion is Germany's decision to move away from nuclear energy after Fukushima, but that nuclear phase-out policy is a decision that was merely hastened rather than created by the Fukushima disaster. There are, however, a handful of cases countries that have banned nuclear energy, some since Fukushima. Italy, for example, has never had nuclear energy capacity and both Spain and Switzerland voted to phase out nuclear energy following Fukushima. Though an examination of these cases is beyond the scope of this study, future projects could offer analysis that would reveal the motivation behind these decisions to moves away from nuclear energy, perhaps in comparison with the German decision to do the same.

Final Comments

The intent of this research project was to create an educated guess as to the future viability of nuclear energy as a resource of the future. That future seems to vary by

[18] "Nuclear Power in Ukraine," World Nuclear Association, Last Updated March 2014, Accessed April 3, 2014, http://www.world-nuclear.org/info/Country-Profiles/Countries-T-Z/Ukraine/.

country, and upon a host of other factors: availability of other resources, price of competing resources, an accepting civil society, and even, in some cases, clean energy goals. The gamut of current levels of nuclear energy pursuance ranges from a complete phase-out, to reductions in nuclear reliance, to the construction of many new future reactors. As electricity demand becomes relatively stable in developed countries, the need for initially expensive nuclear energy will decrease, especially as other energy options, such as renewable sources, become more viable and states become more committed to future clean energy goals. Among developing countries, however, the race to diversify energy supply is on as electricity demand will only increase. For countries without reliable and affordable access to resources, nuclear energy still represents one path to a degree of energy independence, especially as competition for resources becomes increasingly heated.

This project ultimately concludes, first, that the future of nuclear energy is uncertain in the short-term and somewhat dismal in the long-term. The preceding chapters illustrate that when faced with other, equally affordable energy options, states can rarely be expected to invest in initially expensive nuclear energy. A future expansion of this project may choose to comparatively engage states' various market structures with the hypothesis that the stronger the free market, the less likely a state will be to pursue nuclear, while a stronger state presence in the market may provide a more hospitable environment for nuclear investment. This may at least partly explain the expansion of nuclear power in places like China or the United Arab Emirates, in addition to limited citizen-input structures. Expected future electrical demand also seems to be a consistently important factor, evidenced by the growth of nuclear energy in primarily developing

countries that are expecting future growth and the waning of nuclear energy in some developed countries where electrical demand has stabilized or even begun to decrease.

The course of reaching this conclusion about nuclear energy's future also generated knowledge that I did not initially seek out but has proven to be vital in formulating this study's primary conclusions. Among these are that, first, the structure of a state's licensing and regulating body can significantly hasten or impede the process of approving new reactors as well as the continued operation of those reactors. Centralized approval systems like those found in Japan and the US are more susceptible to the problem of regulatory capture where there are close ties between the nuclear commission and the nuclear industry. These ties create a system in which it is easier to gain initial approval for new reactors and more likely that safety regulations will be lax and therefore in financial favor of the nuclear industry at the expense of overall safety. De-centralized systems, like those found in Germany, where individual Länder have final approval over new reactors and work in accordance with the state regulating and approval body as well as the European Commission for Nuclear Energy, tend to exhibit fewer symptoms of regulatory capture and allow citizens greater access to the nuclear policy decision-making process.

Secondly, democratic systems of proportional representation likewise offer citizens the opportunity to influence nuclear energy pursuance through the democratic process of voting. In systems of multi-party representations where there are multiple party options and at least anti-nuclear party, there is a greater chance that an anti-nuclear party will gain a voting threshold for legislative representation and can even form a coalition with similar parties to initiate anti-nuclear policy. In two-party, pro-nuclear

states (the US), or states with a history of pro-nuclear one-party dominance (Japan), citizens' opportunity to elect anti-nuclear representation is limited. Both of these points represent a greater argument about citizen opportunity structures, or systems in which citizens are more likely to influence state nuclear decisions. In a de-centralized approval system, citizen protests are more successful as local legislators are concerned with the next election season. The result is increased willingness to hear citizen demands or concerns, and though there is no guarantee of a response, it is more likely than in a centralized system that may be beholden to the nuclear industry. Future projects should not neglect an examination of these opportunity structures, though it may be that citizens will have less influence over nuclear pursuance in the future simply because most nuclear expansion is occurring in non-democratic countries.

Finally, the discussion of the "nuclear narrative" offered here is, as far as I am aware, something entirely new in academic studies of nuclear energy. The pervasiveness of the state-centric political theory of realism is largely due to a significant body of historical evidence that supports it. States do often make decisions that, while at times unpopular domestically or internationally, seem to be primarily about preserving their own survival and power. Many could argue that state decisions about pursuing or not pursuing nuclear energy are also a product of this line of reasoning, whether it is a party trying to preserve their political power or a state trying to ensure it has access to enough energy resources. However, these decisions cannot be made in a vacuum, for if a country claims to be democratic, it has to exhibit some amount of concern for the welfare of its people and some responsiveness to the will of the people, if for no other reason than to prevent a coup d'etat. Therefore, to varying degrees, states are forced to operate within

issue narratives that prevail in a country, in this case, the narrative about nuclear energy. States can actively participate in the creation of these narratives, have little control over these narratives, or leave well-enough alone in the absence of a narrative.

For example, this project has previously discussed the ways in which the Japanese state attempted to create and control citizens' sentiments about nuclear energy; that is, the state actively worked to create the perception that nuclear energy was intrinsically linked to economic growth and energy independence, a perception that eventually became an ideological norm. Within this narrative, it became much easier for the state to gain approval for nuclear reactors placed in citizen's backyards, though the subsidy money that poured into reactor communities likely did not hurt, either. In Germany, the prevailing narrative about nuclear energy was largely shaped by outside forces such as the Cold War, nuclear weapons, unfortunate geopolitical positioning, and a strong de-militarized sentiment. Had leaders even wanted to actively create a positive image of nuclear energy, the persistent link between nuclear energy and nuclear weapons would have been difficult to overcome given the regional political climate of the Cold War. By way of contrast, the nuclear narrative is largely absent in the US, though films engaging energy issues such as *Pandora's Promise* or *Promised Land* have become more popular in the last decade. Examining the construction and content of these "nuclear narratives" will reveal much about states' resolve (or desperation) to pursue nuclear energy. By also determining where nuclear-promotion funds are coming from, future studies can also determine the extent to which states are linked (or beholden) to the nuclear industry. Lastly, the extent to which citizens react to the forces creating these nuclear narratives and the ways in which these narratives do or do not become ideological norms can lead to

a greater understanding of how citizens self-identify as political participants. In other words, the success or failure of these narratives, especially when states actively expend time and money to create them, will be significant, though perhaps only in democratic countries where citizen consent matters.

The initial goal of this project was simply to offer an educated guess as to the future viability of nuclear energy in a world market of competing electrical power sources such as coal, natural gas, and emerging renewable technologies. Among these resources, nuclear energy poses an interesting case to study for two primary reasons. First, nuclear technology possesses an immense capacity for use in good and evil, not just in terms of the "weapons versus energy" dichotomy, but even within its operation as a peaceful energy source. In this respect, the Henry Wadsworth Longfellow poem about a little girl with a curl on her forehead comes to mind, for when this girl was good, she was very good; however, when she was bad, she was horrid.[19] Nuclear energy similarly has the capacity for efficient and clean energy generation, but the other side of that coin depicts scenes of reactor meltdowns, radiation leakages, contamination and disaster with which the world is all too familiar based on reporting from Chernobyl and Fukushima. Nuclear energy has also been depicted in popular culture perhaps more than any other form of energy, in manga series such as *Astro Boy*; in films such as *The China Syndrome* (1979), *Barefoot Gen* (1986) and *Chernobyl Diaries* (2012); satirized in television shows such as *The Simpsons;* and in poems and popular literature such as *The Crazy Iris* (1984). In this way, nuclear energy has a sort of "personality" that other forms of energy do not have, a personality that is further explore in this project through a discussion of what I

[19] Henry Wadsworth Longfellow, "There Was a Little Girl."

term the "nuclear narrative" and how that personification of risk influences states' abilities to pursue nuclear energy.

Secondly, nuclear energy is a rare resource that can be produced domestically and in abundance while simultaneously allowing states to further their clean energy goals. We currently live in a world of energy yins and yangs, a world of competing interests that push against each other to form a tentative status quo. Preserving the environment, reducing pollution, and protecting citizens' quality of life have all become popular policy goals, especially in Western countries. In tension with those goals is the global economy's need for more and more energy resources. As developed countries strive to maintain their economies and developing countries inevitably continue to grow, there will be fewer and fewer resources to go around. While renewable technologies based on solar, wind, and hydrothermal sources are increasing in popularity and attracting increased investment, these sources are still decades from being capable of replacing traditional fossil fuels. Excluding the needed enriched uranium, nuclear energy also offers states a degree of energy security and independence in a world of resource "haves and have-nots." If our future is to be characterized by resource competition *and* clean energy goals, then the role nuclear energy—a clean, domestic resource—will play in that future will only become increasingly important.

BIBLIOGRAPHY

"30 Years of Policies for Wind Energy: Lessons from 12 Markets." International Renewable Energy Agency, 2012.

"AEO2014 Early Release Overview." Energy Information Administration. Last Updated December 16, 2013.

Aldrich, Daniel P. "Japan's Nuclear Power Plant Siting: Quelling Resistance." *The Asia-Pacific Journal.*

-------."Post-Crisis Japanese Nuclear Policy: From Top-Down Directives to Bottom-Up Activism." Asia Pacific Issues, Analysis from the East-West Center (January 2012).

-------."Post-Fukushima Nuclear Politics in Japan, Part 3: Empowering Anti-Nuclear Sentiment." *The Monkey Cage.* Last Updated March 13, 2013.

"Americans Still Favor Nuclear Power a Year After Fukushima," Gallup. March 26, 2012.

Annual Energy Review, 2012. *US Energy Information Administration.*

"Anti-Nuclear Movement." The Oregon Encyclopedia of Portland State University.

"Anti-Nuclear Protests Show Japan is Becoming an Ordinary Nation, Scholar Says." *Asahi Shimbun.* July 19, 2012.

"Asahi Poll: Abe Cabinet Breaks Trend, Increases Support Rate to 62%." *Asahi Shimbun.* February 18, 2013.

Atomic Safety and Licensing Board Panel Proceedings, 2012. United States Nuclear Regulatory Commission.

Austin, Steve. "Japan Seeks Resilient Energy Policy." Oil-Price.net. Last Updated, October 1, 2013.

Baumgartner, Frank R and Bryan D. Jones. *Agendas and Instability in American Politics.* Chicago: University of Chicago Press, 1993.

Bosso, Christopher. *Pesticides and Politics: The Life Cycle of a Public Issue.* Pittsburg, PA: University of Pittsburg Press, 1988.

BP Statistical Review of World Energy, June 2013. British Petroleum.

Bredimas, Alexandre and William J. Nuttall. "A Comparison of International Regulatory Organizations and Licensing Procedures for New Nuclear Power Plants." Judge Business School, University of Cambridge, EPRG Working Paper.

"Brokdorf Nuclear Power Plant." *E.On.* Last Updated August 2, 2012.

Butcher, Sandra Ionna. "The Origins of the Russell-Einstein Manifesto." *Pugwash History Series.* (2005): 1.

Cavasin, Nathalie. "Citizen Activism and the Nuclear Industry in Japan." *Local Environmental Movements: A Comparison of the US and Japan.* Eds Pradyumna P. Karan and Unryu Suganuma. Lexington, KY: The University Press of Kentucky, 2008.

"CDU Suffers Historic Loss in Baden-Wurttemberg." *The Local.* March 28, 2011,

Chan, Minnie. "Jiangmen Uranium Plant Scrapped After Thousands Take Part in Protests." *South China Morning Post.* July 14, 2013.

Chick, Martin. *Electricity and Energy Policy in Britain, France and the United States Since 1945.* Northampton, MA: Edward Elgar Publishing, 2009.

"Coal Explained: Imports and Exports." Energy Information Administration. Last Updated July 30, 2012.

"Countries' Regulatory Bodies Have Made Changes in Response to the Fukushima Daiichi Accident." United States Government Accountability Office. Report to the Chairman, Subcommittee on Transportation and Infrastructure, Committee on Environment and Public Works, U.S. Senate. March 2014.

"Country Profile: Japan." Energy Information Administration. Last Updated October 29, 2013.

"Cushing, OK WTI Spot Price FOB." US Energy Information Administration.

Davis, Lucas. "Prospects for Nuclear Power After Fukushima." Energy Institute at Haas, Working Paper Series. August, 2013.

-------. "Prospects for Nuclear Power." *Journal of Economic Perspectives,* 26:1 (2012).

Docket from NRC proceedings, Matter of Pilgrim Nuclear Power Station. Feb 9, 2011. Docket # 50-293-LR.

Docket from NRC proceedings, Matter of Southern Nuclear Operating Company Early Permit for Vogtle. March 20, 2008. Docket # 52-011-ESP.

"Dominion Shuts Down Kewaunee Power Station Permanently." Dominion Press Release. May 17, 2013.

Duffy, Robert J. *Nuclear Politics in America.* Lawrence, KS: University Press of Kansas, 1997.

"Emnid Survey: Majority for Further Use of Nuclear Power." German Atomic Forum. June 27, 2006.

"Energy Policies of IEA Countries, Germany: 2013." International Energy Agency. Released January, 2013.

"Energy Policies of IEA Countries, Japan: 2008." International Energy Agency. Released January, 2009.

"Energy Policy and Willingness to Pay: 2013." Befragmich. November 2013.

"Expected New Nuclear Power Plant Applications." United States Nuclear Regulatory Commission. Last Updated August 2013.

"Exports." Australian Coal Association. Last Updated February 2014.

"Exports of Goods and Services as a Percentage of GDP." The World Bank. Last Updated March 2014.

"Fact Sheet on Reactor License Renewal." United States Nuclear Regulatory Commission. Last Updated April 2013.

"FY2012: Energy Supply and Demand Report." Japanese Ministry of Economy, Trade and Industry. October 2, 2013.

"Gazprom Raises Gas Prices for Ukraine." *Al Jazeera.* April 1, 2014.

"German Nuclear Legislation." Nuclear Energy Agency. Last Updated September 2013.

"Germany Marches East, Russia Moves West: Energy Diplomacy." Natural Gas Europe. March 13, 2012.

"Global Trends in Renewable Energy Investment, 2013." Frankfurt School of Finance and Management, Working Paper Series.

Goodell, Jeff. "America's Nuclear Nightmare." *Rolling Stone Magazine.* April 27, 2011.

Gore, Al. *Our Choice.* NY: Bloomsbury, 2009.

Green, Harold P. "Public Participation in Nuclear Power Plant Licensing." *William and Mary Law Review*. 15:3 (1974).

Hasegawa, Koichi. "A Comparative Study of Social Movements of the Post-Nuclear Era in Japan and the United States." *International Journal of Japanese Sociology*. (1995).

Hatch, Michael T. *Politics and Nuclear Power: Energy Policy in Western Europe.* Lexington, KY: University Press of Kentucky: 1984.

"Henry Hub Natural Gas Spot Price." US Energy Information Administration. Last Updated March 26, 2014.

Hockenos, Paul. "Angst or Arithmetic?: Why Germans Are So Skeptical About Nuclear Energy." Heinrich Boll Stiftung, Series on Energy Transformation, 2012.

---------. "Red-Green Germany: Joschka Fischer on the hurly-burly of the Red-Green Years." German Council on Foreign Relations. October 2013.

---------. "German Export of Coal Power Way Up." German Council on Foreign Relations. August, 2013.

Iwata, Mari. "Japan Sees Key Role for Nuclear Power." *Wall Street Journal.* February 25, 2014.

Jahn, Detlaf. "Green Politics and Parties in Germany." *The Political Quarterly*. 68:B (1997), 174-182.

------."Nuclear Power, Energy Policy, and New Politics in Sweden and Germany." *Environmental Politics*, 1:3 (1992).

"Japan Halts Last Reactor at Ohi." *BBC News*. September 15, 2013.

"Japan is the Second Largest Net Importer of Fossil Fuels in the World." US Energy Information Administration. November 7, 2013.

"Japanese Imports." *Trading Economics.* March 2014.

Jasper, James M. *Nuclear Politics: Energy and the State in the United States, France and Sweden.* Princeton, NJ: Princeton University Press, 1990.

Joppke, Christian. *Mobilizing Against Nuclear Energy: A Comparison of the US and Germany*. Berkeley, CA: University of California Press, 1992.

Kaufmann, David and Veronica Penciakova. "Preventing Nuclear Meltdown: Assessing Regulatory Failure in Japan and the United States." Brookings Institute Brief. April 1, 2014.

Kim, E. Tammy. "Tokyo Governor's Race Puts Nuclear Power to Electoral Test." *Al Jazeera.* February 7, 2014.

Kingston, Jeff. *Contemporary Japan: History, Politics and Social Change Since the 1980s*. Malden: Wiley-Blackwell, 2013.

----------. "Nuclear Village." *The Asia-Pacific Journal.* December 2013.

Kitschelt, Herbert P. "Political Opportunity Structures and Political Protests: Anti-Nuclear Movements in Four Democracies." *British Journal of Political Science.* 16 (1986).

Kolb, Felix. *Protest and Opportunities: The Political Outcomes of Social Movements.* Berlin: Campus Verlag, 2007.

Koopmans, Ruud and Jan Willem Duyvendak, "The Political Construction of the Nuclear Energy Issue and its Impact on the Mobilization of Antinuclear Movements in Western Europe." *Social Problems*, 42:2 (1995).

Kotler, Mindy L. and Ian T. Hillman. "Japanese Nuclear Energy Policy and Public Opinion." The Institute for Public Policy at Rice University Japan Access Information Project (May 2000).

Krolicki, Kevin and Ross Kerber. "Special Report: Fuel Storage, Safety Issues Vexed Japan Plant." *Reuters*. March 22, 2011.

Kuroda, Yasumasa. "Protest Movements in Japan: A New Politics." *Asian Survey*, 12:1 (Nov 1972).

"Large Majorities in US and Five Largest European Countries Favor More Wind Farms and Subsidies for Biofuels, but Opinion is Split on Nuclear Power." *PRNewswire*. October 13, 2010.

"Legal System for Nuclear Safety Regulation in Japan." Japanese Ministry of Education, Culture, Sports, Science and Technology.

Lindberg, Leon. *The Energy Syndrome: Comparing National Responses to the Energy Crisis*. Ann Arbor, MI: Lexington Books, 1977.

Mahaffey, James. *Atomic Awakenings: A New Look at the History and Future of Nuclear Power*. NY: Pegasus, 2010.

Mansfield, Jerry. *The Nuclear Power Debate: A Guide to the Literature*. New York: Garland, 1984.

McKee, Lauren E. "German's Renewable Energiewende: Pioneering Path or Troubled Turn?" *Journal of Energy Security*. April 2013.

McQuaid, Kevin. "Worries Heard at Nuclear Relicensing Hearing." *Baltimore Sun*. July 10, 1998.

Morris, Craig. "Energy Transition—Nuclear Power, Very Unpopular." Renewables International. January 2013.

Nakata, Toshihiko. "Nuclear Energy Development in Japan." *Nuclear Energy Development in Asia: Problems and Prospects*. Ed Xu Yi-Chong. New York: Palgrave McMillan, 2011.

Nelkin, Dorothy and Michael Pollok. "Political Parties and the Nuclear Energy Debate in Germany and France," *Comparative Politics*. 12:2 (1980), 127-141.

---------. *The Atom Besieged: Exparliamentary Dissent in France and Germany*. Cambridge, MA: MIT Press, 1981.

Nicola, Stefan. "Merkel's Green Shift Backfires as German Pollution Jumps." *Businessweek*. July 29, 2013.

"Nuclear Power in Germany." World Nuclear Association. Last Updated March 2014.

"Nuclear Power in Japan." World Nuclear Association. Last Updated March 2014.

"Nuclear Power in Russia." World Nuclear Association. Last Updated March 2014.

"Nuclear Power in Ukraine." World Nuclear Association. Last Updated March 2014.

"Nuclear Power in the USA." World Nuclear Association. Last updated March 2014.

"Nuclear Reactors in Japan." Citizens' Nuclear Information Center. Last Updated December 2013.

"Obama Defends Nuclear Energy." *NBC News*. March 16, 2011.

"Opposition to Nuclear Energy Grows." Globescan. November 25, 2011.

Pegg, J.R. "Bush Calls for Development of More Nuclear Power." *Environmental News Service*. April 28, 2005.

"Plans for New Reactors Worldwide." World Nuclear Association. Last Updated March 2013.

"Poll: Germans Support Abandoning Nuclear Power." The Journal.IE. September 2012.
"Poll: Voters Push Union From Nuclear Course." *Der Spiegel.* March 23, 2011.
"Primary Electrical Energy Consumption by Source and Sector, 2011." US Energy Information Administration.
"Public Attitudes to Nuclear Power." Organization for Economic Cooperation and Development, Report, 2010, NEA no. 6859.
"Public Involvement in Japan's Nuclear Licensing System." Citizens' Nuclear Information Center.
Ramseyer, Mark J. "Why Power Companies Build Nuclear Reactors on Fault Lines: The Case of Japan." *Theoretical Inquiries in Law.* 13:2 (2012).
Rosa, Eugene A. "Public Acceptance of Nuclear Power: Déjà vu all Over Again?" *Physics and Society*, 30 (April) 2001.
Rucht, Dieter. "Campaigns, Skirmishes and Battles: Nuclear Movements in USA, France and West Germany" *Organization and Environment,* 4: 1990.
Sabey, Andrew. "Sacramento Shuts Out Rancho Seco." University of California Davis Law Brief. April 10, 2013.
Sagawa, Atsuo. "Outlook for International Coal Market, 2014." 414th Regular Report Presentation to the Fossil Fuels and Electric Power Industry Institute, December 20, 2013.
Sauga, Michael. "Comeback der Reaktoren: Aufbruch ins neue Atomzietaler." *Der Spiegel.* July 2008.
Schreurs, Miranda. *Environmental Politics in Japan, Germany and the United States.* Cambridge, UK: Cambridge University Press, 2003.
Shrader-Frechette, Kristin. *Nuclear Power and Public Policy: The Social and Ethical Problems of Fission Technology.* New York: Springer Publishing, 1980.
Smith, Jim and Nicholas A. Beresford. *Chernobyl: Catastrophe and Consequences.* Chichester: Springer Books, 2005.
Tabuchi, Hiriko. "Japan Sets Policy to Phase Out Nuclear Power Plants by 2040." *New York Times.* September 14, 2011.
"Ten Years Since the Criticality Accident at Tokai-mura: Fear Lingers." NHK Broadcasting Culture Research Institute, January 2010.
Thompson, Scott. "Rogers Woman Who Fought Black Fox Plant Left Lasting Legacy," *Oklahoma's Own,* April 28, 2011.
Toyoda, Masakuza. "Energy Security in North Asia," Report from The Institute of Energy Economics, Japan. March 2014.
"US Crude Oil and Natural Gas Proven Reserves." US Energy Information Administration. Last Updated August 1, 2013.
"US Natural Gas Imports by Country." US Energy Information Administration. Last Updated February 28, 2014.
"US Natural Gas Wellhead Price," US Energy Information Administration. Last Updated February 2014.
Vartabedian, Ralph and Ian Duncan "First New US Nuclear Reactors in Decades Approved." *Los Angeles Times.* February 9, 2012.
von Hippel, Frank. "It Could Happen Here Too." *New York Times.* March 23, 2011.
"What People Really Think About Nuclear Energy." For Atom Project. 2012.

"Widespread Public Distrust of NHK Over Fukushima Radiation Cover-Up." EnergyNews. March 2014.

World Values Survey 1981-2008, Official Aggregate v. 20090901, 2009. World Values Survey Association, Aggregate File Producer: ASEP/JDS, Madrid.

Xu, Yi-Chong. "Nuclear Energy in Asia: An Overview." *Nuclear Energy Development in Asia: Problems and Prospects.* Ed. Yi-Chong Xu. New York: Palgrave McMillan, 2011.

Yetiv, Steve and Lowell Field. "Why Energy Forecasting Goes Wildly Wrong." *Journal of Energy Security*. October 23, 2013.

Yoshida, Takafumi. "Interview with Yasuhiro Nakasone: Learn Lessons From Fukushima and Continue to Promote Nuclear Energy." *Asahi Shimbun.* May 23, 2011.

Yuto, Kawata, Robert Pekkanen and Tsujinaka Yutaka. "Civil Society and the Triple Disasters: Revealed Strengths and Weaknesses." *Natural Disaster and Nuclear Crisis in Japan.* Ed. Jeff Kingston. New York: Routledge, 2012.

VITA

Lauren McKee
7045 Batten Arts and Letters
Hampton Blvd.
Old Dominion University
Norfolk, VA 23529

Lauren is originally from a small town in south Mississippi. She received Bachelor's and Master's degrees in English from the University of Southern Mississippi before teaching composition and literature at the University of New Orleans. Lauren has also taught Japanese literature and political science courses at Doshisha University in Kyoto, Japan. Her work was appeared in the *Journal of Energy Security* and the *Journal of International Women's Studies.* In the fall of 2014, she will join the faculty of Berea College in Berea, KY, as the ASIANetwork-Henry Luce Foundation Postdoctoral Teaching Fellow in Asian Politics.

EDUCATION

Ph.D.	International Studies, Old Dominion University, Norfolk, VA 2014
M.A.	English, University of Southern Mississippi, Hattiesburg, MS 2007 *Concentration:* Asian Literature
B.A.	English, University of Southern Mississippi, Hattiesburg, MS 2004