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The German Gamble: An Analysis of the Energiewende Policy and its Implications for Energy Security in Europe

Rachel Elizabeth Millsap
Missouri State University, Rachel16@live.missouristate.edu

THE GERMAN GAMBLE: AN ANALYSIS OF THE ENERGIEWENDE POLICY AND ITS IMPLICATIONS FOR ENERGY SECURITY IN EUROPE

A Masters Thesis

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In Partial Fulfillment

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Master of Science, Defense and Strategic Studies

By

Rachel Elizabeth Millsap

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ABSTRACT

This thesis examines energy security in Europe, through a focused case study of the German energy policy known as Energiewende, or “energy transition.” The subject of energy policy and security in Europe has moved to the forefront of debate in recent years. Germany in particular has embraced a radical energy policy that aspires toward a low carbon, fully energy independent industrial economy by 2050. From an analysis of Germany’s Energiewende, this thesis seeks to extrapolate insights that can be applied to the debate of European energy dependency, environmental impacts, and their economic considerations. Understanding the implications of Germany’s energy policy, both economically and defensively, will enable EU member states to consider their own domestic energy policies as well as EU-wide climate and energy initiatives. This thesis concludes with an analysis of the impacts Germany’s energy policy is likely to yield upon fellow EU member states, as well as the future of energy security in Europe.

KEYWORDS: Energiewende, European Union, Russian Federation, energy policy, energy security, renewable energy sources, hydrocarbons, decarbonization

This abstract is approved as to form and content

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John P. Rose, PhD
Chairperson, Advisory Committee
Missouri State University

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Approved:

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John P. Rose, PhD

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Ilan Berman, J.D.

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Keith B. Payne, PhD

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Julie Masterson, PhD: Dean, Graduate College

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INTRODUCTION

The defining dilemma of the latter half of the twenty-first century will be centered on energy. Transitioning away from the world's overwhelming dependence on fossil fuels too quickly could prove economically and geopolitically disastrous. Making the transition too slowly, conversely, could be equally problematic for the future. The precipice of a new era of energy sourcing, security, and policy is slowly beginning to unfold. Nations across North America, Europe, and Asia are beginning to seek and consider alternative energy sources, as an energy dilemma appears imminent. As the world begins to confront this energy dilemma, tensions will develop, revealing a complex and often contradictory nature of energy and security. These tensions include: market-led versus policy-led initiatives, carbon-based fuels versus renewable energy sources, and foreign reliance versus energy independence. Today, some countries have started to confront these tensions, as the looming energy dilemma has already begun to emerge. Across the world, nations are beginning to seek alternative sources of energy in the form of renewables. The world's total electricity production from renewable energy sources has been on a steady rise since 1990.[1] As of 2015, the total global production of electricity via renewable energy sources peaked at 1.43 trillion kilowatt hours.[2] Yet despite notable strides in global electricity production via renewable energy sources, reliance on carbon-based fuels continues to grow. While the Renewables 2016 Global

[1] "Electricity Production From Renewable Sources, Excluding Hydroelectric (kWh)," *The World Bank*, December 8, 2017, https://data.worldbank.org/indicator/EG.ELC.RNWX.KH.
[2] Ibid.

Status Report revealed record breaking levels of renewable energy production, the BP 2016 Statistical Review revealed new global heights for fossil fuel consumption.[3] This seeming contradiction between a growth in renewable energy sources and a continued rise in hydrocarbons is where the world finds itself today, as countries continue to navigate global energy markets still favoring carbon-based fuels, while crafting domestic energy policies with sights set on a new era of renewable energy dependence.

As nations begin to confront this new era of energy policy and security, so too will defense and foreign policies undergo rapid transformations. Current dependence on carbon-based fuels is not only a climate consideration, but a geopolitical one as well. Nations with limited domestic energy infrastructure and a vast reliance on foreign imports will likely remain geopolitically disadvantaged. Thus, transformations in energy sources, policies, and providers will undoubtedly alter the international landscape. Nowhere is this a more relevant case study than in Europe today. Despite recent policy shifts, much of the EU remains dependent on foreign imports for a vast percentage of its energy needs, with no foreseeable long-term solution for much of the region. Bulgaria, Estonia, Finland, and Latvia import 100 percent of all natural gas from Russia.[4] Other European countries, such as Lithuania, Romania, Slovakia, and the Czech Republic, import between 65 to 97 percent of all natural gas from Gazprom, and other Russian gas companies.[5] Such lofty reliance upon Russia for natural gas severely restricts many

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[3] Robert Rapier, "World Sets Record For Fossil Fuel Consumption," *Forbes,* June 8, 2016, https://www.forbes.com/sites/rrapier/2016/06/08/world-sets-record-for-fossil-fuel-consumption/#d3db608365f7.

[4] David Yanofsky, "The EU Countries That Depend the Most on Gazprom's Russian Gas," *Quartz*, April 22, 2015, https://qz.com/388148/the-eu-countries-that-depend-the-most-on-gazproms-russian-gas/.

[5] Ibid.

Central and Eastern European nations from a range of economic, foreign, and defense policies vis-à-vis the Russian Federation. Thus, the impending global energy problem will encompass nearly every aspect of policy to include economic, foreign and defense considerations as well.

Confronting an energy dilemma is not a new problem for Europe. The continent as a whole has been facing an energy crisis for decades. A combination of a reliance on foreign imports, the decline in nuclear energy post-Fukushima, and the growing discontent with carbon-based fuels and climate change has left the region grasping for solutions. Beginning in 2010, the EU sought to transition into a new era of prosperity and forward-thinking with a policy known as Europe 2020. Chief among the cited goals was a sustainable shift away from hydrocarbons in light of climate change considerations.[6] The Europe 2020 vision was predicated on the Union's economic crisis in 2009. Although the large aims of Europe 2020 were economically centered, the policy outlined a detailed energy policy and target goals. The policy called for a 30 percent emissions reduction by 2020, as well as a shift away from carbon-based fuels to an increase in renewable energy sources.[7] Additionally, the Europe 2020 plan envisioned a modernization of transportation sectors and increased energy efficiency across the Union.[8] Thus, since 2010, EU nations individually, and the Union as a whole, has sought a new answer to its energy crisis. However, as the EU sought to unveil a new era of economic and energy

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[6] European Commission, *Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth*, (Brussels, 2010), 6, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF.
[7] Ibid.
[8] Ibid.

policy, Germany unveiled its own energy policy designed to take the most dramatic steps forward into the future.

In 2010, as the EU revealed the Europe 2020 policy, the German government passed its own energy reform legislation. The policy was called "Energiewende," and has become the German answer to energy innovation, transition, and energy independence. Energiewende, translated literally to "energy transition," seeks to, foremost, make Germany clean energy independent. Thus, Energiewende is Germany's answer to three separate issues: climate change, lack of sufficient diversification of energy sources, and current reliance on foreign exporters for hydrocarbons including oil and natural gas. Climate change and energy diversification, however, remain the primary stated motivating concerns behind the policy. Germany's Energiewende is part of the larger European trend and concern with "decarbonization" of energy sources – moving away from carbon-based, CO2 emitting sources such as oil, coal, and natural gas, and moving to renewable energy sources – as presented in the Europe 2020 strategy. However, whereas the EU envisioned a slower transition, Energiewende seeks to propel German reliance on renewables by as much as 45 percent in 2020. Additionally, the policy calls for a 40 percent cut in greenhouse gas emissions by 2020, and an 85-90 percent cut by 2050.[9] Even more ambitious is the policy's target for energy saving. Energiewende outlines a goal for primary energy consumption in Germany to fall 20 percent below the country's 2008 levels by 2020, and 50 percent below by 2050.[10]

[9] By comparison, the EU-agreed goal was a 20% reduction by 2020. The member states have not agreed on a later target for 2050.
[10] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 7, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.

In addition to a move away from fossil fuels, Energiewende also outlines the total abandonment of nuclear energy in Germany by 2020. Although this decision fits alongside the post-Fukushima, anti-nuclear sentiment following the 2011 disaster, this additional goal only adds to the policy's difficulties. Despite the phase out, nuclear power still remains one of Germany's key energy sources. In 2016, nuclear power accounted for 13 percent of the country's total electricity generation.[11] Further complicating the policy's target goals is Germany's position as a major industrial economy. Many of Germany's energy intensive industries have expressed concern that the march towards renewables and retreat from nuclear power will drive up energy costs. This increase in cost, alongside the potential for increased instability in electricity supply, could weaken their global competitiveness.[12] Cost concerns of the increased reliance on renewable energy and simultaneous retreat from nuclear power are not limited to industry. Since the launch of Energiewende in 2010, the average household cost of electricity has risen nearly 50 percent.[13] In 2013, *Der Spiegel* reported that over 300,000 German households a year see their power turned off due to unpaid energy bills.[14] The term "energy poverty" has since become a mainstream and widespread criticism of the effects Energiewende has on the German population, as prices per kilowatt hour continue to rise.

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[11] Jeffrey Ball, "Germany's High Priced Energy Revolution," *Forbes*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.

[12] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 7, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.

[13] Jeffrey Ball, "Germany's High Priced Energy Revolution," *Forbes*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.

[14] "How Electricity Became a Luxury Good," *Der Spiegel*, September 4, 2013, http://www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288.html.

Germany also faces potential challenges due to the nature of the timeline of the policy. Such a rapid energy transformation – if successful – could have immense first mover advantages. Such advantages could make Germany the leading nation in renewable technology and energy policy, holding a sizeable share of the global market. However, Germany currently runs the risk of locking itself prematurely into renewable energy sources before global oil and gas markets have sunk costs. Energiewende also risks a marriage to renewables before research and development, as well as renewable technology, has resolved numerous key challenges. Such challenges include electric grid complications and the notorious problem of storage. Indeed, Germany is facing the prospect of an overhaul to its current electric grid system, as well as drastic infrastructure development, in order to make way for Energiewende and its target reliance on renewables. When taken together, these factors must be examined for their vast potential strategic implications for Germany.

Although climate change remains the stated primary reason behind Energiewende, the policy will undoubtedly alter Germany's foreign policy, as well as numerous economic and geopolitical considerations. If the energy transformation is a success, Germany will be less reliant on foreign exporters, most notably Russia. If the policy fails to meet either its 2020, 2030, and 2050 targets, however, Germany will be more reliable on foreign imports to meet its energy needs. A continued reliance on Russian oil and gas in the wake of an Energiewende failure faces the possibility of further dividing the European Union. Many Central and Eastern European member states have sought energy source alternatives to oil and gas, such as nuclear and coal, in order to rely less upon Moscow. Indeed, in a twist of irony, should the energy transformation fail, Germany will also become more reliable on French and Czech nuclear power, without any domestic nuclear energy capability of its own. Such increased reliance on its numerous European neighbors is likely to considerably alter Germany's position as a pillar of the EU, which could, in turn, affect EU cohesion regarding energy policy going forward. Economic considerations are also worth noting, as an Energiewende failure would be catastrophic for the German economy, and its immense investments in renewable technology.

While much acclaim has been granted to Germany's Energiewende policy and its potential for success, little attention has been dedicated to the prospect of its failure. If it is true that such a drastic policy as Energiewende will alter nearly every consideration of the German government, as has been suggested by many German government officials, the potential for its failure must be considered.[15] Defining failure, in case of Germany's Energiewende, is simple: if the policy fails to meet its stated target goals in both the short and long term, the potential for successfully altering climate change and rendering Germany clean energy independent will remain illusory. The short-term, intermediate, and long-term goals explicitly outlined in the Energiewende policy have been deemed the necessary steps Germany must make in order to meet the overarching aim of the energy transformation. If these goals are not met, the policy will have failed. This is not to suggest that the policy cannot succeed in various unforeseen ways. However, if Germany fails to meet the policy's stated target goals, Energiewende can be deemed a policy failure.

[15] Melissa Eddy, "German Energy Official Sounds a Warning," *The New York Times*, January 21, 2014, https://www.nytimes.com/2014/01/22/business/energy-environment/german-energy-official-sounds-a-warning.html.

Presently, current trend levels suggest that Germany will not meet two of its three stated policy target goals for 2020. Current energy consumption levels, although reduced overall, are not in step with the necessary decrease Energiewende stipulates by 2020. Additionally, contrary to the policy's central objective to become more reliant on renewable energy sources such as wind and hydroelectric power, Germany's coal dependence has continued to hover around 40 percent of the country's energy generation since the unveiling of Energiewende in 2010.[16] Such a large continued dependence on coal will only add to the difficultly in meeting the emission reduction target goal by 2020. Indeed, the desire to reduce greenhouse gas emissions and total energy consumption, in order to positively impact the environment and issue of climate change, has been the one of the central-most pillars and overarching goals of Energiewende. If Germany proves it is unable to reduce greenhouse gas emissions and energy consumption, it is unlikely Energiewende can contribute positively to overall climate change.

By setting its sights on a rapid transformation of energy sourcing and consumption, Germany is once more striving for innovative global leadership. Energiewende seeks not only to propel Germany's energy policy and security into the future, but also strives to be a model worthy of emulation across the EU. As the EU's pioneering member state, Germany's energy transition success or failure will likely be seen as a microcosm of the issues its fellow member states will face in the future. As such, the success or failure of Energiewende, and its ability to affordably and positively

[16] Jack Loughran, "Germany's Reliance on Coal Continues Despite Renewables Push," *Engineering and Technology*, April 10, 2017, https://eandt.theiet.org/content/articles/2017/08/germany-s-reliance-on-coal-continues-despite-huge-push-towards-renewable-energy/.

impact climate change, and become energy independent, is likely to have widespread effects across the EU into the future.

Germany is not the first EU nation to confront energy security issues. European Union member nations in both Western and Central Eastern Europe have sought strategies in recent years to distance themselves from energy dependency on Moscow, and what has been described as Russia's "pipeline power."[17] The Russian Federation has become notorious for utilizing its status as a dominant global energy exporter for coercive geopolitical purposes.[18] Apart from climate concerns, the fear of continued Russian influence in Europe through the energy sector has led many EU nations to revise their energy policies. These new energy policies include bypassing Russian oil and natural gas, opting instead for renewed dependency on coal, nuclear power, or renewable energy sources. Germany's Energiewende, therefore is not the first energy policy to take on climate and geopolitical concerns. Where Energiewende remains a pioneering policy, however, is in its forward-thinking, radical approach. Accordingly, the success or failure of Energiewende is likely to impact EU energy security and policy approaches in a variety of ways.

First, if Energiewende fails to reach its target goals in conjunction with its denuclearization policy, many EU member states on similar denuclearization paths may reconsider such an approach. This, in an ironic turn, would make the EU member states that previously vowed to halt all nuclear energy production more dependent upon

[17] Edoardo Saravalle, "Russia's Pipeline Power," Politico, June 20, 2017, https://www.politico.eu/article/opinion-russias-pipeline-power/.
[18] For example, the cut-off of natural gas supplies to Ukraine during the winter months of 2008, as well as 2015.

neighboring member states with continued civil nuclear programs. Second, Germany's continued reliance upon coal, which is likely to prevent success in its emissions reduction target goal, could signal trouble ahead for EU climate policy cohesion. Decarbonization goals have remained a pillar of EU energy policy since the early 2000s. If Germany proves it is unable to reach its emissions reduction target goals, in either the short-term or long-term, some EU member states may become less enthusiastic about Europe's decarbonization project. Such a debate would undoubtedly lead to a contentious period for the EU, risking Union cohesion surrounding energy policy. Lastly, Energiewende's success or failure in lessening Germany's dependence on Moscow could be decisive for the Union. If Energiewende does not enable Germany to become energy independent, many EU nations that have sought policies to reduce Russian dependency will be left with the challenge of either reevaluating such policies, or being left to fend for themselves in a hegemonic energy market dominated by the Russian Federation, aided by Germany. The ability of Germany's Energiewende to reach its target goals, therefore, will have vast consequences upon the EU and the Union's attitude toward energy policy as well as the future of energy security throughout Europe.

In addition to successfully reaching target goals, Germany must also demonstrate the affordability of its energy transition, in order to compel its fellow EU member states to follow its model, in order for the energy policy to be deemed a long-term success. Thus far, much of the evidence suggests Germany has not proven its energy transformation to be an affordable policy option. Accordingly, Energiewende is likely to not only fail to reduce greenhouse gas emissions and energy consumption, but also fail to provide an energy policy model for its fellow EU member states. Such a failure would risk not only immense domestic consequences for Germany, but international ones as well. This thesis, therefore, will argue the following:

1. As current data suggests, Germany will likely not meet its two of its three stated target goals outlined in the Energiewende policy. These include the 20% reduction in energy consumption by 2020, as well as the ambition to reduce greenhouse gas emissions by 40% by 2020.
2. Such short-term target goal failures, combined with the rising renewable energy and subsidy costs, and necessary future infrastructure development, are likely to lead to a loss of popular domestic support for the energy transition policy going forward. This will make both the intermediate and long-term goals of the policy increasingly difficult to meet.
3. Energiewende will therefore, in time, likely prove to be a policy failure, with far-reaching, negative implications on Germany's economy and electric grid system, as well as EU geopolitical realities, energy security, and cohesion as a whole.

In sum, if the current state of Germany's energy transformation is any indication, Energiewende will likely fail in its overall stated goals for the short-term, including the 2020 target goals. Such short-term target goal failures will increase the likelihood of intermediate and long-term target goal failures as well. Additionally, short-term, intermediate, and long-term target goal Energiewende failures are likely to affect EU attitudes regarding energy policy, as its member states continue to face widespread and unique challenges. This, in turn, could lead to increased challenges regarding EU cohesion going forward, as well as EU policy and energy security. Thus, if the energy transition policy fails, both Germany and the EU are likely to be impacted. Therefore, while the EU looks to Germany to forge the path of clean energy independence, it may instead witness a cautionary tale of placing policy initiatives before market realities, with severe short and long-term implications for the Union's energy security.[19]

This thesis will make use of several key terms and theories. Accordingly, definitions of such terms are as follows:

Central Eastern Europe (CEE) refers to a group of countries comprised of Albania, Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, and Slovakia.

Energiewende translated literally in English is "energy transition," although the term is widely used in English language publications without translation. Energiewende refers to the German policy of energy transformation passed into legislation in December 2010. It is the current energy policy of the German government today, with target goals set for 2020, 2022, 2025, 2030, and 2050. The overall aim of the policy seeks to eliminate carbon-based fuels as well as nuclear energy over a relatively short time, in favor of renewable energy sources. The policy stipulates three distinct ambitions: a reduction in greenhouse gas emissions, an increase in reliance on renewable energy sources, and a decrease in energy consumption levels.

Energy security can be defined as the uninterrupted availability of energy sources at an affordable price. However, energy security has many aspects including short-term

[19] This thesis will look at long-term trends and data beginning in 1989 to the present day. The year 1989 was chosen as a start date for long-term trends due to the fall of the Soviet Union and the immense trends Europe underwent as a result. Accordingly, all energy data pertaining to Europe, and particularly Central Eastern Europe, begins modernly in 1989.

and long-term security concerns. This thesis will discuss both short-term energy security concerns, such as supply-demand balance and connectivity concerns, as well as long-term energy security considerations including energy independence, and the connection between energy security, defense, and foreign policy.

European Union, or EU is a political and economic union consisting of 28 countries: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.[20] While this thesis will discuss the different problems facing Western and Central Eastern Europe, all broad and unspecified analysis of "European" energy policy and security is confined to EU countries.

First mover theory postulates that a competitive advantage is gained by a business that is able to be the first to bring a specific product or service to market. For the purposes of this thesis, first mover advantages and disadvantages will be analyzed in accordance with Germany being the first mover as a major industrialized nation to pursue an energy policy based largely upon renewables.

Hydrocarbon fuels are fuels that contain only carbon and hydrogen, often occurring in petroleum, natural gas, and coal. The European trend of "decarbonization" refers to a shift away from dependence upon hydrocarbon fuels in favor of renewable energy sources.

[20] On May 29, 2019, the United Kingdom will officially leave the Union, following the membership referendum that occurred in the UK on June 23, 2016.

Liquefied natural gas (LNG) refers to a primarily methane and ethane gas obtained from underground and undersea in porous sedimentary rocks. The process of liquefaction involves cooling the natural gas to a liquid state in order to ease transportation and shipping over long distances whereby pipeline transportation is not feasible. Natural gas transportation through pipelines has been of particular concern in Europe in recent years, following the Russia-Ukraine and Russia-Belarus gas disputes.

Renewable energy sources (RES) refers to regenerative energy sources to include biomass, hydropower, geothermal, wind, and solar energy. However, the vast percentage of the renewable energy market today focuses largely on hydropower, wind, and solar energy.

Shale gas refers to a natural gas extracted from shale rock using fracking, or hydraulic fracturing of the rock. It is comprised primarily of methane. The European Commission has estimated that nearly 16 trillion cubic meters of shale gas is theoretically recoverable in the EU today.

Smart grid refers to a class of technology used to bring electricity delivery systems into the 21st century, using computer-based remote control and automation. This advanced technology includes advanced sensors that allow operators to assess grid stability that give consumers better information and automatically report outages. In addition, batteries are used to store excess energy and make it available later to the grid in order to meet customer demand.[21]

[21] U.S. Department of Energy Office of Electricity Delivery & Energy Reliability, *Grid Modernization and the Smart Grid*, (Washington D.C. 2017), https://energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid.

Transmission system operators (TSOs) are responsible for providing and operating high voltage networks for long-distance transmission of electricity as well as for supply of lower-level regional distribution systems. TSOs are natural monopolies. This means that high infrastructure costs give the largest supplier in the industry, often the premier supplier in the market, an immense advantage over potential competitors.[22]

Western Europe refers to a group of countries comprised of Belgium, France, Germany, Ireland, Luxembourg, Monaco, the Netherlands, Portugal, Spain, and the United Kingdom. The author has adapted the CIA definition of Western Europe to include Germany, based on both geographic and economic considerations, for the purposes of this thesis.

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[22] Jeffrey M. Perloff, *Microeconomics*, (England: Pearson Education, 2012), 394.

CHAPTER ONE

ENERGY IN EUROPE TODAY: A BRIEF OVERVIEW

Energy has undergone immense changes in the preceding three decades. In 1989, energy infrastructures served one billion customers, fifty percent of oil supply was in the hands of nation-states, and the Washington Consensus had just demonstrated the clear winner in the world to be Western-style democracy. By contrast, 2018 has seen the expansion of energy infrastructure to an additional three billion customers, ninety-seven percent of the world's oil reserves are owned by nation-states, and the Washington Consensus has been replaced by the Moscow/Beijing Consensus, revealing the post-Cold War revival of autocratic and communist states. The growth of coal has slowed, as the world has witnessed the rise of liquefied natural gas (LNG), as well as the shale gas boom. The 2011 Fukushima disaster has seen some countries move away from nuclear energy, while others continue to embrace a domestic nuclear energy capability. Markets are beginning to behold the highest price volatility of oil since the global financial crisis.[23] Clean energy and the rapid growth of renewable technology has come to the forefront in response to climate change considerations.

Yet amid these transitions, problems such as energy dependence, and diversification of sources abound. Countries continue to rely on unpredictable nation-state suppliers, and traditional, carbon-based sources. Now, more than ever, energy security and policy is becoming a strategic consideration. Today, two regions in the

[23] U.S. Energy Information Administration, *Short-Term Outlook: Crude Oil* (Washington, D.C. 2018), https://www.eia.gov/outlooks/steo/marketreview/crude.php.

world face long-term energy supply dependency via imports: Europe and Far East Asia.[24] Although both regions face a daunting task regarding energy policy and foreign dependency, the problems facing Europe, and particularly the EU, have become of particular importance.

The Evolution of EU Energy Policy

Beginning in the late 1990s, energy policy in the European Union became largely centralized in and guided by the European Commission. The Commission has historically revolved energy policy around two key pillars: liberalization of European gas and electricity markets, and climate change and environmental-related issues. Taken together, these two pillars constitute the state of EU energy policy today. Accordingly, the Commission has introduced key legislative packages and mandates regarding these two pillars. Legislation regarding the liberalization of markets was introduced in the form of three legislative packages. The most recent of these, known as the Third Energy Package, entered into force in 2009.

The Energy Third Package outlined five main goals in accordance with the internal energy market and associated structural problems such as grid and pipeline connectivity. Chief among the Package's goals was the "unbundling"[25] of energy supply from the operation of transmission networks, as well as increased transparency in retail

[24] For the purposes of this thesis, only European supply dependency will be considered.
[25] Unbundling refers to the process of "separating energy supply and generation from the operation of transmission networks." This is done to ensure fair competition in markets, by preventing a single company from operating a transmission network, while generating or selling energy at the same time.

markets for the benefit of its customers.[26] Other aims of the Third Energy Package included strengthening the independence of regulators, cross-border cooperation between transmission system operators, and the creation of the Agency for the Cooperation of Energy Regulators (ACER).[27] The Third Package in particular was a response by the Commission to the continued market concentration across the EU, whereby a small number of corporations control vast amounts of the market. This has severely limited cross border trade in Europe, thereby limiting diversification of energy sources and suppliers.

Altogether, all three legislative packages aimed to unbundle the European energy market in order to foster competition, while seeking to insure increased price transparency. Furthermore, by fostering cross border cooperation between EU member states, the Commission sought to bring together what had become "a patchwork of nationally developed electricity and gas markets."[28] The legislative packages introduced to liberalize energy markets across the EU have not yet proven successful across the entirety of the Union. Significant strides have been made across Western Europe since the unveiling of the Third Energy Package, although Central and Eastern Europe continue to face problems with infrastructure connectivity and market diversification.

The second pillar of EU energy policy has centered on environmental and climate-related concerns. The Commission has launched a multitude of climate centered energy policies and initiatives. Following the Kyoto Protocol initially signed into force in

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[26] European Commission, *Market Legislation* (Brussels, 2013), https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation.
[27] Ibid.
[28] Tim Boersma, "Europe's Energy Dilemma," *Brookings*, June 18, 2014, https://www.brookings.edu/articles/europes-energy-dilemma/.

1997, the EU sought to develop and adopt more comprehensive measures in the so-called "fight against climate change."[29] Beginning in 2007, the Commission proposed new target goals for 2020, 2030, and 2050. The targets for 2020 became known as the "20-20-20 Directive" and outlined three key aims: 20% cut in greenhouse gas emissions, 20% of EU energy from renewables, and 20% improvement in energy efficiency.[30] The Directive was enacted in 2009, in accordance with the Europe 2020 strategy, which sought to expand economic growth in the EU, in part by emphasizing sustainable energy alongside increased research and development.[31]

In 2014, the Commission adopted a 2030 climate and energy framework that built upon the 2020 targets and policy. The new key targets for 2030 included: at least 40% cuts in greenhouse gas emissions, at least 27% share for renewable energy, and at least 27% improvement in energy efficiency.[32] Although the EU as a whole has not yet adopted an agreed-upon energy directive or policy for its 2050 goals, the Commission released a study in 2011 called the Energy Roadmap 2050. The study outlined various milestones that would seek to make the EU a low-carbon economy by 2050. The

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[29] Margot Wallstrom, "On the Road to Copenhagen," (presentation, *Political Implications of Climate Change*, Copenhagen, Denmark, March 8, 2008).
[30] European Commission, *2020 Climate & Energy Package*, (Brussels, 2009), https://ec.europa.eu/clima/policies/strategies/2020_en.
[31] European Commission, *Europe 2020 Strategy: Targets*, (Brussels, 2009), https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en.
[32] European Commission, *2030 Climate & Energy Framework*, (Brussels, 2014), https://ec.europa.eu/clima/policies/strategies/2030_en.

roadmap suggested that by 2050, the EU needs to have cut its greenhouse gas emissions by 80%, alongside strong investments in smart grids.[33]

In addition to outlining the necessary progressive emissions reduction and investment commitments, the 2050 Roadmap also analyzed “decarbonization scenarios” if the 2050 aims were met. These scenarios included high energy efficiency with political commitments to large energy savings, a diversified supply of technologies whereby no one technology is preferred, and strong support for RES, and low nuclear reliance to include no new nuclear plants.[34] Absent from the Roadmap was analysis of international concerns or considerations regarding Europe’s current key suppliers, most notably Russia. Although the study did assert that the 2050 aims would leave the EU fully diversified, absent biomass. When analyzing potential biomass exporters in the long-term future, the roadmap labeled the Russian Federation as the foremost potential supplier.[35] Thus, even as the EU seeks to outline a future of energy independence, the Russian Federation still occupies a supplier role in the proposed Roadmap.

Energy Policy and Security Problems in the EU

One of the key problems facing Europe today is the so far incomplete integration of all EU member states. Since the turn of the millennium, the EU has expanded its membership in three separate rounds of enlargement to include Central and Eastern

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[33] European Commission, *Energy Roadmap 2050*, (Brussels, December 2011), 11, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0885&from=EN.
[34] Ibid.
[35] Ibid.

European states.[36] This incomplete integration of CEE nation-states involves a variety of sectors, including telecommunication, transportation, and energy.[37] Currently, many Central and Eastern European states are burdened with insufficient infrastructure to accommodate integration with the rest of Western Europe. This was an intentional policy of Moscow to keep former bloc states highly dependent upon the Soviet Union.[38] The detrimental consequences of insufficient intraregional infrastructure today are most apparent in the energy sector. Furthermore, countries outside of the EU – such as Moldova and Ukraine – are particularly at risk from an increasingly regionally-aggressive Russia. Such risk is a consequence of both insufficient infrastructural connectivity to the rest of Europe, and current dependency upon Moscow for oil and natural gas.[39]

Europe's energy problem is also a strategic problem. Diversification of sources, what many of the Commission policies sought to address, has severely limited the ability of many EU states to decrease reliance on foreign imports. In Europe today, the Russian Federation continues to dominate regional oil and gas imports. Before the legislative efforts were undertaken to liberalize EU gas and electricity markets, most EU member states had only one utility company controlling the supply network and either producing or importing gas on the basis of "an exclusive supply contract."[40] Russia's gas giant, Gazprom, dominated supply to the CEE region, ensuring a monopoly through supply

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[36] The three rounds of EU enlargement featuring CEE states occurred in 2004, 2007, and 2013 with the most recent addition of Croatia.
[37] "Completing Europe: From the North-South Corridor to Energy, Transportation, and Telecommunications Union," *Atlantic Council* (November 2014): 1.
[38] Ibid.
[39] Ibid.
[40] Alan Riley, "Shale Gas – Central Europe's Most Vital Energy Resource," *Center for European Policy Analysis*, March 1, 2012, http://cepa.org/index/?id=fef873297a8a4a4bc01ca5f2df08eeba.

contracts with individual nations. In effect, Russia was able to enjoy ensured demand with no market competition, while rendering former bloc states once more entirely dependent upon Moscow for their gas supplies. To illustrate the regional monopoly Gazprom has thus far enjoyed throughout Europe, the 140 billion cubic meters of gas Gazprom exports to Europe accounts for only one-third of its total production, but two-thirds of its revenue.[41] In 2006, the Swedish Defense Research Agency conducted a study which revealed that between 1991 and 2004, there had been over 40 "politically motivated energy cut-offs across the former Warsaw Pact and Baltic States."[42] The vast majority of such cut-offs had been of gas supplies.

Today, the energy security environment remains largely unchanged for most Central and Eastern European states. Although the Commission's unbundling legislation has proven to be a success for many Western European states, the CEE region is still largely dependent upon Russia and Gazprom for its supply of gas without the benefit of liberalized regional markets. The CEE region's last defense mechanism to bulwark against Gazprom's regional monopoly was the role of transit countries from the gas flowing from Russia to Western Europe, most notably Germany. However, the completion of the Nord Stream pipeline and plans for Nord Stream 2 substantially thwarted such a defense, as both lines circumvent the entire CEE region. Some CEE countries, such as Poland, have been able to safeguard against Russian energy control, by utilizing coal rather than gas to meet the nation's energy needs.[43] However, the growing decarbonization trend across Europe has rejected coal and favored gas as a relatively

[41] Ibid.
[42] Ibid.
[43] Ibid.

CO_2-light option. In turn, the decarbonization trend gripping Western Europe has proven particularly difficult for CEE regions to comply with environmental energy policies, while simultaneously seeking to decrease dependency on Russia gas.

The "Big Green Bang" and Energy Diversification in Europe

In many respects, the recent push for more energy has been eclipsed by a newer demand for clean energy. Colloquially, this has come to be known as the "Big Green Bang." Currently, Western European states are far better positioned to reject carbon-based fuels than their CEE neighbors. This is due to both the widespread policy success of liberalizing predominately Western European energy markets, and a decreased reliance on Russian gas that has thus far been unobtainable to CEE states. However, decarbonization trends are evident throughout the EU, and have been seen as the foremost means to diversify energy sources and suppliers. The European turn to renewable energy sources (RES) began largely in 2009, as the EU first outlined target objectives for 2020, including a 20% dependency on renewable energy by 2020. Before the EU commitment to investing in RES technology and research and development, however, it was not at all clear that renewables would win the day in Europe.

Once the impending energy crisis was understood, the EU was forced to consider a variety of possibilities for change. Such possibilities included a decrease in energy consumption, developing robust partnerships with a variety of suppliers, diversification of sources and supply routes, and the replacement of old fuels with new sources. Although numerous EU energy policies have stipulated a decrease in carbon-emitting source consumption, cutting energy consumption altogether has not been popular across the continent. Indeed, many scholars today assert that the notable decrease in energy consumption in Germany has been done out of necessity, due to the increasing cost of energy within the country.[44] Although Western Europe has been somewhat successful in developing partnerships with a variety of energy suppliers, Central and Eastern European nations still remain predominately dependent on Russia. Therefore, the greatest EU success thus far has been the replacement of old fuel sources with new, technologically advanced sources. Such sources have included renewables, natural gas, and nuclear energy.

The diversification of energy sources has been a dominating trend in Europe for the past fifteen years. Both Western and CEE states across the continent have striven to diversify energy portfolios to include a variety of source dependencies, even when energy suppliers remain unchanged.[45] Renewable energy has allowed for new, innovative sources to win the day in Europe's quest for a solution, but has thus far been a luxury for the wealthiest of EU countries.[46] The shale gas boom offered some hope to countries in the CEE region, as the potential for disruption and competition could have led to an opening in European gas markets, threatening Russia's position as holding the regional monopoly. However, these hopes were diminished some, as countries across Europe began to protest the practices associated with shale gas, most notably hydraulic fracking. Since the shale gas boom, and following some European hopes that the resource would soon flood EU markets as a viable alternative to conventional gas, countries across the

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[44] "How Electricity Became a Luxury Good," *Der Spiegel*, September 4, 2013, http://www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288.html.
[45] As is largely the case today in Central Eastern European states.
[46] Most notably Germany, which bolsters the world's fourth largest economy today.

EU began banning its exploration and extraction. Two EU countries in particular have seen a dramatic public outcry, denouncing the practices: France and Bulgaria.[47] The practice has since been banned in Germany, Scotland, and Denmark as well.[48] Although shale gas remains a viable alternative in the United Kingdom and Poland, both of which maintain ongoing programs of exploratory drillings and testing.[49]

Similar to fracking and the shale gas boom, nuclear energy has undergone immense changes in recent years across the EU. Following the Fukushima disaster in 2011, several countries across Europe elected to eliminate nuclear power plants, and turn away from nuclear energy. The trend became known as the "nuclear phase out" or "denuclearization," and has taken hold in numerous EU countries including Belgium, Germany, Italy, Spain, and Switzerland.[50] Yet many Central and Eastern European nations still look to nuclear energy as a significant source for domestic electricity. Nations including the Czech Republic, Hungary, Lithuania, Slovakia, and Poland, continue to depend upon nuclear energy as a low-carbon, domestic capability for electricity generation.[51] Indeed, nuclear energy has provided numerous CEE states the

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[47] There has been some interest in recent years as to the role the Russian Federation played in the anti-fracking movement in Bulgaria. Bulgaria, an EU nation, is dependent upon Moscow for 85% of its gas, thereby incentivizing Russia to spearhead anti-fracking campaigns in key CEE states. Mark Snowiss, "Bulgaria Key Battleground in US-Russia Energy War," *VOA News*, February 23, 2015, https://www.voanews.com/a/bulgaria-key-battleground-in-us-russia-energy-war/2655196.html.
[48] Arthur Neslen, "The Rise and Fall of Fracking in Europe," *The Guardian*, September 29, 2016, https://www.theguardian.com/sustainable-business/2016/sep/29/fracking-shale-gas-europe-opposition-ban.
[49] European Commission, *Shale Gas*, (Brussels, 2016), https://ec.europa.eu/energy/en/topics/oil-gas-and-coal/shale-gas.
[50] Keno Verseck, "Nuclear Power on the Rise in Eastern Europe," *DW*, December 23, 2013, http://www.dw.com/en/nuclear-power-on-the-rise-in-eastern-europe/a-17177810.
[51] Ibid.

necessary supply to lessen dependency on Russia. Furthermore, several Western European states have thus far been immune from the nuclear phase out trend. Countries such as France, Europe's most enthusiastic nuclear state, and the UK are continuing nuclear operation, while maintaining plans to build more plants in the future.[52] Although the post-Fukushima trend away from nuclear energy has eclipsed key EU states, the death of nuclear energy in Europe has not yet come.[53] Its future, however, remains uncertain.

Carbon-based fuels continue to remain dominant across the whole of Europe, and are still a facet of the global energy market. Countries from Germany to Poland to Bulgaria continue to rely on domestic coal production to account for large percentages of total generated electricity.[54] Thus, despite the "Big Green Bang" and domestic energy policies outlining a more heightened reliance on RES, carbon-based fuels continue to thrive across the continent. In 2015, nearly one-half of all electricity generated across the EU came from carbon-based fuels.[55] Coal production and export from EU nations is in decline, and has continued a downward trend since 1997. However, Germany currently relies on coal for 40% of its total electricity, while 45% of all electricity generation in

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[52] Ibid.
[53] Although some EU nations, such as France, continue to rely upon nuclear energy for significant percentages of electricity generation, President Emmanuel Macron has publically stated that France will reduce its share of nuclear electricity production to 50% by 2025. This pledge was made in 2016.
[54] "Bulgaria," *Euracoal*, accessed December 18, 2017, https://euracoal.eu/info/country-profiles/bulgaria/; "Germany," *Euracoal*, accessed December 18, 2017, https://euracoal.eu/info/country-profiles/germany/; "Poland," *Euracoal*, accessed December 18, 2017, https://euracoal.eu/info/country-profiles/poland/.
[55] "Fossil Fuels," *Eurostat*, accessed December 18, 2017, http://ec.europa.eu/eurostat/web/environmental-data-centre-on-natural-resources/natural-resources/energy-resources/fossil-fuels.

Bulgaria comes from coal.[56] Similarly, Poland relies on coal for 48% of its electricity production.[57] Indeed, contrary to the decarbonization trend across Europe, Poland has extended its long-term goals to include a 60% reliance on coal for all domestic energy production by 2030.[58]

EU Energy Markets Today

Altogether, Europe has an energy problem. Nearly every state across the continent, both EU member and non-member states have begun to make major adjustments to energy policies in order to address what appears to be an imminent threat. However, the threat each country is facing is not one in the same. Western European nations have begun to address climate-related threats, as some look to low-carbon sources such as nuclear energy, while others turn to renewables for a solution. Additionally, many Western European nations are reaping the benefits of EU liberalization energy policies, as energy imports have begun to reflect fair market prices.[59] Central and Eastern European states face a different threat. The CEE region is currently gripped with dependence on the Russian Federation. Such reliance has proven to be politically and economically dangerous in recent years. Therefore, the threat many CEE nations are facing cannot be answered by emissions reductions and increased RES reliance alone.

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[56] Ivan Nishkov, "Bulgarian Coal Industry," (presentation, *International Energy Raw Materials and Energy Summit*, Istanbul, Turkey, October 1-3, 2015).
[57] "Poland," *Euracoal*, accessed December 18, 2017, https://euracoal.eu/info/country-profiles/poland/.
[58] "Poland to Generate Nearly 60 Percent of Energy from Coal in 2030," *Reuters*, July 11, 2017, https://www.reuters.com/article/us-poland-energy-coal/poland-to-generate-nearly-60-percent-of-energy-from-coal-in-2030-official-idUSKBN19W1NE.
[59] Most notably, the gas market.

Instead, Central and Eastern Europe states are beginning to seek a diverse supply of energy sources. These sources often include carbon-based fuels, such as coal and oil, as well as new suppliers such as the U.S.

To view the energy market and security environment in Europe today as unified would be a grave mistake. Different regions across Europe face diverse problems, with far different solutions. In light of the success of energy market liberalization in Western Europe, the decarbonization trend is far more advanced, with countries pledging reduced emissions and increased RES dependency in the very near term. However, many countries in Western Europe are finding the divorce from carbon-based fuels more difficult than was previously thought. Germany is the premier example of such a contradiction, as its Energiewende policy stipulates a 40-45% RES reliance, alongside a 40% emissions reduction by 2020. However, a vast amount of Germany's current electricity production relies upon coal, particularly in the wake of the Merkel government's 2011 decision to phase out all nuclear power plants from the country. Germany, in a sense, has become a microcosm of the problems facing Western Europe: liberalized energy markets, eclipsed by the decarbonization trend, yet largely unable to diversify energy sources away from all carbon-based fuels.

Central and Eastern Europe, conversely, face a daunting problem in regards to current reliance on Russia for oil and gas. Thus far, the CEE region has been unable to liberalize energy markets as successfully as their neighbors to the West, revealing a continuing power imbalance with Moscow vis-à-vis natural gas contracts. This has caused many CEE nations to cling to domestic energy production as a bulwark against increased dependency for foreign imports. Such domestic production in the CEE region comes largely from either coal or nuclear energy. Thus, the decarbonization trend has not flourished in Central and Eastern Europe for two reasons. First, the rising cost of RES technology, research, and development is a luxury unavailable to many CEE states.[60] Second, domestic energy production in the CEE region, cultivated largely as a defense against dependency on Russia gas, principally relies on carbon-based fuels, or nuclear energy. Thus, the problems facing Europe today are both complex, and region-dependent. The solutions available to different European states vary. Therefore, energy policy, and ultimately energy security, in Europe going forward will depend upon a variety of factors and considerations, not all of which will bring cohesive solutions.

[60] For point of comparison, Germany had a gross domestic product (GDP) of 3.4 trillion USD in 2016. Bulgaria, conversely, had a GPD of only 52.4 billion USD in 2016. Poland, considered one of the richest CEE nations had a GDP of 469.5 billion USD in 2016.

CHAPTER TWO

THE EVOLUTION OF GERMAN ENERGY POLICY

The story of Germany's energy policy over the years is a story of progression. At times throughout its history, the German government has been enthusiastic and expectant about the future of energy. This has happened twice in modern history: Germany's first approach to nuclear energy in the 1960s, and its approach to renewable energy today. Germany has long been home to the forefront of technology, innovation, and science. This strong penchant for improvement and modernism has enabled Germany to be on the cusp of all that science and technology has to offer. Its approach to energy and energy policy has been no different. Germany has also dedicated significant resources to research. In 2010, the German government extended a 2.4 billion euro funding project over five years to fund university level research and development endeavors.[61] Even after the funding project ended in 2015, Germany today still maintains Europe's largest national budget for research and development.[62] Put simply, the national fabric of Germany has long included technological prowess and research-driven innovation. Accordingly, following the end of World War II, German energy policy has followed this model to include forward-thinking and scientific modernization as a key concept in every post-war energy policy.

[61] Julie Clayton, "Focus on Germany," *Science*, September 24, 2010, http://www.sciencemag.org/features/2010/09/focus-germany.
[62] Ibid.

German Strategic Culture and Energy Policy

Germany has risen to become the de facto leader in Europe in recent years. Despite the seat of EU leadership residing in Brussels, Germany has led the way forward in many key European issues from Greek bailouts, to the Ukrainian crisis, to current migration quotas. Although German strategic culture outlines hesitancy and restraint in military and defense postures, Germany has risen to the top of European economic matters. Indeed, the German penchant to lead in innovation has been at the forefront of German energy policy for over a decade. Germany also tends to think long-term. Indeed, long-term orientation continues to be a distinct facet of Germany's culture profile.[63]

Also, distinct within Germany's culture profile is the general disdain for uncertainty. Along with long-term orientation, Germans tend to dislike the unknown, and supplement uncertainty by relying strongly on expertise.[64] This tendency also explains Germany's dedication to science, technology, research, and development. In accordance with a high uncertainty avoidance, Germany prides deductive rather than inductive reasoning.[65] Furthermore, Germans are highly pragmatic, and given to meeting goals and requirements. All of these factors have been of significant importance in Germany's energy policy evolution since the end of World War II. Therefore, the necessary context to understanding Germany's current push for increased reliance on RES, as outlined in

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[63] "Germany," *Hofstede Insights*, accessed December 20, 2017, https://geert-hofstede.com/germany/about/culture.upickreviews.html.
[64] Ibid.
[65] This preference for deductive reasoning is in line with the German philosophical traditions of Kant, Hegel, and Fichte, and is therefore an unsurprising facet of German culture.

the Energiewende policy, can be found in previous decades of German energy policy which reveal a repeated call for innovation and technical prowess.

Hydrocarbons in German Energy Policy

Carbon-based fuels were the first major German energy source dating back to the 18th century, and are still a facet of German electricity production today. Although Germany has been a champion of the Western European decarbonization trend, a large percentage of its total generated electricity production depends upon coal. Both coal and oil dominated German energy markets largely until 1966 when nuclear power began to emerge as a competitor. Nuclear energy was, at one time, preferable, as it was seen as a low-carbon source compared to coal and oil. However, following the reunification of Germany in 1989, both coal and oil markets once more intensified throughout the country. At the same time coal and oil markets reignited across Germany following reunification, a new energy source began a steady growth: Russian natural gas.

The growth of German reliance on Russian gas since the end of the Cold War has continued to mature. Between 2000-2012, Russian gas made up 21% of Germany's energy supply. Furthermore, Russian gas comprises over 40% of Germany's total foreign gas import today.[66] Further exemplifying the German dependence upon Russian gas are two pipeline projects connecting Russian gas to Germany: Nord Stream and Nord Stream 2. The first pipeline project, Nord Stream, was commissioned in 2011, and runs for 1,224 kilometers. Running under the Baltic Sea, the pipeline connects Vybord, Russia to

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[66] Weixin Zha and Anna Shiryaevskaya, "Germany is Addicted to Russian Gas," *Bloomberg*, July 4, 2017, https://www.bloomberg.com/news/articles/2017-07-03/german-addiction-to-russia-gas-raises-alarm-in-merkel-s-backyard.

Lubmin, Germany in the Eastern part of the country.[67] The pipeline maintains the capacity to deliver 55 billion cubic meters of gas annually.[68] Moreover, the Nord Stream 2 pipeline, which first began in April 2012, was intended to increase connectivity between Russia, Germany, and several key European states including Norway and the UK. Construction on Nord Stream 2 has not yet been completed, following EU sanctions on Gazprom in 2012, one of the project's key leaders.[69]

The key pipeline projects connecting Russian gas from Siberia to Germany was intended to be an offset strategy as Germany continues to transition away from carbon-bases fuels and nuclear energy. Following the 2010 Energiewende policy, some began expressing doubt regarding the future target goals of Germany's intended emissions reduction if the country continues to rely upon coal. Currently, Germany relies upon lignite, or soft brown coal, for 25% of its electricity.[70] Additionally, Germany also relies upon hard coal for nearly 18% of its annual electricity.[71] Such substantial continued reliance upon lignite and hard coal combined runs contrary to the decarbonization trend that Germany has spearheaded since 2000. Russian natural gas, therefore, has the benefit of being both relatively low-carbon and, following Nord Stream, easily accessible. Thus,

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[67] Ibid.
[68] "1-Nord Stream to Finish First Gas Pipeline," *Reuters*, May 4, 2011, https://uk.reuters.com/article/europe-gas-pipeline/update-1-nord-stream-to-finish-1st-gas-pipeline-thursday-idUKLDE7431M720110504.
[69] Weixin Zha and Anna Shiryaevskaya, "Germany is Addicted to Russian Gas," *Bloomberg*, July 4, 2017, https://www.bloomberg.com/news/articles/2017-07-03/german-addiction-to-russia-gas-raises-alarm-in-merkel-s-backyard.
[70] Lignite, or soft brown coal, has the highest carbon dioxide emissions per ton when burned. Thirty percent more than hard coal, and three times as much as natural gas. However, lignite remains Europe's most abundant and cost efficient domestic fuel.
[71] "France and Germany Turn to Coal," *Institute for Energy Research*, October 24, 2016, https://instituteforenergyresearch.org/analysis/france-germany-turn-coal/.

current German reliance upon Russian gas is largely seen as a protection against wind and solar technologies that may not be able to provide sufficient electricity in accordance with both 2020 and 2050 target goals.

The state of both coal and gas dependency in Germany today is paradoxical. Since 2000, the German government has made clear its resolve to lessen dependency upon carbon-based fuels, particularly coal and oil. Instead, the country advocated an increased reliance upon renewable energy sources, such as wind and solar power. In 2010, the German government reaffirmed its RES support by passing the Energiewende policy. Since its launch, however, Germany continues to rely upon coal for 40% of its electricity production annually. Further problematic is the country's dependence upon lignite. Although lignite is the most abundant form of coal found in Germany, as well as the cheapest to burn, it is also the dirtiest form of coal, resulting in higher emissions than hard coal or natural gas. Thus, the continued use of lignite, as well as hard coal, in Germany has made its emissions reduction target goal increasingly difficult to reach. In order for Germany to reach its 40% emissions reduction goal by 2020, carbon-rich sources, such as lignite and hard coal, must be greatly reduced or eliminated altogether. Thus, the current paradox Germany is experiencing has led many scholars to describe the current situation as a German "coal conundrum."[72] Also problematic is Germany's continued reliance upon Russian natural gas. Although Germany's gas market is often seen as a security strategy against the potential failure of its future RES dependency goals, its place in Germany's energy sector will continue to complicate emissions

[72] Arne Jungjohann and Craig Morris, "The German Coal Conundrum," *Heinrich Boll Foundation*, (Washington, D.C. 2014), 4, http://www.indiaenvironmentportal.org.in/files/file/German_Coal_Conundrum.pdf.

reduction goals long-term, despite its relatively low carbon footprint.[73] However, many scholars agree that no one decision has so uniquely created the current "coal conundrum" and subsequent shift to Russian gas as the German decision to phase out all domestic nuclear energy.[74]

Nuclear Energy in Germany

The history of nuclear energy in Germany is fraught with disagreements. Nuclear energy first emerged in Germany in 1961 with the first commission of an experimental nuclear power plant.[75] By 1966, Germany had produced its first megawatt of nuclear energy.[76] The support, however, did not last long. In response to the oil embargo in 1973, West Germany made plans to extend its nuclear energy capability with a campaign to build a dozen new power plants, under then Chancellor Helmut Schmidt.[77] Soon after this decision, West Germans began an anti-nuclear campaign, signaling a feeling of distrust regarding nuclear energy and capability. This sentiment was exacerbated by the condition

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[73] Although natural gas is generally accepted as a "low-carbon" energy source, its exploration, drilling, and production does effect the environment. Since natural gas is comprised largely of methane, natural gas that leaks into the atmosphere, as a result of drilling, contributes to greenhouse gas emissions. The US Energy Information Agency estimated that in 2015, natural gas accounted for 32% of methane emissions in the US, as well as 4% of total US greenhouse gas emissions. U.S. Energy Information Administration, *Natural Gas Explained*, accessed December 21, 2017, https://www.eia.gov/energyexplained/index.cfm?page=natural_gas_environment.
[74] Arne Jungjohann and Craig Morris, "The German Coal Conundrum," *Heinrich Boll Foundation*, (Washington, D.C. 2014), 4, http://www.indiaenvironmentportal.org.in/files/file/German_Coal_Conundrum.pdf.
[75] "The History of Energy in Germany," *Planete Energies*, April 29, 2015, https://www.planete-energies.com/en/medias/saga-energies/history-energy-germany.
[76] Ibid.
[77] At the time of the oil embargo, West Germany relied upon OPEC for 96% of its oil imports. The crisis led Germany to extend its domestic nuclear capability as well as an increased reliance on non-OPEC suppliers such as Norway, the UK, and the USSR.

of Germany at the time, split between East and West, both armed with an immense number of nuclear weapons provided by the USSR and US, respectively.[78]

In 1986, following the Chernobyl accident, German fears regarding nuclear energy deepened. This fostered a deeper antinuclear sentiment in the country, that would continue to worsen over the years. Three years prior to the accident, the newly established Green Party in Germany had won a total of twenty-eight seats in Parliament.[79] The Chernobyl accident in nearby Ukraine three years later added further support to the antinuclear campaign fostered by the Green Party. By 1998, after fifteen years in Parliament, the Green Party and the Social Democrats formed a coalition that led to the 2000 decision to phase out all nuclear energy in Germany by 2021.[80] The 2000 decision also marked the turning point to renewables in Germany, as the coalition government sought to ensure that the gap left by nuclear energy would be filled by RES through a "feed-in tariff."[81] Thus, by 2000, the Big Green Bang had already begun to emerge in Germany.

The most recent flashpoint in German antinuclear sentiment followed the March 2011 Fukushima disaster.[82] This time, however, Germany was not alone. Following the

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[78] Jeffrey Ball, "Germany's High Priced Energy Revolution," *Forbes*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.

[79] Birgit Gortz, "Germany's Green Mark 30 Years in Parliament," *DW*, March 6, 2013, http://www.dw.com/en/germanys-greens-mark-30-years-in-parliament/a-16646538.

[80] Ibid.

[81] A feed-in tariff is a policy tool used to encourage the development and deployment of RES technology through investment tax credits or other investment subsidies. U.S. Energy Information Administration, *Feed-in Tariff: A Policy Tool Encouraging Deployment of Renewable Electricity Technologies*, (Washington, D.C., 2013), https://www.eia.gov/todayinenergy/detail.php?id=11471.

[82] The disaster occurred on March 11, 2011, following an earthquake and 15-meter tsunami which led to three nuclear reactor meltdowns at the Fukushima Daiichi facility. The accident led to the deaths of over 1,000 people from "maintaining the evacuation,"

incident, the German government announced its decision to shut down eight of its nuclear power plants in May 2011. This was a reversal of the Merkel governments 2010 decision to reverse the original nuclear phase out law.[83] The 2010 reversal of the nuclear phase out was led by coalition government comprised of the Christian Democratic Union and the pro-business Free Democratic Party, and called for an average twelve-year extension to German nuclear reactors.[84] The decision was immediately scrutinized by German opposition parties and neighboring EU states as a “black day for energy policy.”[85] However, the 2011 Fukushima disaster marked once more a turning point for the Merkel government, as antinuclear sentiment soon swept over Europe.[86] On June 30, 2011, the German government announced its decision to retire 47% of the country’s nuclear reactors.[87] In addition, the policy outlined a complete nuclear phase by 2022, echoing the original 2000 decision. The decision was passed with over 80% support in the German Parliament.[88] Today, the German government remains committed to its nuclear phase out plan, as the policy has further been enshrined in the most recent energy policy –

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and the displacement of an additional 100,000. Information taken from: “Fukushima Accident,” *World Nuclear Association*, October 2017, accessed December 20, 2017, http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx.

[83] The initial nuclear phase out law was enacted in 2000 by the Green Party and Social Democrat coalition.

[84] Kate Connolly, “Germany Agrees to Extend Life of Nuclear Power Stations,” *The Guardian,* September 6, 2010, https://www.theguardian.com/world/2010/sep/06/germany-extend-nuclear-power-stations.

[85] Ibid.

[86] Following the 2011 disaster, denuclearization policies gained wide support across European states including, most notably: Belgium, Italy, Spain, and Switzerland.

[87] Or eight of the country’s 17 total nuclear reactors.

[88] Rebecca Staudenmaier, “Germany’s Nuclear Phase-Out Explained,” *DW*, June 15, 2017, http://www.dw.com/en/germanys-nuclear-phase-out-explained/a-39171204.

Energiewende. The gap left by nuclear energy, which continues to supply Germany with 13% electricity in 2016, is planned to be filled by renewable energy as soon as 2025.[89]

Renewable Energy Sources in German Energy Policy

Germany's shift to renewable energy dates back to the 1980s. The original German push for an increased reliance on RES began as a backlash to the decision to increase Germany nuclear power plants in 1973. As Chancellor Helmut Schmidt sought an alternative to Germany's OPEC oil dependency, domestic nuclear energy once more appeared on the rise. The initial push for domestic RES dependence, therefore, was reactionary to long-held antinuclear sentiments in Germany. However, the widespread support and growth for renewables did not occur until the Social Democrats and Green Party coalition government beginning in 1998. With the law declaring the phase out of all German nuclear reactors by 2021, enacted in 2000, the German turn to RES was all but solidified. This was due, in large part, to the so-called "feed-in tariff" system entered into law in 2000.

The feed-in tariff sought to promote the production of renewable energy sources and technology, while encouraging business investments, and overall market production of RES. This was done by introducing a variety of measures including: priority grid access to RES, and fixed prices for energy producers for every kilowatt hour produced

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[89] "Nuclear Power in Germany," *World Nuclear Association*, August 2017, accessed December 20, 2017, http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/germany.aspx.

from an RES for a fixed period. [90] The tariff has been amended four times since 2000, in order to revise the law in accordance with current RES practices.[91] Even as the Merkel government overturned the nuclear phase out law in 2010, increased RES investment and infrastructure development had already taken hold throughout the country. Following the 2011 decision to once more continue the previously planned phase out nuclear energy, this time by 2022, renewables once more began a steady growth throughout Germany that continues today. In 2000, German electricity production from RES was 6.2%. In 2017, this figure had risen to 30.4%.[92]

Although Germany's clean energy transformation was formally enacted into law in 2010, the push for renewables in the country began roughly a decade earlier. Key legislation adopted first in 2000, including both the nuclear phase out and feed-in tariff, set the path that the Merkel government would continue down in the form of Energiewende. Thus, the current RES movement is not a new trend in Germany. Rather, Energiewende should be seen as the evolution and lofty progression of the German push for clean energy that began a decade prior. However, there remain facets of the Energiewende policy that set it apart from other historical German RES initiatives. Energiewende outlines a prompt timeline for Germany to be 80% RES dependent by 2050. Even the short-term goals of the policy stipulate a 40-45% RES dependency by

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[90] The fixed period is generally 20 years. "The German Feed-in Tariff," *Future Policy*, accessed December 20, 2017, http://www.futurepolicy.org/climate-stability/renewable-energies/the-german-feed-in-tariff/.
[91] The Feed-in Tariff was amended in 2004, 2009, 2012, and 2014.
[92] Kerstine Appunn, Felix Bieler, Julian Wettengel, "Germany's Energy Consumption and Power Mix in Charts," *Clean Energy Wire*, February 16, 2018, https://www.cleanenergywire.org/factsheets/germanys-energy-consumption-and-power-mix-charts.

2025. Thus, while previous clean energy legislation in Germany sought a gradual transition to renewable energy, Energiewende seeks to propel Germany forward in rapid fashion.

In many ways, the history of German energy policy has been preparing for the eventual, complete reliance upon renewable energy sources. Germans have expressed a dislike and distrust of nuclear energy since the Cold War, with two policy phase outs of all German nuclear reactors. Furthermore, Germany has been among the most vocal Western European and EU member states advocating decarbonization. While German reliance upon carbon-based fuels such as coal, and foreign imports such as Russian gas continue to abound, the German government remains adamant that such reliance is doomed to a phase out. In short, Germany has set the stage for the world to witness a true clean energy transformation. The question remains, however, if Energiewende will be an attainable policy for Germany. The answer, in turn, is likely to reveal to the rest of Europe whether or not overall RES dependency, and an industrial low-carbon economy, is attainable or doomed to failure. The next chapter will detail an extensive case study analysis of the Energiewende, and particularly the stated short-term policy goals, as well as the reasons behind their impending failure.

CHAPTER THREE

ENERGIEWENDE: A CASE STUDY

The German energy transition policy, known as Energiewende, has set out to revolutionize renewable energy for Europe. The policy itself is characteristically German in nature, seeking to propel the country into the future nearly twice as fast as any other European state. It reflects a strong economy and environmental modernization that the EU has come to expect from Germany, while exhibiting the German mentality of morality, and its synergistic relationship with policy.[93] For this reason, Germany's energy policy, specifically the Energiewende, has been chosen as a case study to analyze the energy security environment in Europe, as well as the policy implications of European energy trends such as energy source diversification and decarbonization. In addition to maintaining the role as the de-facto leader of the European Union, Germany has sought to outpace all other European energy policies and initiatives. The energy transition, in turn, has come to exemplify a European attempt at policy trend-setting. Additionally, Germany has the unique advantage of a sizeable national science and technology focus, the fourth largest economy in the world, and comparatively stable relations with the Russian Federation, particularly as it relates to energy. For this reason, the German Energiewende serves as a premier example of the energy security environment in Europe.

Energiewende was unveiled in 2010, and outlines a daring approach and ambitious shift to renewable energy, without the aid of nuclear energy. The German

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[93] *The Routledge Handbook of German Politics and Culture*, edited by Sarah Colvin and Mark Taplin (New York: Routledge, 2015), xviii, accessed December 23, 2017.

target goal for emissions reduction by 2020 doubles that of the EU-wide emissions reduction policy by the same time. Furthermore, Germany intends to be between 40-45% dependent upon renewable energy sources by 2025, and 80% by 2050. At its most daring, Energiewende calls for a drastic reduction in energy consumption, outlining a 20% fall from 2008 levels by 2020, and a 50% fall by 2050.[94]

In addition to environmental concerns, Energiewende seeks to become the global standard for energy transition. The policy strives not only to succeed by meeting its target goals, but also success through imitation. Indeed, the Energiewende policy is meant to signal to other Western and Central Eastern European states that an energy revolution is possible. Accordingly, all EU eyes have fixed upon the German energy experiment as it seeks to prove, foremost, that the transition to near total renewable energy dependency can be attained. Even more daunting, Germany intends to prove that such a transformation is affordable, and can be done without the aid of nuclear energy.

Energiewende Target Goals and Objectives

Germany has set high standards for itself and its energy policy. The energy transition policy is comprised of various ambitions with targets as far reaching as 2050. At the heart of Energiewende lie four central objectives: "to combat climate change, avoid nuclear risks, improve energy security, and guarantee competitiveness and growth."[95] Accordingly, the key aims of Energiewende are concentrated on CO2

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[94] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 5, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[95] Dimitri Pescia, Patrick Graichen, and David Jacobs, "Understanding the Energiewende," *Agora Energiewende* (October 2015): 7, accessed December 23, 2017,

emission and energy consumption reductions, nuclear energy elimination, and an increased share of renewable sources in German domestic power consumption.[96] The Federal Ministry of Education and Research describes the overall aim of the Energiewende policy to be the realization of “a stable supply of energy which is economically viable and environmentally friendly.”[97] Accordingly, the national energy goals outlined in the Energiewende policy can be categorized by three separate targets:

1. A 40% reduction in greenhouse gas emissions by 2020, and between 80-95% by 2050.[98]
2. A 20% reduction in energy consumption by 2020, and 50% by 2050.[99]
3. A total of 35% gross electricity consumption to come from renewable sources by 2020, and 80% by 2050.[100]

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https://www.agora-energiewende.de/fileadmin/Projekte/2015/Understanding_the_EW/Agora_Understanding_the_Energiewende.pdf.

[96] Kerstine Appunn, “Germany’s Greenhouse Gas Emissions and Climate Targets,” *Clean Energy Wire,* February 1, 2018, https://www.cleanenergywire.org/factsheets/germanys-greenhouse-gas-emissions-and-climate-targets.

[97] “German Energy Transition,” *Federal Ministry of Education and Research*, accessed March 6, 2018, https://www.bmbf.de/en/german-energy-transition-2319.html.

[98] Greenhouse gas emissions levels from 1990 serve as the baseline for both measurements. “Energy Concept,” *Federal Ministry of Economics and Technology*, 5, accessed December 23, 2017, https://web.archive.org/web/20161006040920/http://www.bmwi.de/English/Redaktion/Pdf/energy-concept%2Cproperty%3Dpdf%2Cbereich%3Dbmwi%2Csprache%3Den%2Crwb%3Dtrue.pdf.

[99] Energy consumption levels from 2008 will serve as the baseline for both measurements.

[100] “Energy Concept,” *Federal Ministry of Economics and Technology*, 5, accessed December 23, 2017, https://web.archive.org/web/20161006040920/http://www.bmwi.de/English/Redaktion/Pdf/energy-

In addition to these three goals, Germany also intends to phase out the last of its nuclear reactors by 2022. The nuclear phase out policy was passed into legislation in Germany in 2011, following the Fukushima accident.[101] The decision to pursue a renewables transformation without the aid of nuclear energy substantially increases the difficulty of meeting policy goals. In 2010, a year before the nuclear phase out was announced, Germany generated nearly 20% of its electricity production from nuclear energy.[102] Not only did nuclear energy provide a significant portion of German electricity generation, it did so with no greenhouse gas emissions. Indeed, before the announced phase out, nuclear power remained Germany's foremost low-carbon energy source.[103] Thus, the nuclear phase out policy adds an additional constraint to obtaining an energy transformation and low-carbon electricity as outlined in Energiewende.

In place of traditional, carbon-based sources, the energy transformation seeks to place renewable energy sources at the forefront of German electricity production. In particular, both wind and solar energy are seen as the backbone of the Energiewende policy.[104] This is no small task. The capital of Berlin lies at roughly the same latitude as

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concept%2Cproperty%3Dpdf%2Cbereich%3Dbmwi%2Csprache%3Den%2Crwb%3Dtrue.pdf.

[101] Rebecca Staudenmaier, "Germany's Nuclear Phase Out Explained," *DW*, June 15, 2017, http://www.dw.com/en/germanys-nuclear-phase-out-explained/a-39171204.

[102] Ibid.

[103] David Talbot, "The Great German Energy Experiment," *MIT Technology Review*, June 18, 2012, https://www.technologyreview.com/s/428145/the-great-german-energy-experiment/.

[104] However, the Energiewende policy defines a list of all renewable energy sources that will be considered. They are: hydropower, wind energy, solar radiation energy, geothermal energy, and energy from biomass including biogas, biomethane, landfill gas, and sewage treatment gas. "Act on the Development of Renewable Energy Sources (Renewable Energy Sources Act – RES Act 2014), *Federal Ministry for Economic Affairs and Energy*, August 1, 2014,

Calgary.[105] Germany as a whole, meanwhile, gets on average as much sunlight per year as Seattle, Washington.[106] One German CEO, Jurgen Grossman, described the German solar power endeavor as making "as much sense as growing pineapples in Alaska."[107] Yet, Energiewende outlines a substantial dependency upon, and expansion of, solar power. Wind also holds a key place in the policy. By 2050, wind is slated to hold key importance in German electricity production. Energiewende calls for "a massive expansion of onshore and offshore wind power capacity."[108] The need to massively expand wind power – particularly offshore wind power – remains one of the most expensive components of Energiewende. At the launch of the policy, it was estimated that an additional 75 billion euros would need to be invested in the expansion offshore wind farming.[109] This would need to be done in order to boost wind power capability to produce 25 GW by 2030.[110]

Furthermore, renewables such as offshore wind farms, increase the need for an expansion of Germany's grid system. Due to an increase reliance upon renewables, policymakers assessed that an "overlay grid" would need to be placed upon Germany's

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http://www.bmwi.de/Redaktion/EN/Downloads/renewable-energy-sources-act-eeg-2014.pdf?__blob=publicationFile&v=1.

105 Jeffrey Ball, "Germany's High-Priced Energy Revolution," *Fortune*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.

106 Ibid.

107 Ibid.

108 "Energy Concept," *Federal Ministry of Economics and Technology*, 5, accessed December 23, 2017, https://web.archive.org/web/20161006040920/http://www.bmwi.de/English/Redaktion/Pdf/energy-concept%2Cproperty%3Dpdf%2Cbereich%3Dbmwi%2Csprache%3Den%2Crwb%3Dtrue.pdf.

109 Ibid, 8.

110 Ibid.

existing electricity grid system.[111] This would need to be done in order to ensure the transport of electricity over great distances with minimal losses. Although electricity generation is historically done near the centers of consumption, future reliance on RES, such as offshore wind, will require the development of a new grid system in addition to a new method of electricity generation. The grid expansion and upgrade must also be done in order for Germany to continue to play a key role in Europe as an energy supplier.[112] Therefore, alongside large-scale investments in RES, Energiewende also entails considerable modernization of Germany's current grid infrastructure to make way for the future integration of renewables into the electricity market. Energiewende, consequently, demands that Germany harness both nature and its electricity grid system in ways never before seen. Furthermore, the policy has the added burden of doing so in an economically beneficial way.

Cost Analysis of Energiewende

In addition to being one of the most innovative energy policies in Europe, Energiewende is also estimated to be the most expensive. The total cost of implementing Energiewende by 2025 in the electricity sector alone was estimated to be 520 billion euros.[113] A 2017 study revealed the estimated costs of Energiewende by 2030 to be

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[111] Ibid, 18.
[112] Ibid.
[113] Justus Haucap, Ina Loebert, and Susanne Thorwarth, "Cost of Energiewende," *Dusseldorf Institute for Competition Economics (DICE)*, October 2016, http://www.insm.de/insm/Presse/Pressemeldungen/Pressemeldung-Studie-EEG.html.

between 600-700 billion euros.[114] This figure does not include costs associated with what will become necessary transformations of the heating and transportation sectors.[115] Before the launch of Energiewende, it was clear that subsidies would be required to overcome the "innate cost and convenience advantage of hydrocarbons," which have traditionally not been penalized for the carbon they emit.[116] The Germany government acknowledged this in June 2011, by stating that "the expansion of renewable energy must be cost-efficient to guarantee affordable electricity prices [because] what is a niche market must become a volume market."[117] The cost of transforming the niche RES market into a volume market in Germany has been done to great success with the feed-in tariff. In 2000, Germany adopted a rigid tariff system through the Renewable Energy Sources Act.[118] The Act introduced fixed feed-in tariffs for each kind of renewable energy, generally guaranteed for 20 years, and set to decrease over time as the renewable operators become more experienced in the technology.[119]

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[114] Thomas Unnerstall, "How Expensive is the German Energy Transition? A Lesson from the German Energiewende," *Energy, Sustainability, and Society* (December 18, 2017): 1, https://doi.org/10.1186/s13705-017-0141-0.
[115] Ibid.
[116] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 13, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[117] Ibid.
[118] Or Erneuerbare Energien Gesetz (EEG) in German.
[119] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 16, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.

Renewable Energy Sources Act

The goal of the Renewable Energy Sources Act was to generate enough investments in RES technology to afford Germany an enormous increase in the share of renewables in the country's total electricity consumption. The policy ensures renewable energy operators receive priority grid access, as well as a fixed price for every kilowatt hour of energy produced from an RES.[120] Furthermore, this fixed price is set for a fixed period, generally 20 years.[121] The fixed price is high enough to ensure a return on investment for the operator. The extra cost, in turn, is paid for by all energy consumers through a surcharge on electricity bills.[122] Thus far, the policy has been credited with an ensured RES investment security, which has allowed for the rapid expansion of RES share in electricity consumption. The total generation of electricity from RES in Germany in 2000 was 6.2%. This figure had more than tripled by 2012, comprising a 23.7% total share in electricity production. In 2017, a staggering 33.1% of all German electricity was produced by renewables.[123] Such a rapid expansion of RES has also placed a tremendous burden on those most impacted by the policy: average German citizens.

In addition to high industry expenses, Energiewende has placed a tremendous financial burden upon German households. The cost of RES subsidies is met through a

[120] "The German Feed-In Tariff," *Future Policy*, accessed December 23, 2017, http://www.futurepolicy.org/climate-stability/renewable-energies/the-german-feed-in-tariff/.
[121] Ibid.
[122] Ibid.
[123] Kerstine Appunn, Felix Bieler, Julian Wettengel, "Germany's Energy Consumption and Power Mix in Charts," *Clean Energy Wire*, February 16, 2018, https://www.cleanenergywire.org/factsheets/germanys-energy-consumption-and-power-mix-charts.

surcharge placed upon consumer energy bills, known as the "EEG-Umlage."[124] Even more problematic, this surcharge has continued to rise over the years. In 2000, the surcharge amounted to 0.2 cents per kilowatt hour.[125] In 2012, the amount had increased nearly twenty-fold, costing German consumers an additional 3.59 cents per kilowatt hour.[126] In 2017, the EEG Umlage amounted to 6.8 cents per kilowatt hour.[127] Additionally, the EEG-Umlage is not the only energy tax levied on German citizens. Consumers also pay an "eco-tax on fuel and gas" as well as "a share of electricity grid connection costs."[128] As a result, energy bills have become among the most expensive German household costs. In 2016, the average German spent 1,060 euros annually on electricity; a 50% increase from 2007 levels.[129] Such figures are even more pronounced on a national level. In 2013, German consumers paid a total of 20 billion euros altogether from wind, solar, and biomass plants. The industry costs of the electricity produced from said plants, however, amounted to a mere 3 billion euros.[130]

In the aftermath of the rapid increase in RES electricity costs, the term "energy poverty" has become commonplace when discussing Energiewende and the effects of the

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[124] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 19, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[125] Ibid.
[126] Ibid.
[127] "EEG Surcharge 2017," *Netztransparenz*, accessed December 23, 2017, https://www.netztransparenz.de/EEG/EEG-Umlagen-Uebersicht/EEG-Umlage-2017.
[128] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 19, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[129] Jeffrey Ball, "Germany's High-Priced Energy Revolution," *Fortune*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.
[130] "How Electricity Became a Luxury Good," *Der Spiegel*, September 4, 2013, http://www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288.html.

policy.[131] In 2015, the German government released data revealing that between 2011 and 2015, over 300,000 German households had their power cut off due to unpaid electricity bills.[132] Since the start of the energy transition policy, Germans have witnessed to the transformation of electricity as a luxury good. Despite recent price hikes in the form of RES surcharges on energy bills, the German government has not adjusted government pensions or social welfare program payments. As a result, "every new fee becomes a threat to low-income consumers."[133] Long-term projections reveal more problems for German citizens. The Karlsruhe Institute of Technology has predicted that wholesale electricity prices will be even higher in 2025.[134] Thus, the German energy innovation, it appears, is bleeding German citizens through unparalleled high energy costs, without clear indication of any relief in sight.

Denuclearization and Energy Consumption

Many of the current difficulties regarding Germany's Energiewende policy can be summarized by two particularities: the decision to phase out all nuclear energy, and the decision to massively expand RES at a time when the technology was still relatively expensive. By phasing out nuclear energy, Germany is forced to rely upon additional,

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[131] Jeffrey Ball, "Germany's High-Priced Energy Revolution," *Fortune*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.
[132] "Over 30,000 Poverty-Hit German Homes Have Power Cut off Each Year," *The Local*, March 2, 2017, https://www.thelocal.de/20170302/over-300000-poverty-hit-german-homes-have-power-cut-off-each-year.
[133] "How Electricity Became a Luxury Good," *Der Spiegel*, September 4, 2013, http://www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288.html.
[134] "Energiewende," *The Economist*, July 28, 2012, http://www.economist.com/node/21559667.

more traditional energy sources until more of its gross electricity consumption can be reliably obtained from RES. This further aim has paradoxically seen the growth of coal and natural gas in Germany since 2010. An increase in domestic coal production, in order to offset the nuclear phase out policy, has caused the rise of Germany's greenhouse gas emissions. In both 2013 and 2015, Germany's emissions levels saw slight increases from previous years.[135] In addition to the rise of coal as an offset to denuclearization, Germany is also witnessing the rise of energy consumption. The German energy consumption data from 2017 reveals a one percent increase compared to 2016 levels.[136] This increase in energy consumption not only adds to the difficulty in meeting the consumption reduction goal, but also leads to further difficulty with another key Energiewende goal: 20% energy consumption reduction by 2020.

First Mover Wager

The decision to pursue a massive expansion of renewables while the technology was still relatively expensive, is best summarized as Germany's "first mover wager." By creating an energy transformation based on RES, Germany is ultimately testing the resolve of a theory which champions that policies can predict and control markets. Although Energiewende was launched when RES technology was still a fringe market, Germany today constitutes a huge portion of the global renewable market. Currently,

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[135] James Conca, "Why Aren't Renewables Decreasing Germany's Carbon Emissions?" *Forbes*, October 10, 2017, https://www.forbes.com/sites/jamesconca/2017/10/10/why-arent-renewables-decreasing-germanys-carbon-emissions/#74991f6a68e1.

[136] Soren Amelang, Benjamin Wehrmann, and Julian Wettengel, "Germany's Energy Use and Emissions Likely to Rise Yet Again in 2017," *Clean Energy Wire*, November 13, 2017, https://www.cleanenergywire.org/news/germanys-energy-use-and-emissions-likely-rise-yet-again-2017.

Germany employs nearly 400,000 workers in the renewable energy industry.[137] Moreover, Germany is home today to over 3,200 large scale renewable energy companies, including, most notably, the German Engineering Federation or VDMA.[138]All of which maintain vested interests in ensuring the continuation of Germany's energy transformation. Thus, the first mover theory holds that if the renewable energy market continues to grow, alongside widespread renewable technology proliferation, Germany will be the premier global investor in RES, maintaining a significant portion of the renewable market. There remain, however, significant disadvantages to Germany's current wager.

The first mover disadvantages, conversely, risk Energiewende evaporating into the past as a cautionary tale of placing policy before markets. By rushing the global pace of change, Germany could suffer a remarkable disadvantage through its historically high subsidies for wind, solar, and biomass electricity generation. Such subsidies that have been placed largely on the shoulders of average German households run the risk of regretting the cost. Solar power, for example, has seen significantly high subsidy costs in Germany since 2010. In turn, solar energy has seen technological proliferation that countries like China and the US have been happy to exploit at the expense of German renewable subsidies. Furthermore, by crafting an energy policy built upon RES before global markets indicated a favorable outcome for renewable investments, Germany has, in effect, rolled the dice on the future of its energy supply and security. Even more

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[137] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 3, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[138] Ibid.

problematic, data is beginning to emerge that reveals the improbability of Energiewende's long-term success.

Greenhouse Gas Emissions Levels

In January 2017, German economist Heiner Flassbeck released an article outlining fundamental misconceptions and flaws inherent in Germany's Energiewende. Flassbeck argued that the elimination of both nuclear power and fossil fuels, opting instead to rely upon mainly wind and solar energy, is simply not feasible according to weather patterns and long-term trends.[139] According to Flassbeck, weather irregularities that left Germany with insufficient wind and solar energy in December 2016, point to a more macro level trend. Specifically, that Germany will never be able to solely rely upon renewable energy, regardless how much new capacity is built in the future.[140] Flassbeck is not alone in his skepticism. Many economists, policymakers, government officials, and industry titans have been quick to dismiss Energiewende as an impending failure. Among the most cited examples of Energiewende's thus far failure is Germany's current emissions level, as well as its continued reliance upon lignite, or brown coal, and Russian natural gas.

Germany has thus far learned a critical lesson in energy sourcing and subsidies. Namely, that spending an immense amount of money to subsidize a small output of electricity generation through renewables is not an effective method to lower carbon

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139 Heiner Flassbeck, "The End of Energiewende?" *Energy Post*, January 10, 2017, http://energypost.eu/end-energiewende/.
140 Ibid.

emissions.[141] Energiewende doubles the EU-wide goal of emissions reduction, outlining a 40% reduction in greenhouse gas emissions by 2020. Data from 2017 reveals that currently, Germany has seen a 30% decrease in its emissions from 1990 levels. This means that, in order to meet its emissions target goal, Germany must reduce its emissions by nearly 10% in the next two years.[142] Scientists and policymakers alike agree this prospect is dim. Yet in the time span between 2017 and Germany's target date of 2020, renewable energy subsidies are set to increase from 13.5 billion euros per year, to 15 billion euros per year.[143] The reasons for this paradox are compelling, and illustrate the Energiewende correlation fallacy between increased RES subsidies and lowered CO2 emissions levels.

One of the largest barriers to the Energiewende emissions reduction goal has been the continued growth and reliance upon coal. To be sure, Germany's persistent dependence on coal is due to a multitude of factors including: industry pressure, the potential fallout of dramatic job losses from coal industries, and the 2011 nuclear phase out policy. In 2010, RES investments in Germany totaled 10 billion euros, and the industry employed an estimated 370,000 German workers.[144] Even more, coal industry figures from 2016 revealed that although renewables accounted for 29% of power output,

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[141] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 11, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[142] Kerstine Appunn, "Germany's Greenhouse Gas Emissions and Climate Targets," *Clean Energy Wire,* February 1, 2018, https://www.cleanenergywire.org/factsheets/germanys-greenhouse-gas-emissions-and-climate-targets.
[143] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 11, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[144] Ibid, 17.

German power plants burning imported hard coal accounted for 17% of electricity generation. Even more problematic, brown coal mines, or lignite, accounted for 23% of power output in Germany in 2016.[145] Additionally, the economic benefits of lignite, a particularly cheap and abundant European source, has allowed for brown coal to become the leading source of electricity when weather prevents reliance upon wind and solar.[146]

The effects of the nuclear phase out also dictate an increased reliance upon imported hard coal, as well as domestic brown coal production. In 2016, nuclear energy accounted for 13% of German power. By 2022, following the retirement of Germany's last nuclear reactors, the country will face a significant energy void to fill. If history is any indicator, Germany is likely to continue to turn to the coal industry to account for this gap. Furthermore, many of Germany's policy peculiarities have provided little incentive to eliminate coal plants throughout the country. Because German law stipulates that RES receives priority access to the electricity grid, most of the excess electricity Germany transports to its European neighbors comes from the source of lowest grid priority: coal.[147] This, coupled with the cheap cost of trading permits for carbon emissions throughout Europe, has given little incentive for German coal plants to shut down.[148] The

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145 Jack Loughran, "Germany's Reliance on Coal Continues Despite Renewables Push," *Engineering and Technology*, August 10, 2017, https://eandt.theiet.org/content/articles/2017/08/germany-s-reliance-on-coal-continues-despite-huge-push-towards-renewable-energy/.

146 Ibid.

147 Richard Martin, "Germany Runs Up Against the Limit of Renewables," *MIT Technology Review*, May 24, 2016, https://www.technologyreview.com/s/601514/germany-runs-up-against-the-limits-of-renewables/.

148 Ibid.

continued growth and survival of Germany's coal industry, therefore, will remain one of the largest impediments to reaching the Energiewende emissions reduction goals.

Electricity Grid

In addition to difficulties with a nuclear phase out and a RES "first mover wager," the German energy revolution has witnessed profound grid problems. Renewable energy imposes additional grid requirements on a country for three key reasons. First, some RES, such as wind power, are typically far from the centers of energy demand, best exemplified in offshore wind farms.[149] This is due to the economic considerations of RES, where cost and placement of renewable technology reign supreme over consumption center concerns.[150] Second, renewable energy generation is more widely distributed than traditional power such as coal or nuclear energy.[151] Renewable energy generation typically requires more transport unless it is used locally. Third, renewable energy output can replace traditional energy to a limited extent, but backup capacity will remain necessary for still or cloudy days.[152] Mixing energy sources puts an additional strain on electricity grids. Such constraint requires grid advancements to allow for fragmented renewable energy production. Furthermore, Germany's electricity grid was

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[149] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 18, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[150] Jabeen Bhatti, "Germany's Energy Transition Creates Costly Problems with Grid," *Bloomberg BNA*, September 14, 2017, https://www.bna.com/germanys-energy-transition-n57982087949/.
[151] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 19, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[152] Ibid.

originally designed for a centralized approach to energy transmission and consumption, which included a variety of non-renewable sources.[153] This has led to a variety of structural considerations as well as transportation concerns.

Germany's grid problems did not begin with Energiewende, but were evident years prior as Germany began outlining its clean energy ambitions. In 2005, the German government began discussing necessary modernizations to both the country's transmission and distribution grids.[154] Transmission grids are used to transport more electricity along longer distances at a high voltage. These grids have become of central importance since Germany's energy transformation and increased reliance upon RES, which are often located far from consumption centers. Distribution grids, conversely, involve electric lines with a lower voltage, used for local electricity transport. Both grid systems in Germany have been criticized in recent years, as being outdated and ill-equipped for the country's proposed RES advancements. In 2005, the German government estimated that it would need to expand its high voltage transmission grid an additional 850 kilometers.[155] By 2010, a total of only 90 kilometers had been expanded. The same year, the German government published a second study which revealed the need for a 36,000-kilometer addition to the high voltage line, by 2020.[156]

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[153] Jabeen Bhatti, "Germany's Energy Transition Creates Costly Problems with Grid," *Bloomberg BNA*, September 14, 2017, https://www.bna.com/germanys-energy-transition-n57982087949/.
[154] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 19, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[155] Ibid.
[156] Ibid.

Germany's low voltage distribution grid system has also been of central importance since its increase in renewable dependence. The distribution grid has increasingly become the central nervous system through which solar power flows. Currently, solar power produces low voltage electricity and therefore must be connected to the distribution grid.[157] Wind turbines are also currently connected to the distribution grid, though it is predicted that as the turbines grow in generation capacity, they will need to be transferred to the transmission grid.[158] Accordingly, the distribution grid will require modernization to account for increasing solar electricity generation. Chief among these modernizations will be bi-directional capability. This will ensure that low voltage renewable electricity can flow both from households generating it, as well as buying from it.[159] A 2011 monitoring report revealed that German distribution grid systems now accommodate more generating capacity than transmissions systems.[160] However, it remains unclear if the distribution grid can shoulder this heavy load. As of 2015, only 30% of the power lines outlined in the 2009 Power Grid Expansion Act have been completed.[161]

Germany's inadequate grid system is causing another financial problem for Energiewende: renewable power curtailment.[162] Per German law, electricity produced

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[157] Ibid.
[158] Ibid, 24.
[159] Ibid, 21.
[160] Ibid.
[161] Jeff St. John, "As Germany Curtails Wind and Solar, Billion-Euro Grid Projects Help Bring More Green Power On-Line," *Greentech Media*, April 28, 2016, https://www.greentechmedia.com/articles/read/as-germany-curtails-wind-and-solar-billion-euro-grid-projects-seek-to-bring#gs.3Je0S2E.
[162] For the purposes of this analysis, "curtailment" is meant to describe a scenario wherein power that has already been generated or can be generated is thrown away. This is done when the electricity grid cannot accommodate it. Craig Morris, "New Proposals

from renewable energy is given priority grid access. However, under certain conditions, the network operator can "scale back priority feed-in from these installations temporarily if the network capacities are not sufficient to transport the total amount of electricity generated."[163] Thus far, this is exactly the grid predicament Germany is facing. Germany's grid system has so far failed in adequately connecting many of its wind farms in the northern part of the country, to consumption centers in the south.[164] This, in turn, has led to a rising level of renewable power curtailment. In 2014, Germany reached a new peak of renewable power curtailment, losing 1.16% of all renewable energy electricity. This was a particularly shocking revelation, as it totaled more than all renewable power curtailment from the previous four years combined.[165] Altogether, the renewable energy curtailment in 2014 cost Germany more than 82 billion euros.[166] The grid concerns and costs do not stop there. A 2015 German government report outlined a projected 6.6 billion euro project to be undertaken over the next ten years on "grid optimization and reinforcement projects" for distribution system operators. An additional 2.6 billion euros was slated to be invested in the high voltage transmission network over

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Would Kill Solar and Wind in the European Union," *Energy Transition: The Global Energiewende*, June 28, 2017, https://energytransition.org/2017/06/new-proposals-would-kill-solar-and-wind-in-eu/.

[163] Jeff St. John, "As Germany Curtails Wind and Solar, Billion-Euro Grid Projects Help Bring More Green Power On-Line," *Greentech Media*, April 28, 2016, https://www.greentechmedia.com/articles/read/as-germany-curtails-wind-and-solar-billion-euro-grid-projects-seek-to-bring#gs.3Je0S2E.

[164] Craig Morris, "Renewable Power Curtailment Skyrockets in Germany," *Energy Transition: The Global Energiewende*, November 23, 2015, https://energytransition.org/2015/11/renewable-power-curtailment-in-germany/.

[165] Ibid.

[166] Ibid.

the same period.[167] Thus, it appears RES investments and high priced energy bills were just the beginning of Energiewende's worrisome price tag. The true cost, data shows, lies literally underneath, buried below in Germany's underground, outdated electricity grid system.

Renewable Energy Source Development in Germany

Despite numerous problems and setbacks, Energiewende has proven to be a success in several areas. Today, renewable energy sources account for over 30% of Germany's total electricity consumption, a stunning feat by global comparison.[168] By contrast, renewable energy sources comprised only 10% of total energy consumption the United States in 2016.[169] Thus far, Germany has been able to devastate the myth that renewable sources that seek to harness nature are too unreliable or unstable to generate a notable percentage of a country's total electricity generation. Furthermore, Germany has seen such a transition occur in less than a decade. To an industry that measures investments in "half-century increments," Germany has revealed that an energy transition is not only possible, but can be conducted in rapid fashion. Additionally, Germany is slated to meet one of its three target goals by 2020: the achievement of a total of 35% gross electricity consumption to come from renewable sources by 2020. In 2017, a total

[167] Jeff St. John, "As Germany Curtails Wind and Solar, Billion-Euro Grid Projects Help Bring More Green Power On-Line," *Greentech Media*, April 28, 2016, https://www.greentechmedia.com/articles/read/as-germany-curtails-wind-and-solar-billion-euro-grid-projects-seek-to-bring#gs.3Je0S2E.
[168] Jeffrey Ball, "Germany's High-Priced Energy Revolution," *Fortune*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.
[169] *U.S. Energy Information Administration*, "How Much US Energy Consumption and Electricity Generation Comes from Renewable Energy Sources?," accessed January 16, 2018, https://www.eia.gov/tools/faqs/faq.php?id=92&t=4.

of 30.7% of gross electricity consumption came from RES in Germany.[170] This is a remarkable achievement for the country.

Energiewende in Public Polls

Despite analysis that reveals increasing German energy bill costs associated with subsidy surcharges, the energy transformation policy still enjoys relative widespread public support. A 2017 poll revealed that 88% of German citizens responded positively to the question: "Do you generally approve of the Energiewende."[171] A total of 9% partially agreed, and only 3% disagreed.[172] These percentages reveal an increase in public support since 2014, when only 85% of those surveyed acknowledged an approval of the energy transition.[173] A majority of 75% of those surveyed said they "want to actively take part in making the energy transition happen," indicating Germany's success with its "bottom-up" approach to the Energiewende.[174] Although, almost two-thirds of those surveyed agreed that the cost of Energiewende has not been fairly allocated between average wage earners, businesses, and wealthy individuals.[175] This concern with increasing energy costs, and the disproportionate burden shouldered onto ordinary German households, has remained a central criticism of Energiewende. Indeed, the disproportionate costs of

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[170] Kerstine Appunn, Felix Bieler, Julian Wettengel, "Germany's Energy Consumption and Power Mix in Charts," *Clean Energy Wire*, February 16, 2018, https://www.cleanenergywire.org/factsheets/germanys-energy-consumption-and-power-mix-charts.
[171] Soren Amelang, Benjamin Wehrmann, and Julian Wettengel, "Poll Reveals Citizens' Support for Energiewende," *Clean Energy Wire*, November 15, 2017, https://www.cleanenergywire.org/factsheets/polls-reveal-citizens-support-energiewende.
[172] Ibid.
[173] Ibid.
[174] Ibid.
[175] Ibid.

Germany's energy transition, as well as its continued and increased reliance upon lignite and hard coal, and continuing dependence on Russian natural gas, are problems even avid supporters of the German Energiewende cannot ignore.[176]

Policy Crossroads

The Energiewende policy is at a crossroads. As the first target goal year approaches, current data suggests Germany is on track to meet only one of its three target goals. Namely, 35% gross electricity consumption from renewable sources by 2020. The other two target goals of a 40% reduction in greenhouse gas emissions and a 20% reduction in energy consumption by 2020, appear improbable. Yet, many agree that Germany's progress thus far has been nothing short of remarkable. Germany currently leads Europe in RES integration and investment. Since the introduction of the feed-in tariff in 2000, promotion of renewables in Germany has skyrocketed. In the eighteen years between the inception of the feed-in tariff to today, renewable generation has grown almost 30%.[177] In just a decade between 2007 and 2017, renewable power has increased 18% in Germany.[178] This is evidence of a green power transition. However, this has come at a tremendous cost, both in the form of RES subsidies, grid modernizations, and expansions. Many remain doubtful that the gap left by the abandonment of nuclear power can be reliably filled by renewables. Furthermore, Germany's energy consumption remains largely unchanged since 2000, and its continued reliance upon coal lingers,

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176 John Matthews, "The Spectacular Success of the German Energiewende – and What Needs to be Done Next," *Energy Post*, October 10, 2017, http://energypost.eu/the-spectacular-success-of-the-german-energiewende-and-what-needs-to-be-done-next/.
177 Ibid.
178 Ibid.

thwarting its emissions reduction goal.[179] The likely 2020 target goal failures are likely to linger throughout the country, and poses the potential to halt the policy altogether.

Alongside the complex and seemingly contradictory nature of the current state of Germany's energy transition policy, the policy has thus far failed to prove it can be an affordable model for Europe. The proposed cost of grid modernization and expansion alone totals more than several Central and Eastern European state GDPs. One journalist likened the German energy transition to a heart-transplant: "A worthy endeavor, undoubtedly, but one that remains unattainable for all but the very wealthiest."[180] For the EU, this is bad news. The Union has sought its own energy transition policy, albeit at a far more moderate rate than Germany. The success or failure of Energiewende's target goals, as well as the price tag of a rapid energy transition, could lead other European countries to shy away from future environmental policies. Should Energiewende fail to meet its short-term policy goals, as data suggests it is likely to, Germany risks being an "example of international bad policy."[181] This could leave Germany with a credibility problem in the future. Thus far, the German strategy of subsidy and first mover risk remains a uniquely expensive German solution to the world's impending energy crisis.

Overall, the impending failure of Germany to meet two of its three target goals for 2020 will create widespread problems for the future of Energiewende. Such a failure will

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[179] Kerstine Appunn, Felix Bieler, Julian Wettengel, "Germany's Energy Consumption and Power Mix in Charts," *Clean Energy Wire*, February 16, 2018, https://www.cleanenergywire.org/factsheets/germanys-energy-consumption-and-power-mix-charts.
[180] Jeffrey Ball, "Germany's High-Priced Energy Revolution," *Fortune*, March 14, 2017, http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.
[181] "It's Not Easy Being Green," *The Economist*, August 11, 2016, https://www.economist.com/news/europe/21704819-even-new-reforms-doubts-remain-about-germanys-energy-transition-its-not-easy-being-green.

not only call into question the intermediate and long-terms goals of the policy, but the policy itself. The cost of Energiewende has been deemed worthwhile by the German public and policymakers alike on the assumption the policy was succeeding. Justifying a 20 billion euro increase in energy bills annually on a one-third success rate will become increasingly challenging. Additionally, European support for Energiewende remains at risk as the policy continues to present economic strain and difficulties. Furthermore, the likely failure of Energiewende's two target goals for 2020 will only increase the likelihood that future target goals, in both 2030 and 2050, will be unmet. Such unmet targets of Energiewende carries with it the potential for a wide-ranging energy policy and security conundrum.

Altogether, the cost analysis of Energiewende, as well as key concerns relating to continued electric grid difficulties, hydrocarbons, and denuclearization combine to reveal why Germany is currently projected to fail to meet two of its three stated policy goals for 2020. Current data reveals continued high cost projections, with minimal policy goal success. Coal, particularly lignite, continues to abound throughout the country, and ineffective grid systems still waste renewable energy production through power curtailment. Furthermore, despite adopting an energy policy that seeks clean energy independence, Germany continues to import Russian natural gas at high rates. Perhaps most troubling of all, the cost of Germany's energy transformation has led to a growing energy affordability problem for many German citizens, with little promise for improvement. The impending failure to reduce greenhouse gas emissions, as well as energy consumption levels, will impact both Germany's current international credibility, as well as Energiewende's intermediate and long-term policy goals. This includes

Germany's ability to continue to maintain public support for the policy in light of the likely 2020 target goal failures. The next chapter will discuss the current state of Energiewende's intermediate and long-term policy goals, and how the likely short-term goal failures discussed in this chapter could negatively impact the future of the energy transformation policy.

CHAPTER FOUR

THE FUTURE OF ENERGIEWENDE: INTERMEDIATE AND LONG-TERM TARGET GOAL ANALYSIS

Germany's Energiewende policy has reached a moment of profound evolution. With the first target year, 2020, looming overhead, German policymakers have begun to rethink and reshape some aspects of the policy. This is undoubtedly due to impending short-term target goal failures, including the emission reduction goal, as well as the energy consumption reduction goal. To begin, lawmakers have initiated the long overdue process of restructuring renewable subsidies, and retiring the feed-in tariff system. In its place, German policymakers have adopted an auction-based system for new and future RES contracts. Additionally, Germany has also begun to reconsider the ownership structure of RES throughout the country. Signs of a shift away from citizens' cooperatives, in favor of a more industry-based ownership, are beginning to emerge. The declared need for an international carbon tax going forward has also reached new heights in the Energiewende debate, as Germany has repeatedly been confronted with its paradoxical continued reliance upon hydrocarbons such as coal. Indeed, policymakers and citizens alike are beginning to vocally challenge this central tension within Germany's current energy transformation. Altogether, these facts reveal that the energy transition policy is itself in transition. The future of Germany's Energiewende hangs in the balance, where politicians, policymakers, and average citizens have begun to re-conceptualize and restructure the energy policy. Reforms made in the coming years, and their outcomes, carry tremendous consequence for the energy transition policy. The success or failure of such reforms holds with it the future of energy policy and security in Germany.

Feed-in Tariff and Auction Based System

The future of Energiewende will depend foremost upon the continued cost of the policy. Indeed, the expense of Energiewende has remained at the forefront of debate in Germany. Thus far, Energiewende has been able to prove that a rapid growth in renewable technology is possible. Since 2000, the "feed-in tariff" has allowed for a massive RES expansion, as Germany paid generously to subsidize renewables.[182] Indeed, this has been the price tag of Germany's "first mover wager" on renewable energy. Energiewende chose to introduce the feed-in tariff at a time when solar and wind power still far outpriced hydrocarbons. However, in the years since, renewables have begun to ride the "downward cost curve associated with the global learning curve."[183] Put simply, as investment and increased electricity share in renewables have grown in Germany, the costs have begun to decrease. Even this seeming financial benefit, however, is not without issues. The problem lies within the tariff timeline. Germany did not expect the technical progress of RES to outpace the 20-year price guarantee written in the policy contracts. However, this is precisely what happened. Accordingly, the German government has begun to confront the costly issue of subsidies, and what can be done.

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[182] John Matthews, "The Spectacular Success of the German Energiewende – and What Needs to be Done Next," *Energy Post*, October 10, 2017, http://energypost.eu/the-spectacular-success-of-the-german-energiewende-and-what-needs-to-be-done-next/.
[183] Ibid.

In 2017, German policymakers sought to address the subsidy issue through a reform of the Renewable Energy Act (EEG). The reform of the Act, which created the feed-in tariff, seeks to do away with the tariff system it created.[184] In place of the feed-in tariff system, a new system of auctions has been developed in order to both keep a handle on the amount of renewable capacity added to the grid system each year, and introduce a market-based mechanism to support the continued growth of renewable energy investments. The auction based approach to subsidizing renewables seeks to drive down the price of RES subsidies through a system of bids. The auction system works by the German government first setting a target level of investment in renewable energy capacity. The government then allocates this set level of contracts to the lowest bidders.[185] As opposed to the auction based system, feed-in tariffs have traditionally been set high above the market electricity price. The auction based system, however, seeks to reduce subsidy costs by prompting competition.[186] This is accomplished through the simple, market-based approach to offering RES contracts only to those who bid the cheapest price.[187] This reform is a vital step toward a RES market economy. Such a system is also intended to ease the costs of renewables on German consumers, while

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[184] Kerstine Appunn, "EEG Reform 2016 – Switching to Auctions for Renewables," *Clean Energy Wire*, July 8, 2016, https://www.cleanenergywire.org/factsheets/eeg-reform-2016-switching-auctions-renewables.
[185] Meredith Fowlie, "The Renewable Energy Auction Revolution," *Energy Institute at Haas*, August 7, 2017, https://energyathaas.wordpress.com/2017/08/07/the-renewable-energy-auction-revolution/.
[186] Ibid.
[187] "It's Not Easy Being Green," *The Economist*, August 11, 2016, https://www.economist.com/news/europe/21704819-even-new-reforms-doubts-remain-about-germanys-energy-transition-its-not-easy-being-green.

allowing the government greater control over the pace of RES expansion.[188] Indeed, the rapid pace of RES expansion in Germany has become a particularly concerning problem in recent years.

In a cruel twist of fate, the only target goal Energiewende is on track to meet has become a liability for Germany. The use of feed-in tariff incentives caused the explosion of renewable energy technology, particularly in the last decade. However, an insufficient grid system has left Germany unable to connect a significant amount of renewable generated electricity to the consumers. As a result, a massive amount of RES energy is being wasted, while Germany continues to see the expansion and growth of renewables that is cannot accommodate. In 2015, for example, northern Germany produced 4,100 kilowatt hours of excess energy that could not be transported to the south.[189] Enough energy, it was estimated, to provide 1.2 million German households with energy for a year.[190] This is precisely the problem Germany is attempting to resolve by setting a target level of RES investment thereby regaining some control over RES expansion.

The Renewable Energy Act reform stipulates "deployment corridors" for each renewable technology.[191] For example, an annual cap of 2.5 gigawatts of solar capacity

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[188] Weixin Zha, Brian Parkin, and Tino Andresen, "How Germany Hammers Down Renewable Energy Costs," *Bloomberg*, February 7, 2017, https://www.bloomberg.com/news/articles/2017-02-07/how-germany-hammers-down-renewable-energy-costs-quicktake-q-a.
[189] Philip Oltermann, "Germany Takes Steps to Roll Back Renewable Energy Revolution," *The Guardian*, October 11, 2016, https://www.theguardian.com/environment/2016/oct/11/germany-takes-steps-to-roll-back-renewable-energy-revolution.
[190] Ibid.
[191] Soren Amelang, "Germany's Energy Transition Revamp Stirs Controversy Over Speed, Participation," *Clean Energy Wire*, June 29, 2016, https://www.cleanenergywire.org/dossiers/reform-renewable-energy-act#climate.

will be installed, of which 600 megawatts is set to be auctioned.[192] Onshore wind installations, conversely, will be set at 2.8 gigawatts of annual installation.[193] The overgrowth of Germany's windfarm sector has become of particular concern since 2015. In 2016, it was reported that wind power had so congested the grid, the Germany government was forced, in some cases, to pay RES companies to turn off wind turbines.[194] Such problems, it is theorized, would not occur under a deployment corridor cap. German policymakers have remained adamant that the shift to an auction system is the last hope of a sustainable energy transition going forward into the future.[195] Others, however, remain fearful that the auction system will prevent citizen participation in the energy transition, shifting the advantage to corporations. This, in turn, reveals another problem with the future of Energiewende: the tension between national targets and decentralized responsibilities.

Ownership Structure

Germany's Energiewende has been praised for its decentralized supply structure, and utilization of citizens' energy cooperatives. Indeed, this has been one of the fundamental characteristics of the energy transition. However, the 2017 policy switch to an auction system of RES contracts is likely to change the entire structure of

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[192] Ibid.
[193] Ibid.
[194] Philip Oltermann, "Germany Takes Steps to Roll Back Renewable Energy Revolution," *The Guardian*, October 11, 2016, https://www.theguardian.com/environment/2016/oct/11/germany-takes-steps-to-roll-back-renewable-energy-revolution.
[195] Soren Amelang, "Germany's Energy Transition Revamp Stirs Controversy Over Speed, Participation," *Clean Energy Wire*, June 29, 2016, https://www.cleanenergywire.org/dossiers/reform-renewable-energy-act#climate.

Energiewende. This change almost certainly spells disaster for the future of Energiewende. According to a 2012 study conducted by the Leuphana University of Luneburg, nearly half of Germany's installed biogas, wind, and solar capacity was owned by citizens.[196] This has as much to do with the feed-in tariff incentives as it does with the roots of the German anti-nuclear and environmental movements.[197] What was thought to be a monopolistic market at the outset, has grown into a polypolistic German energy market. With recent changes to the feed-in tariff system, however, and its replacement with an auction system, the formerly guaranteed prices of RES investments are no longer. This has caused considerable constraint in future RES investments by cooperatives.[198] The future of citizen participation in the Energiewende, therefore, hangs in the balance.

Citizen participation in Energiewende entails far more than public support. Even at the inception of the policy, Energiewende enshrined the importance of "personal responsibility and ordinary citizens" as the key to the policy's overall success.[199] A large component of what made the Energiewende policy unique was not only its rapid timeline for RES dependency, but also its use of and praise for "bottom-up activism from municipal companies and citizens cooperatives" in support for the low carbon

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[196] Ibid.
[197] Lars Borchert, "Germany Between Citizens' Energy and Nimbyism," *Clean Energy Wire*, March 10, 2015, https://www.cleanenergywire.org/dossiers/peoples-energiewende.
[198] Ibid.
[199] "Energy Concept," *Federal Ministry of Economics and Technology*, 5, accessed January 10, 2018, https://web.archive.org/web/20161006040920/http://www.bmwi.de/English/Redaktion/Pdf/energy-concept%2Cproperty%3Dpdf%2Cbereich%3Dbmwi%2Csprache%3Den%2Crwb%3Dtrue.pdf.

ambition.[200] The power of the average German citizen was most evident in the ownership structure of RES technology in the first years following the launch of Energiewende. By the end of 2010, the first year of the energy transition policy, private citizens, largely cooperatives, owned 40% of Germany's total 53 gigawatts of installed renewable energy capacity.[201] German farmers accounted for an additional 11%, and project developers owned 14%.[202] Energy companies owned a mere 13.5%, while banks and investment funds owned only 11%. Commercial companies, largely the wood sector, owned a total of 9% of Germany's installed renewable energy capacity.[203]

Following changes to the feed-in tariff system, many began to express fear that the auction system would favor more corporate ownership. After the Renewable Energy Act reform passed in January 2017, the German economic and energy ministry issued a statement declaring the desire to continue to ensure a "high level of diversity" in RES ownership, to include citizens' cooperatives. This was cited as one of the three goals of the auction system, the other two being "the ability to plan the energy transition," and "to keep costs down by introducing competition."[204] Through the newly established auction system, cooperatives and small citizen owners face the risk of not only losing the auction, by losing the initial investment cost as well.[205] Many Germans have begun to view the

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[200] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 4, accessed January 16, 2018, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[201] Ibid, 10.
[202] Ibid.
[203] Ibid.
[204] Soren Amelang, "Germany's Energy Transition Revamp Stirs Controversy Over Speed, Participation," *Clean Energy Wire*, June 29, 2016, https://www.cleanenergywire.org/dossiers/reform-renewable-energy-act#climate.
[205] Ibid.

reform as a veiled attempt by the government to assure the survival of large utility companies that have come under attack in recent years.[206] Energiewende, therefore, currently runs the risk of either isolating citizens' cooperatives, historically seen as the backbone of the energy transition policy, or pushing utility companies "over the brink."[207] How well German policymakers can maintain this balance is likely to affect the entire success of Energiewende.

Government Structure

The tension between national targets and the historical decentralized RES ownership structure has led to another anxiety of the energy transition policy. Germany's governmental organization, and in particular the concerning lack of coordination between multi-level governmental structures regarding energy policies. This debate has emerged in the context of Energiewende's most recent modifications. The concern lies within Germany's multi-level policy structure, and the cross-level implementation of energy transition policies. Energiewende arose as a national policy, with national targets. The policy was passed into law in 2010 by the German parliament. Thus, at the inception of the energy transition policy, Germany utilized a top-down strategy of policy. However, the implementation of the policy, including a majority of the RES ownership structure, occurred at the subnational level.[208] This includes the sixteen states of the German Republic, known as the Lander, all of which have crafted additional subnational

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[206] Ibid.
[207] Ibid.
[208] Dorte Ohlhorst, "Germany's Energy Transition Policy Between National Targets and Decentralized Responsibilities," *Journal of Integrative Environmental Sciences*, vol. 12, no. 4, (November 2015): 2, https://doi.org/10.1080/1943815X.2015.1125373.

renewable energy policies.[209] The problem, then, is concerned with whether federal, or national energy transition policies are reinforced by subnational policies. Or, conversely, if such tensions between national and subnational energy policies reveal a disconnect, or misalignment.[210]

The difference in subnational energy policies is due to different subnational, or statewide, concerns and priorities across the country. Germany's federal states face different geographical and demographical structures, which leads to varying priorities. Additionally, some states have sought a key leadership role in the country-wide energy transition, thereby adopting more innovative statewide energy policies.[211] Presently, the current multi-level governance structure of Germany's energy policy is not providing for the necessary incorporation of both national and subnational policies. Such a constraint has led to the reevaluation of the horizontal and vertical governmental and policy elements of the energy transition. Unless changes are made to the current implementation of Energiewende, and its marriage to subnational energy policies and priorities, Germany risks a lack of cohesion in cross-country energy policy adoption that could lead to the destruction of the Energiewende policy.

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[209] "German Legal Research Guide," *University of Wisconsin-Madison Law Library*, accessed January 16, 2018, http://law.wisc.libguides.com/germany.

[210] Dorte Ohlhorst, "Germany's Energy Transition Policy Between National Targets and Decentralized Responsibilities," *Journal of Integrative Environmental Sciences*, vol. 12, no. 4, (November 2015): 2, https://doi.org/10.1080/1943815X.2015.1125373.

[211] Ibid.

Carbon Tax

The future of Germany's energy transition policy also depends upon the country's ability to phase out hydrocarbons. This has led to outcry among many German policymakers for an international carbon tax. The sustained use of hydrocarbons in Germany, particularly lignite and hard coal, continues to abound, due in part to the simple fact that its usage still makes financial sense. This is owing, many argue, to the thus far failure to introduce any meaningful carbon taxation, or national carbon floor price.[212] In 2017, experts estimated that it would take a carbon tax price of 30 euros per ton of CO2 in order for Germany to abandon hard coal in favor of natural gas.[213] A price of 50 euros per ton of CO2 would be necessary in order for Germany to switch from brown coal, or lignite, to gas.[214] Presently, the European Union's Emissions Trading Scheme (ETS) has set the price at 5 euros per ton.[215] Many argue that the implementation of a steeper German carbon tax is the only way to ensure the abandonment of dirty, carbon emitting sources, thereby allowing Germany a chance to meet its intermediate and long-term emissions reduction goals. Such a tax, however, remains a distant dream for many Germans. This is due, in large part, to the political considerations of the German coal industry. Indeed, phasing out coal, as a higher carbon tax would intend to do, carries with it serious political considerations. To begin, Germany is abundant in soft coal, or

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212 "The Future of Germany's Energiewende," *Energy Transition: The Global Energiewende*, July 24, 2017, https://energytransition.org/2017/07/the-future-of-germanys-energiewende/.
213 Craig Morris, "German Renewables Sector Calls for Carbon Tax," *Energy Transition: The Global Energiewende*, February 24, 2017, https://energytransition.org/2017/02/german-renewables-sector-calls-for-carbon-tax/.
214 Ibid.
215 Ibid.

lignite. It is estimated that nearly 5 billion tons of soft coal are accessible in the country, through both existing and planned future mines.[216] Furthermore, the coal industry accounts for roughly 40% of the total energy produced in Germany, and generates over 30,000 jobs.[217]

Germany will likely continue to rely upon lignite and hard coal due to both economic considerations, as well as political ones. Presently, a proposed higher carbon tax has failed to generate momentum both in Germany as well as internationally. The international problem of carbon taxation is clear. Unlike sulfur dioxide, carbon emissions do not stay within national borders.[218] CO2 is a global pollutant, and even proponents of a carbon tax understand the market implications if only certain countries adopt a steep carbon tax. Thus, should Germany adopt a high carbon price, it would only serve to decrease German competitiveness, while making emissions suddenly cheaper in neighboring countries.[219] In order to circumvent such a problem, an international carbon tax would need to be adopted. For Germany, the problem is simple: the slowest countries would drive the timeline.[220] To a country that has adopted the most rapidly paced energy policy ever before witnessed, this is unacceptable.

Without the framework of a significantly increased carbon tax in Germany, the value of coal, and particularly lignite, will persist. The implications of this conundrum are

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[216] Kerstine Appunn, "Coal in Germany," *Clean Energy Wire*, December 5, 2017, https://www.cleanenergywire.org/factsheets/coal-germany.
[217] Ibid.
[218] Alex Trembath and Matthew Stepp, "Why a Carbon Tax is a Bad Idea," *Energy Post*, November 12, 2013, http://energypost.eu/carbon-tax-bad-idea/.
[219] Craig Morris, "German Renewables Sector Calls for Carbon Tax," *Energy Transition: The Global Energiewende*, February 24, 2017, https://energytransition.org/2017/02/german-renewables-sector-calls-for-carbon-tax/.
[220] Ibid.

clear. Energiewende will remain unable to meet its lowered CO2 emissions goal so long as hydrocarbons are still favored. In order for hydrocarbons to fall out of favor in Germany, a steep carbon tax, roughly 50 euros per ton of CO2, would need to be adopted. Following such a steep carbon tax, German policymakers would likely face severe political backlash from the lignite and hard coal industries. Indeed, such political debate regarding the coal industry had led to the continued prosperity of coal in Germany, even after the launch of Energiewende. The variability of renewables has remained a central problem in the energy transition, as Germany has continued to look to the coal industry to fill the gaps left by RES. Until such a choice is no longer politically and economically viable, Germany is likely to continue its reliance upon coal, particularly lignite. This, in turn, will make Energiewende's intermediate and long-term goals for emissions reduction out of reach. Long-term emissions reduction success of Energiewende depends upon an international carbon tax that is years, if not decades, away from universal acceptance and agreement.[221] Thus, it appears the Energiewende policy may have found an unstoppable force upon which it cannot overcome: global politics. As German policymakers continue to focus on intermediate and long-terms goals, in light of impending 2020 target goal failures, the need for reform of Germany's hydrocarbon dependence will come to the forefront of the debate, without any clear potential for resolution.

[221] Germany proposed an international carbon tax rate at the G20 summit meeting in 2017. However, the biggest opponents include the US and China, both of which would have to agree before any international carbon tax would carry meaning.

Potential Flashpoints

The key next steps of the Energiewende policy will require immense infrastructure development throughout the country. This, in turn, has sparked an old but important problem in Germany: the phenomenon known as "Not in my backyard" or Nimbyism.[222] Many observers have begun to wonder if Nimbyism carries with it the potential to thwart the future of Energiewende altogether. As RES ownership data and the decentralized structure of the energy transition reveal, citizen cooperation and support has remained central to the policy's implementation and success. Although large-scale support for Energiewende continues to abound, resistance has formed over various aspects of the policy. Large-scale infrastructure projects, such as grid expansion and the construction of biomass plants across the country, have become a major point of contention in recent years.[223] Sizable wind and solar parks have also been of key concern, as they continue to proliferate across the German countryside.

The concerns regarding future infrastructure development are varied. Many German citizens have expressed concern over plummeting property values, due to close proximity to wind turbines, power masts, or above ground transmission cables.[224] Others cite health and environmental concerns as well as damage to tourist appeal in local economies.[225] Infrastructure development, particularly grid expansion, is seen by many German policymakers and experts as the most crucial step forward, in order for the

222 Lars Borchert, "Germany Between Citizens' Energy and Nimbyism," *Clean Energy Wire*, March 10, 2015, https://www.cleanenergywire.org/dossiers/peoples-energiewende.
223 Ibid.
224 Ibid.
225 Ibid.

country to meet its 2035 target goal of 55% RES power generation.[226] Concerns over grid expansion, however, have been widespread in even the most Energiewende-supportive German states. In 2014, Bavaria was ranked number one in terms of its overall performance in the energy transition.[227] By 2015, however, mass protests had erupted across the state over planned future power lines.[228] Concern over infrastructure, and the next stages of the Energiewende reveal potential cracks in the foundation of the policy. Although the financial costs of Germany's energy transition policy have been debated for some time, the social cost of the policy is just beginning to be felt. Such criticism could have the potential to topple the necessary next stages of the policy before a single additional power line or plant is erected.

Alongside "Nimbyism" resistance to grid expansion, Germany's proposed grid modernization and expansion projects could also prove problematic for the future of Energiewende. As the energy transition policy moves into its next stages of implementation, the success of continued and furthered RES reliance will depend largely upon Germany's ability to make necessary grid adjustments. The current debate on grid expansion has something for everyone. Consumers want to ensure a dependable energy supply, at low prices. Energy suppliers need assurance infrastructure investments will prove to be lucrative. Conservationists need to ensure expansion is environmentally friendly, while locals expect property value protection.[229] Thus, impending grid

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[226] Ibid.
[227] Ibid.
[228] Ibid.
[229] "Grid Expansion in Germany," *Federal Ministry of Economics and Technology*, August 2014, accessed January 16, 2018, https://www.netzausbau.de/SharedDocs/Downloads/EN/WhatyouneedtoknowBrochure.pdf?__blob=publicationFile.

expansion will face a litany of social and political problems, as well as logistical complications.

Currently, the future of RES development and dependence relies upon expansion of the high-voltage transmission grid, as well as updates to the low-voltage distribution grid system.[230] Apart from being a costly proposition, both expansion to the transmission grid, and modernization of the distribution grid will require country-wide support. Additionally, Germany has historically endured problems with infrastructure realities running contrary to environmentally ambitious policies.[231] Before the genesis of Energiewende, Germany had already begun to confront problems with its grid system. Technical complications, mixed with political realities and local "Nimbyism" pushback has proven to be a lethal combination for proposed grid modernizations in the past. Germany has yet to prove it has a solution to such problems, further risking the future success of the energy transition policy.

The Energiewende is currently in transition. With the 2020 targets goals approaching, and the likely failures of two policy objectives, Germany's next steps will be critical to the survival of the energy transition policy. Policymakers have begun to rethink many of the original constructs of the policy including the feed-in tariff, RES ownership structure, and carbon taxation. The decision to replace the original feed-in tariff system with an auction system in 2017 has been one of the most drastic alterations of the origins of the Energiewende policy. This reform is likely to alter the ownership

[230] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 11, accessed January 16, 2018, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[231] Ibid, 19.

structure of RES contracts, favoring large industry and companies over citizens' cooperatives. Such a change is likely to alter public support for the future of the policy. Lack of public support for Energiewende would be a devastating blow to the policy, as it has been recognized for its decentralized RES supply structure and diverse ownership. Energiewende also risks the long-term policy goal failures associated with decreased greenhouse gas emission levels. The continued use of coal, particularly lignite, in Germany, has heightened the possibility of a new wave of Energiewende policy failures. Presently, many German politicians are calling for an international carbon tax. However, such an international taxation system is still many years away from adoption. In order for Germany to meet its long-term emissions reduction goal, its cost-effective domestic lignite production would need to face a much steeper financial penalty for its CO_2 emissions. Until an international carbon tax can be adopted, this is unlikely.

Aside from the likely 2020 target goal failures, Energiewende's most pressing potential flashpoints lie in "Nimbyism" phenomenon, conceivable loss of public support, and technical complications associated with infrastructure developments. The next steps of Energiewende implementation require immense infrastructure development across Germany. This includes grid expansion and construction of wind and solar parks as well as biomass plants. Local pushback for such planned future developments has come from a variety of groups including homeowners fearful of dwindling property values, and conservationists fearful of environmental impacts. Thus, at the outset of Energiewende's next key steps, public support is nowhere near assured. Technical and financial risks are also involved in the next phase of infrastructure development, as both the transmission grid and the distribution grid are slated to be difficult and costly.

Altogether, the future ahead for Energiewende is riddled with strife. The most pressing issues will involve the infrastructure development needed to propel the policy forward in accordance with its intermediate and long-term goals. Public support has proven to be a key pillar of the energy transition policy, but recent pushback and local protests reveal discontent with the recent changes and planned future installations. Citizens concerned over Energiewende's new auction-based contract system, declining property values associated with infrastructure development, and the continued use of lignite allude to a difficult road ahead for Germany's energy transition. Government structure in Germany, as well as the contentious debate regarding an international carbon tax are also premier problems for Energiewende and Germany's ability to meet both intermediate and long-term policy goals. Thus, it appears both the 2020 target goals, as well as the intermediate and long-term policy aims of Energiewende, are at risk for disappointment. This disappointment, in turn, is likely to occur both domestically and across the EU as a whole. The next chapter will discuss the implications an Energiewende intermediate and long-term policy failure could have upon the EU, as well as strategic implications for Germany going forward.

CHAPTER FIVE

STRATEGIC IMPLICATIONS OF ENERGIEWENDE AND THE FUTURE OF ENERGY SECURITY IN GERMANY AND THE EU

The future of Energiewende will likely reflect the future of energy policy and security in Europe. As Germany continues its vulnerable march toward a renewable energy transformation, its success or failure will render consequences both within and beyond the German border. If Energiewende proves it cannot successfully transition Germany into a low-carbon economy, the abandonment of the energy transition policy will come with its own challenges. Such challenges will include the future of supply security in Germany, and the EU, as well as EU decarbonization policies, energy diversification prospects, and diminished flexibility in both German and EU-wide foreign and defense policies. Thus, while the domestic implications of Energiewende as have previously been analyzed are of vital importance, also critical to the policy are the ways in which Energiewende can alter the landscape of energy security throughout Europe – for either better or worse.

The strategic implications of the possibility of an Energiewende failure are vast. Such a policy failure could lead to problems for Germany and Europe as a whole. The energy transition was intended to not only solve environmental concerns relating to climate change, but was also meant to signal an era of possibility. The possibility of clean energy independence. Should Energiewende fail, the landscape of both European clean energy and energy security would be in peril. Furthermore, landscape changes in energy security could further upset the presently fragile balance of energy supplier relations in

Europe. An increasingly aggressive Russian Federation can be seen as being emboldened by its current assurance of regional importance as a key energy supplier. Should Energiewende fail to signal to other European nations the possibility of decreased foreign reliance, Russia is likely to continue to maintain its regional stronghold as the key supplier. Such a stronghold, in turn, is likely to allow the Russian Federation to broaden its regional footprint and widen its sphere of influence, as its EU neighbors continue to be constrained from responding due to energy dependency. Alongside climate concerns, the cardinal threat in energy policy facing the Eurozone today is the continued dependency on Moscow for their energy future. This, in turn, means that energy security in Europe is not just an economic or environmental issues – it is also an issue of national security for Germany as well as the EU. Energiewende's culpability in how a policy can effectively offer a counter to Russian energy dependency, therefore, will be vast.

An Energiewende failure will also impact the future of energy policy and security in the EU. Since 2010, all eyes have focused upon Germany to behold whether a nation can successfully transition away from foreign imported hydrocarbons, into a low-carbon economy without the aid of nuclear energy. Accordingly, German politicians and policymakers have stressed the possibility of Energiewende as an international model for energy transition policies.[232] If Energiewende proves it is unable to export Energiewende to the EU, many member states will be forced to reevaluate current and future climate change goals and policies, as well as their likely impact on domestic energy security and

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[232] Soren Amelang, "Energy Transition Shapes Foreign Policy in Germany and Beyond," *Clean Energy Wire*, July 8, 2015, https://www.cleanenergywire.org/dossiers/energiewende-and-its-implications-international-security.

supplier security. Altogether, the German Energiewende has been tasked with two distinct burdens: transitioning Germany's energy policy and economy, as well as setting the tone for the future of EU-wide energy policies. Accordingly, the implications of Energiewende's success or failure, and its likely impact on the future of EU energy security, are vital to consider.

Energiewende and German Foreign and Defense Policy

The outcome of Energiewende will not only affect Germany's economic and energy policies, but its foreign policy as well. Although the debate surrounding Energiewende at the time of its launch in 2010 centered largely on domestic and environmental concerns, the scope of the debate, and the implications of Energiewende widened beginning in 2014. In many ways, 2014 was a watershed year for Europe. Heightened Russian aggression, evidenced by the annexation of Crimea and tensions in Ukraine, caused many European countries to increasingly question Russian energy and supply dependency. Following concerns of foreign import reliance, Energiewende began to take on a new, important role in German policy. In March 2014, the German Minister of Foreign Affairs, Sigmar Gabriel, described the Energiewende as a "global project" that will "enable us to reduce our dependence on oil and gas imports while reaching our climate change targets."[233] The impact of Energiewende was no longer limited to energy policy and climate change, but to international relations as well.

The relationship between Germany's supply security and Energiewende has remained of central importance to energy transition advocates. Energiewende has been

[233] Ibid.

called the "strategic imperative" for German supply security, through its emphasis on diversification and decreased foreign dependency.[234] In 2011, a study was undertaken for Germany's Armed Forces, the Bundeswehr, outlining the environmental dimensions of security.[235] The authors of the report recommend "a quick rollout of renewable energy" in order to gain "more leeway in foreign policy."[236] Although Germany has historically maintained good relations with Russia in accordance with its oil and gas needs, recent years of increased aggression by the Russian Federation has led even countries such as Germany to reconsider the implications of the future of its supply security. Energiewende has been seen in recent years as one of the most promising policies regarding Germany's foreign policy vis-à-vis Russia. By advocating for a decreased need of foreign hydrocarbon imports in the near future, Energiewende carries with it the potential for greater German foreign policy flexibility vis-à-vis the Russian Federation. Relatedly, should Energiewende fail, Germany will be faced with the prospect of continued or increased foreign reliance on Russia for hydrocarbons. As recent years have shown an increase in Russian willingness to engage and heighten regional tensions, an Energiewende failure would prevent Germany from taking stronger defense stances against the Russian Federation, in order to maintain supply security for foreign energy imports.

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[234] Ibid.
[235] Ibid.
[236] Soren Amelang, "Energy Transition Shapes Foreign Policy in Germany and Beyond," *Clean Energy Wire*, July 8, 2015, https://www.cleanenergywire.org/dossiers/energiewende-and-its-implications-international-security.

Energiewende and Russia

Since the launch of the Energiewende policy in 2010, the role of Russian influence in German energy policy has been a point of concern. German government officials with unusually close ties to the Kremlin, as well as the Nord Stream 2 project's volatile history of policymaker support in Germany, has led to questions surrounding Energiewende's prospects for success. While Germany enjoys a relatively stable relationship with Russia, exemplified by pipeline cooperation and import price stabilization, some have begun to wonder if this stable relationship between the two European powers is undermining the Energiewende. Following the 2018 election and coalition between the Social Democratic Party (SDP) and the Christian Democratic Union (CDU), the controversial Nord Stream 2 undersea pipeline connecting Russia to Germany has gained new life and support. This is due, in large part, to the Social Democratic Party's stance that deepened economic ties with Moscow can diffuse tensions between the East and West.[237] Indeed, the SDP has a history of advocating for natural gas contracts between the two countries dating back to the 1970s.[238] In March 2018, the German maritime authority, the Federal Maritime and Hydrographic Agency, approved of the construction and operation for the pipeline to go forward.[239] Although the future of the pipeline project remains uncertain, the renewed support for Nord Stream 2 in

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[237] Matthew Karnitschnig, "Germany Revives Putin's Pipeline Dream," *Politico*, December 26, 2017, https://www.politico.eu/article/germany-revives-putins-pipeline-dream/.
[238] Ibid.
[239] "Germany Fully Approves Russia-built Nord Stream 2 Gas Pipeline," *Reuters*, Match 27, 2018, http://www.hurriyetdailynews.com/germany-fully-approves-russia-built-nord-stream-2-gas-pipeline-129381.

Germany appears to run contrary to the energy transition model outlined in Energiewende, which advocates for low carbon, energy independence.[240]

The renewed support for the Nord Stream 2 project in Germany has exposed additional concerns regarding German government officials and their connections to Russian energy companies. In August 2017, former Chancellor Gerhard Schroder accepted a position as an independent director on the board of Rosneft, Russia's largest oil company.[241] Additionally, Schroder has also been a board member of Russian associations where Gazprom, Russia's government-controlled gas giant company, is either "the majority or sole shareholder."[242] Furthermore, in October 2017, Schroder was appointed chairman of Nord Stream 2, which is led by Russia's Gazprom.[243] While Schroder no longer plays an active role in Germany's government, he is far from a fringe figure. In June 2017, Schroder gave a speech at the Social Democratic Party convention that was well-received by fellow party members.[244] The speech was rebutted by the Chairman of the German parliament's foreign affairs committee, Norbert Rottgen, who made a statement denouncing Schroder's recent roles in Russian energy companies. He

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[240] The uncertainties of Nord Stream 2 will be discussed below in the section entitled "Russian Energy and the EU."
[241] Rick Noack, "He Used to Rule Germany. Now, He Oversees Russian Energy Companies and Lashes Out at the U.S.," *The Washington Post*, August 12, 2017, https://www.washingtonpost.com/news/worldviews/wp/2017/08/08/he-used-to-rule-germany-now-he-oversees-russian-energy-companies-and-lashes-out-at-the-u-s/?utm_term=.ec3fc2dd3b98.
[242] Ibid.
[243] Judy Dempsey, "Schroder's Unswerving Loyalty to Putin," *Carnegie Europe*, October 3, 2017, http://carnegieeurope.eu/strategiceurope/73281.
[244] Rick Noack, "He Used to Rule Germany. Now, He Oversees Russian Energy Companies and Lashes Out at the U.S.," *The Washington Post*, August 12, 2017, https://www.washingtonpost.com/news/worldviews/wp/2017/08/08/he-used-to-rule-germany-now-he-oversees-russian-energy-companies-and-lashes-out-at-the-u-s/?utm_term=.ec3fc2dd3b98.

declared that, “Schroder’s involvement won’t improve relations between Germany and Russia. On the contrary it will strain them. If he thinks he wants to ensure energy in Germany, then I consider that a bad joke since he will be increasing Germany’s dependence on Russia.”[245]

Although there is little evidence to support any corruption playing a decisive role in the lack of Energiewende’s target goal successes, there remain warranted concerns regarding the nature of German-Russian relations. Particularly the inherent contradiction between Energiewende’s outlined energy goals, and continued reliance on Russia for natural gas. The Nord Stream 2 pipeline project, as well as continued and deepened natural gas ties between Russia and Germany, reveals an inherent paradox between the Energiewende’s long-term goal of clean energy independence, and the geopolitical reality in which Germany currently finds itself. Concerns also include the ability of the Russian Federation to continue to exert its energy influence in the region aided by Germany’s continued cooperation through pipeline projects and gas contracts, and the inability of other EU member nations to effectively distance themselves from energy giants in Moscow vis-à-vis Berlin. The EU’s ability as a whole to decrease its energy dependency upon Russia lies at risk in the face of continued natural gas cooperation between Germany and Russia, regardless of Energiewende target goals and strategic aims.

[245] Judy Dempsey, “Schroder’s Unswerving Loyalty to Putin,” *Carnegie Europe*, October 3, 2017, http://carnegieeurope.eu/strategiceurope/73281.

Energy Diversification in the EU

Europe is looking for a way out of its current energy crisis. Presently, the continent imports over half of the energy it consumes.[246] This supply has been characterized in recent years by regional instabilities and economic shocks that have proven energy to be Europe's foremost security issue. Collectively, the European Union nations have striven to advance energy policies in recent years aimed at solving such a crisis. The EU has centered largely on two main goals as a strategy to combat current energy problems: diversification and decarbonization. Diversification refers to both diverse suppliers as well as diverse sources. Decarbonization, meanwhile, has taken hold in various EU countries, pursuing low-carbon energy policies and phase outs of hydrocarbons. No national policy better encompasses both of these goals as Germany's Energiewende. The Energiewende seeks to diversify energy sources through a shift to RES, while eliminating fossil fuels and pursuing a low-carbon economy for Germany in the near future. The problem, then, is simple: the failure of Energiewende as a whole could signal to Europe the unlikely future success of its diversification policy goals. Such a failure could, in turn, cause an EU-wide splinter over the future of energy policy, further damaging the European alliance at a moment of key vulnerability for the Union.

As Europe continues to watch Germany, the potential failure of Energiewende could signal trouble ahead for EU and non-EU states seeking their own energy transition and environmental policy. States seeking similar nuclear phase outs could hesitate, if RES prove to be an unreliable gap fill. Currently, Energiewende has proven to be an

[246] Rafael Leal-Arcas, *The European Energy Union* (London: Claeys & Casteels, 2016): ISBN: 9789491673450.

option only available to the wealthiest countries. For many CEE nations, the energy transition has already been labeled a non-starter. For those still awaiting results before deciding, the approaching 2020 target failures are likely to further dissuade. An Energiewende policy failure could also signal to Central and Eastern European states the need for continued foreign reliance on coal, oil, and natural gas. A persistent European-wide reliance upon oil and gas, consequently, will mean the continued dominance of Russia as a regional supplier. Accordingly, should Germany's energy transition fail, Europe's dominant energy supplier, Russia, is likely to remain of central importance to EU countries. The continued reliance upon Moscow for oil and natural gas has been seen in recent years as the heart of the energy crisis, and a key source of regional instability and turmoil.

However, if Germany is unable to launch a successful turn away from Russian energy, this could signal to other EU nations, particularly Central and Eastern European states, the need for continued dependence upon Moscow. Following the 2014 Russian annexation of Crimea, and military involvement in separatist movements in eastern Ukraine, the Oxford Institute for Energy Studies launched a study intended to analyze regional options for reducing European dependence on Russian energy. The results of the study were not encouraging. The authors found that the majority of European countries possess a "limited scope" to reduce reliance on Russian gas, to the extent that it is "replaced by coal power generation."[247] Further troubling, some countries in both the Baltic region and south-eastern European states are likely to remain "extremely

[247] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 7, accessed December 23, 2017, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.

vulnerable" to Russian energy dependency and potential interruptions into the 2020s.[248] The report ended its conclusions by stating that regardless of its geopolitical situation, Russia, the EU, and individual European nations will face a "necessary continued natural gas relationship" based on current Gazprom contracts, and the foreseeable future of Europe's energy needs.[249]

Germany's Energiewende was one European response to the circumstances noted in the Oxford Institute for Energy's 2014 study. However, despite the Oxford Institute report's findings, several Central and Eastern European have begun to seek alternative sources of energy, as well as means to block Russian energy dominance throughout the continent. Although Germany has approved of the Nord Stream 2 pipeline, the battle over the pipeline represents the variety of EU attitudes regarding Russian gas supply to the region. Since the inception of the gas line set to run parallel with Nord Stream 1, Nord Stream 2 has caused an uproar in the Union. To begin, the project led by Russian gas company Gazprom, involves not only Germany but Denmark, Finland, and Sweden as well.[250] This is due to the necessary building permits that each country must agree to for the pipeline to run across the Baltic Sea.[251] The pipeline, and more importantly its operators, must also adhere to European Union law in accordance with energy and environment regulations.[252] Among the most concerning aspects of the Nord Stream 2

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248 Ibid.
249 Ibid.
250 "The National and European Politics Behind Nord Stream II," *Vote Watch Europe*, accessed April 17, 2018, http://www.votewatch.eu/blog/the-national-and-european-politics-behind-nord-stream-ii/.
251 Ibid.
252 Maros Sefcovic, "Nord Stream II – Energy Union at the Crossroads" (speech, European Parliament, Brussels, April 6, 2016), http://europa.eu/rapid/press-release_SPEECH-16-1283_en.htm.

project for many CEE nations is the pipeline's bypassing of Ukraine. Many EU member states, including Estonia, Italy, Latvia, Lithuania, and Poland, have expressed vehement opposition to the project on the grounds that it violates the EU's energy vision.[253] CEE critics of the pipeline also argue that Nord Stream 2 will increase the region's dependency on Russian energy, expose the region to political pressures and gas cutoffs, and damage Ukrainian revenue in transit fees.[254]

In addition to Nord Stream 2 opposition, several Central Eastern European nations have sought energy diversification methods that alienate the Russian Federation. In August 2017, Lithuania became the first "ex-Soviet state" to buy US gas.[255] The following year in November, Poland signed a five-year natural gas import deal with the United States.[256] These victories follow in the wake of the shale gas boom in the U.S., and the country's newfound ability to export gas at economically competitive prices – a significant feat in recent years.[257] Such CEE diversification continues to be made possible by the new and planned gas terminals throughout the region, which seek to increase

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[253] "Opposition to Russia's Nord Stream Pipeline Growing in Eastern Europe," *Radio Free Europe*, March 9, 2018, https://www.rferl.org/a/opposition-growth-eastern-europe-russia-nord-stream-2-pipeline-germany-baltic-sea-lithuania-estonia-latvia/29087938.html.
[254] Ibid.
[255] David Sheppard, "Lithuania Becomes First Ex-Soviet State to Buy US Natural Gas," *Financial Times*, August 21, 2017, https://www.ft.com/content/33113758-8680-11e7-8bb1-5ba57d47eff7.
[256] Timothy Cama, "Poland Signs 5-Year US Natural Gas Import Deal," *The Hill*, November 21, 2017, http://thehill.com/policy/energy-environment/361413-poland-signs-5-year-us-natural-gas-import-deal.
[257] David Sheppard, "Lithuania Becomes First Ex-Soviet State to Buy US Natural Gas," *Financial Times*, August 21, 2017, https://www.ft.com/content/33113758-8680-11e7-8bb1-5ba57d47eff7.

interconnectivity, particularly in the Baltic region.[258] Germany's Energiewende, therefore, does not hold the monopoly on European energy policies that seek to reduce Russian energy influence in the region.

At first glance, Germany's Energiewende appears to outline a contradictory approach to energy independence and Russian gas imports. The energy transition outlines a future of low-carbon, energy independence for Germany, but expects gas demand for power production to peak around 2025.[259] Only after, it is theorized, can wind and solar technology replace LNG.[260] Thus, although Germany has continued to express its desire for Russian gas imports, most notably through the Nord Stream 1and 2 pipeline projects, its national energy strategy still aims to produce 80% of its energy from RES by 2050.[261] The problem, then, lies in the future of Energiewende, should the policy fail. More specifically, how the intersection of perceived Russian cooperation in Nord Stream 1 and 2, and the Energiewende policy of diversification and energy independence, will affect German energy security.

If Germany is unable to meet its long-term goal of 80% RES by 2050, it will face a continued reliance upon Russian LNG to fill the gap left in its energy needs that it was unable to develop through increased RES. This future projection seems not only likely, but imminent following the March 2018 Federal Maritime and Hydrographic Agency's

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[258] Simon Hoellerbauer, "Baltic Energy Sources: Diversifying Away from Russia," *Foreign Policy Research Institute*, June 14, 2017, https://www.fpri.org/article/2017/06/baltic-energy-sources-diversifying-away-russia/.
[259] Weixin Zha and Anna Shiryaevskaya, "Germany is Addicted to Russian Gas," *Bloomberg*, July 4, 2017, https://www.bloomberg.com/news/articles/2017-07-03/german-addiction-to-russia-gas-raises-alarm-in-merkel-s-backyard.
[260] Ibid.
[261] Ibid.

approval of the construction and operation of Nord Stream 2. Such a move is likely to signal to other European countries their own continued dependency upon Russian energy imports, or the likely failures that await them should they pursue policies that seek to forgo Russian energy. Even more troubling, European countries unable to turn to large-scale RES development due to cost constraints, but still desirous of a decreased dependency on Russian gas, are likely to look instead to increased coal use, as the Oxford study reported. The continued and increased use of dirty, CO2 emitting sources, such as coal, in some European countries is likely to cause a future splinter in the EU as its decarbonization goals risk continent-wide failure. Such a potential future splinter in EU policy also involves conflicting views on Russian oil and natural gas supply to the region, and the potential geopolitical and national security implications for the Union. Thus, EU cohesion surrounding its energy policies is at risk should energy independence and Union-wide decarbonization prove illusive.

Decarbonization in the EU

Decarbonization has remained a central European Union energy policy pillar since the turn of the millennium. The EU has striven to take a leadership goal in climate change policies for nearly five decades, and has adopted internal and external energy policy initiatives including the UN Framework Convention on Climate Change and the Kyoto Protocol.[262] Both the Third Energy Package and the Roadmap 2050 strategy envisioned decarbonization objectives for the EU. The 2030 framework adopted by the

[262] Claire Dupont and Sebastian Oberthur, "Decarbonization in the EU: Setting the Scene," in *Decarbonizatoin in the European Union: Internal Policies and External Struggles* (London: Palgrave Macmillian, 2015): 17, DOI: 10.1057/97811137406835.

European Council in October 2014 includes the ambition for the EU to pursue a 40% reduction in greenhouse gas emissions from 1990 levels by 2030.[263] This was followed by the 2015 Paris Agreement. Although the EU has outlined key decarbonization goals, Germany's Energiewende policy has charted the most far-reaching and fast-paced decarbonization goals. Through its energy transition policy, Germany has sought a leadership role within the European Union. By attempting to surpass the EU-wide emissions reduction rate in nearly half the time, Germany has striven to prove that not only is decarbonization attainable, but rapid decarbonization can be achieved.

Germany's rapid decarbonization aim, outlined in its emissions reduction goals as well as its RES dependency targets, is a key distinguishing feature of Energiewende. Presently, Germany is not on track to meets its 40% emissions reduction goal by 2020. This is due to a multitude of factors, including the continued use of hard coal and lignite, as well as the intermittency problem of renewables.[264] If Germany is unable to meet its climate targets regarding greenhouse gas emissions, it not only risks its reputation as a global climate leader, but its failure could also impact European climate cohesion as a whole. Although decarbonization has grown in popularity throughout Europe in recent years, numerous EU and non-EU member states have continued to pursue energy policies that outline extensive fossil fuel dependency. A 2017 survey revealed that a total of eleven European countries presently provide subsidies totaling over 80 billion euros

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[263] Kacper Szulecki "European Energy Governance and Decarbonization Policy: Learning from the 2020 Strategy," *Climate Policy*, vol 16, (2016), https://doi.org/10.1080/14693062.2016.11811599.
[264] Kerstine Appunn, "Germany's Greenhouse Gas Emissions and Climate Targets," *Clean Energy Wire,* February 1, 2018, https://www.cleanenergywire.org/factsheets/germanys-greenhouse-gas-emissions-and-climate-targets.

annually to fossil fuel industries.[265] They included: Czech Republic, France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Spain, Sweden, and the UK.[266]

Presently, there is no single EU-consensus regarding the future of decarbonization policies, and individual state implementation. Energiewende's failure could do more than just discourage European countries still undecided about future decarbonization policies. An Energiewende failure could also further threaten to splinter EU attitudes regarding fossil fuels and low-carbon economies. Such a splinter, in turn, could lead to a massive shift in EU energy policies as well as the future of Union relations as a whole. If Germany fails to meet its emissions reduction target goals, it could also signal just how far off a low carbon economy could be for Europe. This, in turn, risks a reevaluation of European Commission energy policies, including the 2030 framework as well as the Roadmap 2050. Following recent Union-wide disagreement regarding the refugee crisis as well as taxation, and regulatory overreach, energy may be one of the last areas whereby consensus in the Union could be reached. An Energiewende failure risks this potential EU energy policy cohesion.

EU Energy Policy Going Forward

In addition to alliance cohesion problems, the EU also faces policy agreement barricades. This is due to the nature of the Union as a multi-nation body, and what is

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[265] Fiona Harvey, "European Countries Spend Billions a Year on Fossil Fuel Subsidies, Survey Shows," *The Guardian*, September 28, 2017, https://www.theguardian.com/environment/2017/sep/28/european-countries-spend-billions-a-year-on-fossil-fuel-subsidies-survey-shows.

[266] Ibid.

known as the "plurality of actors problem."[267] The most recent expansion of the EU in 2004 saw the addition of predominately Eastern European states to the Union. This, in turn, added a layer of complexity to EU energy policy. Generally, Western EU member states have had a far different relationship with regional suppliers, pipeline connectivity, and LNG contracts than their Eastern EU counterparts. Historically, Western EU member states have seen the healthy development of a regional gas market to include storage facilities, pipeline infrastructure, and "regasification terminals" which allow for uninterrupted gas supplies to the region.[268] This integrated market, in part, is one of the key reasons Germany can continue to reliably depend upon Russia for its LNG supply, before wind and solar are slated to take over. In Central and Eastern EU states, however, a vastly more complex picture of energy persists.

Eastern gas markets have been slower to integrate. This stems from both geographical and geopolitical considerations. CEE EU states do not bolster nearly the infrastructure support necessary for an integrated gas market as Western European EU states. Accordingly, it has made sense for countries in the region to turn to the nearest local exporter, Russia, to supply its modest amount of gas demand.[269] However, this has not been without significant geopolitical consequence. Both Ukraine and Belarus have a history of gas disputes with the Russian Federation, dating back to 2006. The argument, particularly between Russia and Ukraine, has led Moscow to sporadically cut off all gas

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[267] Rafael Leal-Arcas, *The European Energy Union* (London: Claeys & Casteels, 2016): ISBN: 9789491673450.
[268] Tim Boersma, "Europe's Energy Dilemma," *Brookings*, June 18, 2014, https://www.brookings.edu/articles/europes-energy-dilemma/.
[269] Ibid.

supplies to the country three times in eight years.[270] Under these conditions of a lack of supplier competition, arbitrary pricing has become "the rule more than the exception."[271] Instead, coal markets, and to a lesser extent oil markets, have reigned in Central and Eastern Europe. Against a backdrop of a particularly Western European trend toward decarbonization, and the historical and continued reign of coal in Eastern Europe, it is reasonable to assess EU energy policy as an intricate maze.

Today, Western EU states approach energy policy and security from a far different vantage point than their Eastern neighbor member states. This difference in approach and outlook has made Union-wide energy policy adoption tremendously difficult for the European Commission. Germany's Energiewende is foremost a reflection of Western EU energy policy and geopolitical positioning. The energy transition can comfortably rely on Russia for much of its continued gas import, due in large part of the well-integrated regional gas market. Decarbonization is seen as more attainable, due to the financial capability of the German economy – the fourth largest in the world. Diversification of sources, including the phase out of nuclear energy, has led to the massive growth of RES technology and power generation in the last ten years. Energiewende, then, is purely Western European in nature. The potential failure of the energy transition policy, therefore, runs the risk of expanding the divide in the EU on energy policy and security. Indeed, should Germany's energy transition fail, many Central and Eastern EU member states will be better able to assert the disconnect

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[270] Jack Farchy, Roman Olearchyk, and Christian Oliver, "Russia Cuts off Gas Supplies to Ukraine," *Financial Times*, June 16, 2014, https://www.ft.com/content/db64d8f8-f522-11e3-afd3-00144feabdc0.
[271] Tim Boersma, "Europe's Energy Dilemma," *Brookings*, June 18, 2014, https://www.brookings.edu/articles/europes-energy-dilemma/.

between EU energy policy goals and geopolitical realities. Furthermore, an Energiewende failure could reveal to Western EU nations the danger in seeking a fast-paced decarbonization policy. This has been one of the key points of agreement among Western EU nations in recent years. A disparity of interests, politics, and outlooks exist in the European Union. Recent years have seen major changes to the Union, including the UK decision to leave, and formidable disagreements regarding social and economic policies. Should Energiewende fail, energy policy may soon be the next great point of divide in the EU.

EU Foreign and Defense Policy Implications

In November 2016, the European Union leaders met and agreed on a new EU Global Strategy. The new strategy sought to replace the previous one dating back to 2003, and highlighted key changes in the threat environment, as well as new responses to them. Among the most notable differences between the two strategies is the marked change between the former security environment that was boasted as evidence of "prosperity, security, and freedom," to the new realization of increasing global instabilities.[272] Also noteworthy, is the EU's decision to link the new threat environment with "managing climate risk and the global energy transition."[273] The designation of climate change risk as a security and defense concern echoed the Obama Administration's 2013 Climate Action Plan, and United States 2014 Quadrennial Defense

[272] "Success of EU Foreign Policy Hinges on Climate and Energy Security," *Energy Transition: The Global Energiewende*, October 12, 2016, https://energytransition.org/2016/10/success-of-eu-foreign-policy-hinges-on-climate-and-energy-security/.
[273] Ibid.

Review, both of which concluded that impacts of climate change are "threat multipliers."[274] Defense and security policies have finally caught up with the energy crisis being felt across Europe. In particular, the 2016 EU Global Strategy highlighted the connection between EU member states facing governmental, economic, and energy fragility, and outlined the potential for disruption in such areas as important a consideration as terrorism and hybrid threats.[275] The need for a so-called "energy development and transition" across the EU speaks to the vitality of energy policies, as well as their inherent connection between supply security, and defense and foreign policy.[276]

The outcome of Energiewende, therefore, will impact a variety of issues beyond energy policy in Europe. If Energiewende can successfully transition into a low-carbon economy, many wealthy European nations are likely to follow suit. Some analysts argue that although at the outset this appears positive, the potential for such a large-scale change in dependency could "profoundly alter global power relations."[277] However, if Energiewende fails to prove the viability of a low-carbon economy across the EU, what has at times been called "mutual dependencies" or "foreign dependencies" on Russian oil and gas, will continue to abound.[278] This too carries with it potential consequences for the

[274] Kathryn Archer and John P. Banks, "American and German Approaches to Energy-Climate Policy," *Brookings*, June 11, 2014, https://www.brookings.edu/articles/american-and-german-approaches-to-energy-climate-policy/.
[275] European Commission, "European Union Global Strategy," June 2016, 12, https://eeas.europa.eu/archives/docs/top_stories/pdf/eugs_review_web.pdf.
[276] Ibid.
[277] Soren Amelang, "Energy Transition Shapes Foreign Policy in Germany and Beyond," *Clean Energy Wire*, July 8, 2015, https://www.cleanenergywire.org/dossiers/energiewende-and-its-implications-international-security.
[278] Ibid.

EU. By continuing to rely upon Russia for oil and gas imports, EU member states, particularly Central and Eastern European nations, face a distinct disadvantage in foreign and defense policy flexibility vis-à-vis Russia. As recent years have shown, and as encapsulated by the EU's 2016 Global Strategy, the threat environment in Europe includes newfound aggressions previously unseen since the Cold War.[279] As broad security and defense reviews in recent years have begun to reflect, the inherent relationship between energy security, and supply security in particular, cannot escape consequence in defense and foreign policy. Should Energiewende fail, the EU as a body would face increasingly limited response options in light of newfound regional instabilities and aggressions emanating from Moscow.

The Future of Energy Security in Europe

The future of energy security in the EU will depend upon the future of the Union itself. The integration of Europe has been a shining success of the twenty-first century. The EU has evolved over time to include twenty-eight nations. The Union has sought a closer incorporation of markets in recent years, including its energy market. Over the course of its existence, the EU has seen political and economic globalization that has at times strengthened, and at times weakened the Union.[280] As the EU continues to face disagreements and membership debates, many have begun to wonder if the future of the Union is in peril. Indeed, many scholars in recent years have begun analyzing the so-

[279] European Commission, "European Union Global Strategy," June 2016, 10, https://eeas.europa.eu/archives/docs/top_stories/pdf/eugs_review_web.pdf.
[280] Jan Techau, "Four Predictions on the Future of Europe," *Carnegie Europe*, January 12, 2016, http://carnegieeurope.eu/strategiceurope/62445.

called "end" or "death" of Europe.[281] This includes member states divergences regarding immigration policies, foreign and defense policies, and the recent surge of populist parties and movements across the continent.[282] The EU has witnessed five major challenges in particular since the unveiling of the Europe 2020 strategy. These include: the UK June 2016 vote to leave the Union, the Greek debt crisis and Eurozone anxieties, a resurgent Russia, the ongoing migrant and refugee crisis, and an increased threat of terrorism.[283] Within this framework of panic, energy security and policy occupies a quiet concern. However, the success or failure of Germany's Energiewende may hold the key to the future of EU cohesion going forward.

If the EU as a whole can achieve its Union-wide decarbonization goals, it will be due in large part to nuclear energy. The growth of renewables in Europe has been dramatic in recent years. However, the continued use of coal, particularly lignite, in many CEE states places the EU emission reduction goal at risk. Furthermore, many Eastern EU nations simply do not possess the necessary capital to grow RES technology at the rate which Germany has exemplified. Feed-in tariff mechanisms, and massive state subsidies are not yet an option across the continent. Indeed, for every European state that has denounced nuclear energy, a different nation has reinvested in its own nuclear energy

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[281] Including, most notably James Kirchick's *The End of Europe* as well as Douglas Murray's *The Strange Death of Europe.*

[282] Cas Mudde, "Europe's Populist Surge," *Foreign Affairs*, November 3, 2016, https://www.researchgate.net/publication/309643775_Europe's_Populist_Surge_A_Long_Time_in_the_Making.

[283] U.S. Library of Congress, Congressional Research Service, *The European Union: Current Challenges and Future Prospects*, R44249 (2017).

programs. Currently, fourteen EU nations house operating nuclear reactors.[284] Seven EU member states are generally cited as pro-nuclear, or strong-nuclear states: France, Lithuania, Poland, Romania, Slovakia, Slovenia, and the UK.[285]

Conversely, the strongest opponents of nuclear energy in the EU include: Austria, Germany, Greece, and Italy.[286] Germany's decision to pursue an energy transformation without the aid of nuclear energy has been criticized by numerous EU member states that have chosen to continue nuclear energy programs after the 2011 Fukushima accident. If Energiewende proves it is unable to implement a successful energy transition without nuclear energy, EU states that have also launched denuclearization policies and programs may reconsider. Furthermore, anti-nuclear states seeking decarbonization policies, or similar domestic energy transitions, may see a shift in public attitudes or national policies regarding nuclear attitudes. States that continue to pursue decarbonization policies without the aid of nuclear energy, in the wake of an Energiewende failure, are likely to face continued or enhanced criticism from pro-nuclear EU member states. This, in turn, would likely further the EU divide over the contentious nuclear energy debate.

In addition to a growing difference in nuclear energy attitudes, coal faces an uncertain future in Europe. Coal has remained an essential component to the industrialization of Europe over the centuries. Today, a total of nine EU countries do not yet have a coal phase out plan under discussion: Bulgaria, Croatia, Czech Republic,

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[284] "EU Countries Pro and Against Nuclear," *Association of the Accredited Public Policy Advocates to the European Union*," April 25, 2016, accessed February 10, 2018, http://www.aalep.eu/eu-countries-pro-and-against-nuclear.
[285] Ibid.
[286] Ibid.

Greece, Hungary, Poland, Romania, Slovenia, and Spain.[287] Poland and Greece in particular have been vocal against coal phase outs, as both nations refused to sign a 2017 EU initiative pledging no new coal-fired power plants after 2020.[288] Following a potential Energiewende failure, and particularly an emissions reduction goal failure, coal phase out initiatives are less likely to thrive across the EU. Furthermore, member states that have failed to initiate coal phase out plans are even more likely to maintain coal-powered plants. One of the fundamental European trends Germany's Energiewende relied upon was the "beginning of the end for coal."[289] Both its emissions reduction goal as well as its increased RES share goal envisioned a smaller role for coal in the EU going forward. However, the anti-coal trend in various EU member states has yet to reflect energy market realities as well as EU-wide attitudes. An impending Energiewende failure is likely to see a renewed European debate on the future of coal. Such a debate, in turn, will affect the future of coal phase out plans in a variety of EU member states, as well as pro-coal sentiments operating on the periphery of the EU, particularly in former Soviet bloc states seeking alternatives to Russian LNG.

An Energiewende failure will also seal the fate of continued European reliance on Russian gas. A resurgent Russia came to the forefront of EU concerns following the 2014 annexation of Crimea and occupation of eastern Ukraine. Some EU member states,

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[287] "National Coal Phase Out Announcements in Europe," *Europe Beyond Coal*, accessed February 10, 2018, https://beyond-coal.eu/wp-content/uploads/2018/02/Overview-of-national-coal-phase-out-announcements-Europe-Beyond-Coal-Feb-2018.pdf.
[288] Arthur Neslen, "The End of Coal: EU Energy Companies Pledge No New Plants From 2020," *The Guardian*, April 5, 2017, https://www.theguardian.com/environment/2017/apr/05/the-end-of-coal-eu-energy-companies-pledge-no-new-plants-from-2020.
[289] Ibid.

particularly Western EU nations, maintain extensive economic ties to Russia, including Germany and Italy.[290] Many of these nations continue to rely upon Russia for oil and natural gas, Germany in particular, due in part to the benefit of well-integrated regional energy markets. Accordingly, in the wake of a resurgent Russia, many Western EU member states have continued to express a cautious, yet continued reliance upon Moscow. Germany's Energiewende encompasses such a belief, as the energy transition policy outlined a continued reliance upon Russian LNG until renewable energy can reliably fill the gap. However, many former Soviet bloc states in Central and Eastern Europe have expressed distrust and wariness at Russian dependence. Although Russia continues to operate as the region's key supplier of oil and natural gas, CEE gas markets have notable differences than their Western counterparts. If the Energiewende fails, Germany will face a seemingly unending dependence upon Russian LNG for the conceivable future, particularly following any denuclearization reiteration in the wake of an Energiewende failure. This, in turn, will signal to EU member states the likelihood of prolonged regional dependence upon Moscow for natural gas. Such geopolitical realities will be met with concern, particularly among former bloc states now member to the EU.

Although some European nations, including Germany, have sought to diversify their energy sources through exploratory fracking and expanded LNG contracts with the West, there remains compelling evidence of Russian interference with such attempts. This interference includes, most notably, Russian support of anti-fracking movements and protests that have crippled some CEE nations from breaking free of Russian gas

[290] U.S. Library of Congress, Congressional Research Service, *The European Union: Current Challenges and Future Prospects*, R44249 (2017).

dependency. In 2014, the New York Times reported of Russian support to the anti-fracking movement in Romania after the US energy company Chevron leased land in Pungesti for exploratory drilling.[291] Lithuania also suspected the Kremlin of fueling and funding protest movements aimed at undermining a natural gas opening for the US in the CEE region, seeking to maintain their geopolitical hold on the lucrative gas market. Two years prior, in 2012, Bulgaria faced similar waves of anti-fracking protests following a shale-gas license issued to Chevron.[292] Although the Russian Federation has denied any involvement in the protest movements, the Kremlin's role in spearheading inorganic protests movements aimed at preventing competitors from gaining a foothold in the gas market has become a widely-accepted reality in European energy security.

In late 2014, NATO Secretary General Fogh Anders Rasmussen declared that, "Russia, as part of their sophisticated information and disinformation operations, engaged actively with so-called non-governmental organizations – environmental organizations working against shale gas – to maintain dependence on imported Russian gas."[293] Similarly, a 2017 report issued by the U.S. Director of National Intelligence states that the Russian state media channel, RT, "runs anti-fracking programming, highlighting environmental issues and the impacts on public health."[294] The report continues to assert

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291 Andrew Higgins, "Russian Money Suspected Behind Fracking Protests," *The New York Times*, November 30, 2014, https://www.nytimes.com/2014/12/01/world/russian-money-suspected-behind-fracking-protests.html?auth=login-email.

292 Austin Yack, "Russia's Financial Support for Anti-Fracking Groups is No Coincidence," *National Review*, July 21, 2017, https://www.nationalreview.com/2017/07/anti-fracking-groups-russia-secret-funding-protects-kremlin-interests/.

293 Ibid.

294 U.S. Office of the Director of National Intelligence, *Background to "Assessing Russian Activities and Intentions in Recent US Elections:" The Analytic Process and*

that such an effort is “likely reflective of the Russian Government’s concern about the impact of fracking and US natural gas production on the global energy market and the potential challenges to Gazprom’s profitability.”[295] Thus, the problem of Russian-led protest movements is indicative not only of the harsh geopolitical realities felt by numerous CEE nations, but also of the associated problems with energy diversification in the region, and the likelihood of continued Russian energy dominance.

Germany’s energy transition policy is both an expression of national ingenuity, and international leadership. As such, the Energiewende will have widespread affects upon Germany, and the EU as a whole. The European Union in particular will feel the consequences of the energy transition policy, both in its successes and failures. As the EU faces cohesion problems, the core Union principle of solidarity remains at risk. Following the Greek debt crisis and migration concerns, analysts have begun to note “a high degree of acrimony and a lack of trust among EU member states.”[296] This is particularly alarming in light of Germany’s impending target goal failures. The Energiewende policy was unveiled as both a national strategy, and Germany’s attempt to lead the EU in energy policy. If the energy transition proves to be a failure, Germany risks its standing in the EU as a leading member state. Agora Energiewende, a German think tank supporting Energiewende, published a 2017 study analyzing Germany’s likely emissions reduction goal failure. The study concluded that, should Energiewende fail to meet its 2020 goals, Germany is likely to suffer “irreparable damage to its international reputation as a climate

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Cyber Incident Attribution (Washington, D.C. 2017), 8, https://www.dni.gov/files/documents/ICA_2017_01.pdf.
[295] Ibid.
[296] Ibid.

protection frontrunner."[297] Furthermore, the shift between Western EU member states and Central and Eastern EU member states is likely to grow following an Energiewende failure. The energy divide in the EU has centered on Russian LNG reliance, decarbonization and coal phase out plans, and denuclearization. Energiewende as a policy encompasses nearly every EU concern since the unveiling of its first Union-wide comprehensive energy policy.

The future of energy security in the EU will foremost be determined by the outcome of Germany's Energiewende. If the Energiewende can prove to be a successful international model for clean energy independence, many wealthy EU member states are likely to follow in its example. However, if the energy transition ultimately fails in its goals, all EU member states will be forced to face unique geopolitical realities surrounding energy policy and security. An Energiewende failure could also signal to the rest of Europe the problems associated with rapid decarbonization policies. Such a signal is likely to affect the EU push for low-carbon energy, as well as reinvigorate countries that continue to favor coal, such as Poland and Greece. An Energiewende failure also risks geopolitical consequences for the Union. If RES are unable to fill the gap left by Russian gas, Germany will face a necessary and indefinite relationship with Moscow to meet its energy needs. This could be seen as a provocative position in the EU, as many former Soviet bloc states in the Union have remained wary of reliance upon Russia to supplement their energy needs. If Energiewende is unable to propel Germany into energy

[297] Kerstine Appunn, "Germany's Greenhouse Gas Emissions and Climate Targets," *Clean Energy Wire,* February 1, 2018, https://www.cleanenergywire.org/factsheets/germanys-greenhouse-gas-emissions-and-climate-targets.

independence, the EU faces vast future disagreements about the future of energy policy and security within the Union. Such disagreements could risk the future of Union cohesion going forward.

CHAPTER SIX

CONCLUSION: WHAT ENERGIEWENDE GOT RIGHT

While Germany's Energiewende is likely to fail to meet its stated policy goals, the energy transformation will undoubtedly render a variety of positive impacts upon the future of renewable energy and technology. To begin, Germany has been able to disprove the argument that renewable energy is too unreliable or unstable to generate large portions of a country's total electricity generation. Today, over 30% of Germany's electricity is generated from RES. This a remarkable feat for Germany and renewable energy, particularly by global comparison. Renewable energy has grown 18% in a decade inside Germany, and the decentralized model of the energy transition policy has seen unmatched local involvement, citizen ownership, and public support. This ownership structure has proven to the world the power of grassroots social movements, which ultimately paved the way for Energiewende in Germany. Thus, the social implications and possibilities of the energy transformation alone are worth noting for the future of global energy and security.

Germany's Energiewende has also shouldered the burden of cost, associated with its "first mover wager." This, in turn, has enabled the growth of RES technology and made its proliferation increasingly more cost efficient for other countries. German renewable energy subsidy costs have absorbed much of the production expense burdens, particularly with solar photovoltaic (PV) energy. Energiewende, therefore, has enabled more cost-efficient RES proliferation in countries including China and the US.[298] The energy transition policy has also paved the way forward in renewable energy innovation. New technologies, such as renewable jet fuel, and the expansion of previously less popular RES infrastructure, such as offshore wind farming, have seen recent growth and optimism.[299] This leads to the conclusion that what Energiewende may lack in terms of policy goal success, it can perhaps make up for in the longevity of international attitude changes regarding the future of renewable energy. Put simply, where Energiewende may fail in policy goal implementation, it is likely to succeed in generating a global era of renewable energy possibility. Thus, the positive impact of Germany's Energiewende may be one of hope for a new future, apart from any policy goal failure.

New Milestones

Although Energiewende is unlikely to meet its greenhouse gas emission level reduction goal for 2020, Germany has still witnessed a profound change in overall emission levels since 1990. Between 1990 and 2016, Germany experienced an overall 28% decline in greenhouse gas emissions.[300] This decline amounts to the difference between an annual total of 1.25 billion tons of CO2 emitted in 1990, to 906 million tons

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[298] David Buchan, "The Energiewende – Germany's Gamble," *The Oxford Institute for Energy Studies*, (June 2012): 17, accessed March 6, 2018, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.
[299] Jennifer Delony, "Top 10 Renewable Energy Trends to Watch in 2017," *Renewable Energy World*, December 30, 2016, http://www.renewableenergyworld.com/articles/2016/12/top-10-renewable-energy-trends-to-watch-in-2017.html.
[300] "Indicator: Greenhouse Gas Emissions," *Federal Environmental Agency*, October 20, 2017, accessed March 6, 2018, https://www.umweltbundesamt.de/en/indicator-greenhouse-gas-emissions#textpart-3.

in 2016.[301] Such a reduction is a remarkable environmental achievement for Germany, particularly in light of the country's continued status as a major industrial nation and economy. Regardless of Germany's likely failure to meet its 2020 target goal of a 40% emissions level reduction, Energiewende has positively contributed to notable greenhouse gas emissions decline since the launch of the policy. In addition to greenhouse gas emissions decline, Germany has recently reached new milestones for renewable energy. One sunny and gusty day in May 2017, a record-breaking 85% of Germany's total energy from renewables.[302] Although this success has not been consistent, it does reveal the possibility of large-scale RES dependency, and the potential diminished need for coal and nuclear energy. Furthermore, the continued success of renewables share in electricity generation in the winter has caused an upsurge of optimism for the future. Most experts have expressed belief that large percentages of power use from renewables would occur on windy, spring days, as the May 2017 record exemplifies. However, data from January 2018 reveals the possibility of record highs in the winter months as well. This, in turn, has caused some scientists to declare that Germany is entering into a "new phase of renewables."[303]

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301 Ibid.
302 Charlotte England, "Germany Breaks Renewables Record with Coal and Nuclear Power Responsible for Only 15% of Country's Total Energy," *Independent*, May 5, 2017, http://www.independent.co.uk/news/world/europe/germany-renewable-energy-record-coal-nuclear-power-energiewende-low-carbon-goals-a7719006.html.
303 Soren Amelang, "Renewables Cover About 100% of German Power Use for First Time Ever," *Clean Energy Wire*, January 5, 2018, https://www.cleanenergywire.org/news/renewables-cover-about-100-german-power-use-first-time-ever.

The Rise of New Technologies

In addition to continued growth of RES share in power usage, Energiewende has also given rise to a host of new renewable technologies. Among the most cited examples of RES technology growth stemming from Energiewende is offshore wind farming. The launch of the German energy transition policy in 2010 envisioned a large growth in wind farming, particularly offshore wind. Since then, offshore wind power in Europe has risen to a prominent place in energy production. In 2015, over 3,000 megawatts (MW) of offshore wind power was connected to European grids.[304] While still the majority of this wind power resides in Germany, both the UK and Netherlands have begun to rival the energy transition leader. In 2015, Britain connected a total of 556 MW of offshore wind to the grid, while the Netherlands connected 180 MW.[305] Furthermore, the total amount of offshore wind investment in Europe reached 13.3 billion euros in 2015, doubling 2014 total investments.[306] Just as Energiewende outlined, the offshore wind energy industry is growing globally. Over 100 offshore wind turbines, with a projected 626 MW capacity, were installed in Germany in the first half of 2017.[307] Meanwhile, European wind turbine orders were up 75% in 2016.[308] Such data is indicative of not only increases in domestic German offshore wind capability, but an increase in continental growth of offshore wind. Even China has reached new RES heights in the wake of Germany's energy transition.

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[304] Arthur Neslen, "Germany Leads Europe in Offshore Wind Energy Growth," *The Guardian*, February 2, 2016, https://www.theguardian.com/environment/2016/feb/02/germany-leads-europe-in-offshore-wind-energy-growth.
[305] Ibid.
[306] Ibid.
[307] Ibid.
[308] Ibid.

The People's Republic installed an estimated 29,000 MW of offshore wind capability in 2015.[309] While Energiewende is not solely responsible for this global trend in RES development, Germany's energy transformation can be seen as the pioneer of large-scale offshore wind farming, which has begun to bloom across Europe.

In addition to increasing existing renewable technology, Energiewende has also encouraged research and development into future RES technologies. Following the successes Germany has experienced regarding the expansion of renewable, RES has seen a growth in promising new technologies. Such technologies include new solar thermal storage solutions, floating wind turbines, biomass gasification techniques, tidal energy, and renewable jet fuel.[310] The search for new solar storage solutions in particular is born from the successes of Energiewende and solar PV energy. Germany's energy transition policy oversaw the subsidy cost which has enabled solar power, and particularly solar or photovoltaic panels, to be cheaper now than at any other moment in history.[311] However, unlike many other energy sources, storage for solar is especially difficult and costly due to fluctuations in supply being weather-dependent. Although Germany has been able to dispel the former notion that RES could only supply a small share of the electric grid due to intermittency, a storage capability for solar energy is needed to ensure a stable and steady supply of energy.[312] Thus, since Energiewende has proven large shares of the

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[309] Ibid.

[310] Praveen Duddu, "Six of the Most Promising New Green Power Technologies," *Power Technology*, March 19, 2014, http://www.power-technology.com/features/featuresix-of-the-most-promising-new-green-power-technologies-4199646/.

[311] Michael J. Coren, "Solar and Wind Are Now the Cheapest Energy Around – Unless You Need to Store It," *Quartz,* November 14, 2017, https://qz.com/1125355/solar-and-wind-are-now-the-cheapest-energy-around-unless-you-need-to-store-it/.

[312] This steady and stable supply of solar energy is necessary to deal with peaks, or the highest point of electricity demand in the day.

electricity grid can be generated through renewable energy sources, the next problem to solve is storage. Furthermore, such research and development into new renewable storage, such as molten salt storage technology, has been deemed a less perilous investment following the success of Germany's wind and solar energy proliferation.

Although Energiewende has not sought to revolutionize the transportation sector – a commonly cited flaw of the policy – Elon Musk and the advent of the Tesla and SpaceX, as well as continued development of renewable jet fuel, have all followed in the wake of the German energy transformation. The transportation industry worldwide is among the largest global contributors to greenhouse gas emissions.[313] Although most energy policies today focus on energy and industrial activity, including Energiewende, global greenhouse gas emission levels will continue to rise until transitions can be made to low-carbon transport options.[314] Presently, inventions such as the Tesla and renewable jet fuel, are aimed at transforming the transportation sector in order to move away from traditional, carbon-emitting transport infrastructure. Renewable jet fuel in particular could have implications for both civilian and military transportation emissions. Although such research and development achievements in the transportation sector are not explicitly linked to Germany's Energiewende and its outlined goals, the energy transition policy undoubtedly led to increased fervor and possibility in RES research and development. Furthermore, when taken together, the milestones of Energiewende,

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[313] Benoit Lefevre and Angela Enriquez, "Transport Sector Key to Closing World's Emissions Gap," *World Resources Institute*, September 19, 2014, http://www.wri.org/blog/2014/09/transport-sector-key-closing-world%E2%80%99s-emissions-gap.

[314] Ibid.

combined with low-carbon milestones in the transportation sector, carries with it the potential for a true global energy and climate change transformation.

Cost and the Second Mover

One of the most successful and controversial components of the German Energiewende was the advent of the feed-in-tariff system. Under the feed-in tariff, or FiT, fixed prices for renewable technology were guaranteed, generally for 20 years, in order to encourage RES investment with minimal risk.[315] In order to raise the funds to pay for the guaranteed fixed prices, a surcharge was placed on all German electric bills, known as the EEG.[316] This, in turn, became known as Germany's "first mover wager" regarding renewable energy. Years of subsidized support for renewables would pay off, many believed, as RES technology and investment began to proliferate globally. Once this occurred, Germany will have gained a sizeable portion of the global market in renewables, by being the first large investor.[317] The proliferation of RES technology, it was reasoned, would occur once Germany's first mover investment had seen the lowered cost of renewables. In turn, Germany's first mover investment in renewable energy sources and technology has paved the way for the second mover, or movers. One of the central issues of renewable energy and energy policy innovation is the "free rider

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[315] Robert Fares, "Energiewende: Two Energy Lessons for the United States from Germany," *Scientific American*, October 7, 2014, https://blogs.scientificamerican.com/plugged-in/energiewende-two-energy-lessons-for-the-united-states-from-germany/.
[316] For further explanation of the EEG, as well as the FiT system, refer to the section entitled "Renewable Energy Sources Act" in Chapter 3.
[317] For further analysis of first mover advantages and disadvantages, refer to the section entitled "First Mover Wager" in Chapter 3.

problem." William Nordhaus, a Yale economist who has focused on climate change outlined the free rider problem, as well as Germany's solution to it. He writes, "Because [climate change] is a global problem, and doing something is costly, every country has an incentive to do nothing and hope others will act. Germany has behaved differently… And in doing so, it has made the journey easier for the rest of us."[318]

The second mover phenomenon in RES technology has begun to occur, remarkably, without the aid of feed-in tariff systems. Presently, other countries are beginning to introduce renewables into energy portfolios without the need of public subsidies.[319] The best example of Germany's first mover wager, and the associated second mover opportunity can be found in solar photovoltaic technology and energy. When Germany introduced the feed-in-tariff system, both solar and wind power costs far outweighed those of hydrocarbons. In 2000, the price of a photovoltaic module, or solar panel, was 5 euros per watt.[320] Between 2006 and 2014, following a boom in the German solar energy industry and local demand, the installed cost of PV modules fell an at annual average rate of 13%.[321] By 2015, the cost of a solar panel was less than 0.70 euros per watt.[322]

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[318] Robert Kunzig, "Germany Could Be a Model for How We'll Get Power in the Future," *National Geographic*, November 2015, https://www.nationalgeographic.com/magazine/2015/11/germany-renewable-energy-revolution/.

[319] John Matthews, "The Spectacular Success of the German Energiewende – and What Needs to be Done Next," *Energy Post*, October 10, 2017, http://energypost.eu/the-spectacular-success-of-the-german-energiewende-and-what-needs-to-be-done-next/.

[320] Robert Fares, "Energiewende: Two Energy Lessons for the United States from Germany," *Scientific American*, October 7, 2014, https://blogs.scientificamerican.com/plugged-in/energiewende-two-energy-lessons-for-the-united-states-from-germany/.

[321] Ibid.

[322] Ibid.

As a result of the German solar energy boom, the market price of solar PV technology is the lowest it has ever been. As of 2017, the levelized cost of solar PV electricity was cheaper than most fossil fuel sources. Incredibly, solar electricity was even cheaper than natural gas in some places.[323] Accordingly, the global drop in solar photovoltaic panel prices has been dubbed "Germany's gift to the world."[324] Thus, the result of affordable solar technology and its proliferation is unquestionably linked to Energiewende, which led to the solar PV boom, resulting in affordable RES technology for second movers today.

Energiewende as a Social Movement

In addition to its first mover achievement, Germany's Energiewende has also been heralded as a governmental policy born from local, grassroots movements. Belgian theorist Michel Bauwens has argued there are two different ways in which to analyze Energiewende. One is purely technical, while the other is social and political. From a technical perspective, Bauwens argues, Energiewende is somewhat unexceptional. Bauwens cites Denmark, Uruguay, and Costa Rica as all producing a larger percentage of electricity from renewables than Germany presently does.[325] However, from a social and political perspective, Bauwens argues, Energiewende is an immense accomplishment. He writes,

"[When] looked at from a more social and political angle, the Energiewende is an enormous success for social movements, for people power changing the world from

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[323] Ibid.
[324] Ibid.
[325] Michael Bauwens, "Why Did the German Energiewende Succeed," *P2P Foundation*, April 2, 2017, 5, https://blog.p2pfoundation.net/german-energiewende-succeed/2017/08/02.

below, in a policy-field – power politics as it were – that has traditionally been one of the key areas of governmental control. The struggle [of Energiewende] has meant that more and more people in Germany are regaining at least some control over their energy futures… it is precisely for this reason that the term energy democracy has emerged to describe and even internationalize this process."[326]

Bauwen's argues that the grassroots support that allowed for Energiewende and its investment success is an extension of 1960s era social movements that sought to bring about the "new world."[327] The German Anti-Nuclear movement in particular is emblematic of such environmental social movements. What makes Energiewende unique as a social movement, however, is the way in which the movement has survived the institutionalization process.

According to social movement theory, organized grassroots movements are often forced to institutionalize, in order to cement movement gains.[328] However, institutionalization often causes movements to fail. The success of surviving the institutionalization process, therefore, is where Energiewende is unique. Bauwen argues through a combination of "local movement processes and national legislation, and an unusual combination of political and economic logics," Energiewende has been able to withstand the institutionalization process, and continue to make gains.[329] One of the instrumental successes of Energiewende and its ability to survive the institutionalization

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[326] Ibid, 6.
[327] Ibid.
[328] Marc Schneiberg, "Institutional Theory and Social Movements," in *The Wiley-Blackwell Encyclopedia of Social and Political Movements* edited by David A. Snow, Donatella Della Porta, Bert Klandermas, and Doug McAdam (Blackwell Publishing, 2013): 470, https://doi.org/10.1002/9780470674871.
[329] Michael Bauwens, "Why did the German Enerigewende Succeed," *P2P Foundation*, April 2, 2017, 9, https://blog.p2pfoundation.net/german-energiewende-succeed/2017/08/02.

process was the establishment of citizen's cooperatives. Just three years after the energy transition policy launch, the extent of local RES ownership and citizen's cooperatives was evident. In 2013, Germany housed 888 energy cooperatives, comprised of 130,000 people, and amounted to 1.2 billion invested euros.[330] Put simply, the ability of Energiewende to succeed as a social movement has a direct relationship with the initial grassroots optimism for green energy in Germany, and the subsequent formation of citizen's cooperatives for RES investment and production. In this way, Energiewende has been a tremendous success in pioneering a "people's energy revolution" that is the first ever bottom-up energy revolution. In this way, Bauwen argues, Energiewende is the decades long realization of European social movements that have sought to bring together "local coops and rural communities where people work together on practical projects in ways that transcend ideological and social boundaries, where an increase in autonomy and sovereignty means that local value creation, too, is increased."[331]

The Prospect of Possibility

Alongside Energiewende's success as a social movement, the energy transition has engineered possibility for a new low carbon future. The German energy transformation has sought to model the future of energy production and consumption, as one of hope and hard work. Although the outlined policy goals of Energiewende have been more fraught than was previously assumed, Germany's daring energy experiment has shown that the future of RES and clean energy is closer than was previously thought.

[330] Ibid, 10.
[331] Ibid, 11.

As journalist Robert Kunzig writes, "They [the Germans] knew Energiewende was never going to be a walk in the forest, and yet they set out on it. What can we learn from them?"[332] For the time being, it appears Energiewende has not proven to be an affordable energy policy model for all of Europe – particularly less economically prosperous Central and Eastern European states. However, one of the likely long-lasting impacts of Germany's Energiewende will be the power of innovation, and the importance of long-term vision. Although Germany is not on track to meet its 2020 policy goals, the country is far ahead of the EU goal schedule.[333] Furthermore, the German clean energy trend appears to be catching on in several European countries. Denmark has seen its green power generation rise to 43% in 2015.[334] In 2011, Italy added a record-breaking 9.3 gigawatt of renewable energy onto its grid system, and has increased its green power share of electricity to over 17% at the end of 2017.[335] Spain, meanwhile, has expanded its solar and wind power production over 15%.[336] While Energiewende may not be an affordable clean energy transition model for all of Europe, its legacy of forward-thinking policy and investment in the future has already begun to positively impact European energy policies centered on a sustainable future.

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332 Robert Kunzig, "Germany Could Be a Model for How We'll Get Power in the Future," *National Geographic*, November 2015, https://www.nationalgeographic.com/magazine/2015/11/germany-renewable-energy-revolution/.

333 Ibid.

334 Jakob Schlandt, "Energiewende – Germany is Not Alone," *Clean Energy Wire*, June 24, 2015, https://www.cleanenergywire.org/factsheets/energiewende-germany-not-alone.

335 "Italy Has Already Surpassed Its Renewable Energy Target for 2020," *The Local*, March 16, 2017, https://www.thelocal.it/20170316/italy-has-already-surpassed-its-renewable-energy-target-for-2020.

336 Jakob Schlandt, "Energiewende – Germany is Not Alone," *Clean Energy Wire*, June 24, 2015, https://www.cleanenergywire.org/factsheets/energiewende-germany-not-alone.

Additionally, Germany's Energiewende has turned the correlation between policy and markets on its head, revealing how policies can shape markets, contrary to the former thought that only markets should shape policy. Germany embarked on its energy transition at a time when RES technology was still costly, and markets overwhelmingly favored fossil fuels. By adopting an energy policy that favored renewables at a time when markets favored hydrocarbons, Germany has been able to engineer the RES market through its first mover cost burden. Since the adoption of the feed-in tariff system that allowed for large-scale renewable investment in 2000, Germany has given rise to an entirely new RES market. Both solar and wind power compete with traditional carbon-based energy sources, at affordable investment prices. In just fifteen short years, the German Energiewende has been able to alter what was once a niche market into a mainstream one. Thus, another key dimension of the Energiewende's success is a political one: policymaking. Although the stated policy goals on Energiewende remain problematic for the short-term and long-term future, the mass investment and subsequent widespread proliferation of now affordable RES technology has given rise to a renewable market success. Through its first mover wager, Germany has been able to prove how governmental policy can affect markets. This construct has been Germany's answer to the debate over the relationship between policy and markets. Energiewende, it appears, has successfully shown how a governmental policy can steer an international market.

Conclusion

Energiewende will go down in history with a complex legacy. Many of the expressed policy aims of the energy transition will not be met. These include the 2020 goals of a 40% greenhouse gas emission reduction as well as a 20% reduction in energy consumption. Such short-term policy failures are connected to the rising cost of renewables disproportionally put onto the German public, as well as the continued use of lignite and coal, and the necessary and looming electricity grid modernizations. Furthermore, such short-term goal failures are likely to make both intermediate and long-term goals of the policy even more difficult to meet. Public support is likely to wane in upcoming years, making the necessary infrastructure development for intermediate and long-term goals less feasible. Furthermore, changes in the ownership structure of RES, particularly the shift away from citizen's cooperatives through the adoption of an auction-based system, risk alienating the base of public support that has thus far enabled the energy transition. If Energiewende fails to meet its target goals, the policy jeopardizes its ability to prove the viability of the renewable energy project, as well as the likelihood that such a policy could be adopted by the European Union. As the de facto leader of the EU, Germany's potential energy policy failure could risk the country's international credibility and capability of steering EU policy in the future. Moreover, an Energiewende failure is likely to divide the EU member states even further on issues of foreign dependency, nuclear energy, and decarbonization. Such a fractured debate, in turn, risks further dividing the EU at a time of momentous instability in the Union. Put simply, an Energiewende policy failure would have vast implications for German energy policy, and EU energy policy cohesion going forward and into the future.

Although the policy failure implications of Energiewende are great, Germany's energy transition also yields tremendous lessons and positive implications for the global future of energy. Thus far, Germany has been able to dispel the former argument that renewables were too unreliable and unstable to generate sizeable portions of electricity. The burden of cost put upon German citizens through the renewable electricity surcharge has enabled RES technology to proliferate at historically low prices throughout Europe and beyond. For the first time in history, solar and wind power are beginning to outpace hydrocarbons in affordability. Countries in Europe, as well as China and the US, have begun to adopt renewable energy at increased rates, due in part to the RES first mover costs Germany absorbed for nearly twenty years. The Energiewende has also shown the power of grassroots organizations and social movements, as the energy transition was born, foremost, from local activism including the Anti-Nuclear movement and the German environmental party, known as the Greens. Germany's energy transition originated in homegrown investment and RES ownership through the growth and expansion of citizen's cooperatives and local and state-wide policy initiatives. Yet the greatest success of Energiewende has been the ability of the energy policy to project possibility, and the hope of a low carbon future.

By taking on the most dramatic energy policy designed to combat climate change, Germany has sought to lead the world in clean energy independence. Regardless of the policy outcome, many of the trends Energiewende sought to introduce are likely to remain. These include: expanded solar and wind energy markets, increased RES demand, storage solution research and development, and local grassroots renewable energy generation and investment. Indeed, such trends have already begun to flourish across Europe, China, and the US. By adopting an energy transformation policy, Germany took on the role as first mover both financially and morally. German policymakers harnessed the aspirations that have surrounded nearly two decades of EU energy aims, and crafted a domestic energy policy that sought to look farther to the future than any policy before it. The forward-thinking approach, so characteristically German in nature, has taken the first step toward a decarbonized, decentralized, diverse energy future. This has been the German gift to the world, and this is the gift of Energiewende.

REFERENCES

Articles

Amelang, Soren. "Energy Transition Shapes Foreign Policy in Germany and Beyond." *Clean Energy Wire*. July 8, 2015. https://www.cleanenergywire.org/dossiers/energiewende-and-its-implications-international-security.

Amelang, Soren. "Germany's Energy Transition Revamp Stirs Controversy Over Speed, Participation." *Clean Energy Wire*. June 29, 2016. https://www.cleanenergywire.org/dossiers/reform-renewable-energy-act#climate.

Amelang, Soren. "Renewables Cover About 100% of German Power Use for First Time Ever." *Clean Energy Wire*. January 5, 2018. https://www.cleanenergywire.org/news/renewables-cover-about-100-german-power-use-first-time-ever.

Amelang, Soren, Benjamin Wehrmann and Julian Wettengel. "Germany's Energy Use and Emissions Likely to Rise Yet Again in 2017." *Clean Energy Wire*. November 13, 2017. https://www.cleanenergywire.org/news/germanys-energy-use-and-emissions-likely-rise-yet-again-2017.

Amelang, Soren, Benjamin Wehrmann and Julian Wettengel. "Poll Reveals Citizens' Support for Energiewende." *Clean Energy Wire*. November 15, 2017. https://www.cleanenergywire.org/factsheets/polls-reveal-citizens-support-energiewende.

Appunn, Kerstine. "Coal in Germany." *Clean Energy Wire*. December 5, 2017. https://www.cleanenergywire.org/factsheets/coal-germany.

Appunn, Kerstine. "EEG Reform 2016 – Switching to Auctions for Renewables." *Clean Energy Wire*. July 8, 2016. https://www.cleanenergywire.org/factsheets/eeg-reform-2016-switching-auctions-renewables.

Appunn, Kerstine. "Germany's Greenhouse Gas Emissions and Climate Targets." *Clean Energy Wire.* February 1, 2018. https://www.cleanenergywire.org/factsheets/germanys-greenhouse-gas-emissions-and-climate-targets.

Appunn, Kerstine, Felix Bieler and Julian Wettengel. "Germany's Energy Consumption and Power Mix in Charts." *Clean Energy Wire*. February 16, 2018. https://www.cleanenergywire.org/factsheets/germanys-energy-consumption-and-power-mix-charts.

Archer, Kathryn and John P. Banks. "American and German Approaches to Energy-Climate Policy." *Brookings*. June 11, 2014. https://www.brookings.edu/articles/american-and-german-approaches-to-energy-climate-policy/.

Ball, Jeffrey. "Germany's High Priced Energy Revolution." *Forbes*. March 14, 2017. http://fortune.com/2017/03/14/germany-renewable-clean-energy-solar/.

Bauwens, Michael. "Why Did the German Energiewende Succeed." *P2P Foundation*. April 2, 2017. https://blog.p2pfoundation.net/german-energiewende-succeed/2017/08/02.

Bhatti, Jabeen. "Germany's Energy Transition Creates Costly Problems with Grid." *Bloomberg BNA*. September 14, 2017. https://www.bna.com/germanys-energy-transition-n57982087949/.

Boersma, Tim. "Europe's Energy Dilemma." *Brookings*. June 18, 2014. https://www.brookings.edu/articles/europes-energy-dilemma/.

Borchert, Lars. "Germany Between Citizens' Energy and Nimbyism." *Clean Energy Wire*. March 10, 2015. https://www.cleanenergywire.org/dossiers/peoples-energiewende.

Bruninx, Kenneth, Darin Madzharov, Erik Delarue, and William D'haeseleer. "Impact of the German Nuclear Phase Out on Europe's Electricity Generation." *Energy Institute of Belgium*. Accessed August 6, 2017. https://www.mech.kuleuven.be/en/tme/research/energy_environment/Pdf/wpen2012-15.

Buchan, David. "The Energiewende – Germany's Gamble." *The Oxford Institute for Energy Studies*. June 2012. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/06/SP-261.pdf.

Cama, Timothy. "Poland Signs 5-Year US Natural Gas Import Deal." *The Hill*. November 21, 2017. http://thehill.com/policy/energy-environment/361413-poland-signs-5-year-us-natural-gas-import-deal.

Clayton, Julie. "Focus on Germany." *Science*. September 24, 2010. http://www.sciencemag.org/features/2010/09/focus-germany.

"Completing Europe: From the North-South Corridor to Energy, Transportation, and Telecommunications Union." *Atlantic Council.* November 2014.

Conca, James. "Why Aren't Renewables Decreasing Germany's Carbon Emissions?" *Forbes*. October 10, 2017.

https://www.forbes.com/sites/jamesconca/2017/10/10/why-arent-renewables-decreasing-germanys-carbon-emissions/#74991f6a68e1.

Connolly, Kate. "Germany Agrees to Extend Life of Nuclear Power Stations." *The Guardian.* September 6, 2010. https://www.theguardian.com/world/2010/sep/06/germany-extend-nuclear-power-stations.

Coren, Michael J. Coren. "Solar and Wind Are Now the Cheapest Energy Around – Unless You Need to Store It." *Quartz*. November 14, 2017. https://qz.com/1125355/solar-and-wind-are-now-the-cheapest-energy-around-unless-you-need-to-store-it/.

Delony, Jennifer. "Top 10 Renewable Energy Trends to Watch in 2017." *Renewable Energy World*. December 30, 2016. http://www.renewableenergyworld.com/articles/2016/12/top-10-renewable-energy-trends-to-watch-in-2017.html.

Dempsey, Judy. "Schroder's Unswerving Loyalty to Putin." *Carnegie Europe*. October 3, 2017. http://carnegieeurope.eu/strategiceurope/73281.

Duddu, Praveen. "Six of the Most Promising New Green Power Technologies." *Power Technology*. March 19, 2014. http://www.power-technology.com/features/featuresix-of-the-most-promising-new-green-power-technologies-4199646/.

Dupont, Claire and Sebastian Oberthur. "Decarbonization in the EU: Setting the Scene." In *Decarbonizatoin in the European Union: Internal Policies and External Struggles*. London: Palgrave Macmillian, 2015. DOI: 10.1057/97811137406835.

Eddy, Melissa. "German Energy Official Sounds a Warning." *The New York Times*. January 21, 2014. https://www.nytimes.com/2014/01/22/business/energy-environment/german-energy-official-sounds-a-warning.html.

"Energiewende." *The Economist*. July 28, 2012. http://www.economist.com/node/21559667.

England, Charlotte. "Germany Breaks Renewables Record with Coal and Nuclear Power Responsible for Only 15% of Country's Total Energy." *Independent*. May 5, 2017. http://www.independent.co.uk/news/world/europe/germany-renewable-energy-record-coal-nuclear-power-energiewende-low-carbon-goals-a7719006.html.

Farchy, Jack, Roman Olearchyk and Christian Oliver. "Russia Cuts off Gas Supplies to Ukraine." *Financial Times*. June 16, 2014. https://www.ft.com/content/db64d8f8-f522-11e3-afd3-00144feabdc0.

Fares, Robert. "Energiewende: Two Energy Lessons for the United States from Germany." *Scientific American*. October 7, 2014. https://blogs.scientificamerican.com/plugged-in/energiewende-two-energy-lessons-for-the-united-states-from-germany/.

Flassbeck, Heiner. "The End of Energiewende?" *Energy Post*. January 10, 2017. http://energypost.eu/end-energiewende/.

"France and Germany Turn to Coal." *Institute for Energy Research*. October 24, 2016. https://instituteforenergyresearch.org/analysis/france-germany-turn-coal/.

Fowlie, Meredith. "The Renewable Energy Auction Revolution." *Energy Institute at Haas*. August 7, 2017. https://energyathaas.wordpress.com/2017/08/07/the-renewable-energy-auction-revolution/.

"Germany Fully Approves Russia-built Nord Stream 2 Gas Pipeline." *Reuters*. Match 27, 2018. http://www.hurriyetdailynews.com/germany-fully-approves-russia-built-nord-stream-2-gas-pipeline-129381.

Gortz, Birgit. "Germany's Green Mark 30 Years in Parliament." *DW*. March 6, 2013. http://www.dw.com/en/germanys-greens-mark-30-years-in-parliament/a-16646538.

Hake, Jurgen-Friedrich, Wolfgang Fischer, Sandra Venghaus, and Christoph Weckenbrock. "The German Energiewende – History and Status Quo." *Energy Policy*, vol. 92, no. 3. December 2015. http://www.sciencedirect.com/science/article/pii/S0360544215004594.

Harvey, Fiona. "European Countries Spend Billions a Year on Fossil Fuel Subsidies, Survey Shows." *The Guardian*. September 28, 2017. https://www.theguardian.com/environment/2017/sep/28/european-countries-spend-billions-a-year-on-fossil-fuel-subsidies-survey-shows.

Haucap, Justus, Ina Loebert and Susanne Thorwarth. "Cost of Energiewende." *Dusseldorf Institute for Competition Economics (DICE)*. October 2016. http://www.insm.de/insm/Presse/Pressemeldungen/Pressemeldung-Studie-EEG.html.

Higgins, Andrew. "Russian Money Suspected Behind Fracking Protests." *The New York Times*. November 30, 2014. https://www.nytimes.com/2014/12/01/world/russian-money-suspected-behind-fracking-protests.html?auth=login-email.

Henderson, James and Tatiana Mitrova. "The Political and Commercial Dynamics of Russia's Gas Export Strategy." *The Oxford Institute for Energy Studies*. September 2015. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2014/07/Executive-Summary-The-Political-and-Commercial-Dynamics-of-Russias-Gas-Export-Strategy.pdf.

Hoellerbauer, Simon. "Baltic Energy Sources: Diversifying Away from Russia." *Foreign Policy Research Institute*. June 14, 2017. https://www.fpri.org/article/2017/06/baltic-energy-sources-diversifying-away-russia/.

"How Electricity Became a Luxury Good." *Der Spiegel*. September 4, 2013. http://www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288.html.

"Italy Has Already Surpassed Its Renewable Energy Target for 2020." *The Local*. March 16, 2017. https://www.thelocal.it/20170316/italy-has-already-surpassed-its-renewable-energy-target-for-2020.

"It's Not Easy Being Green." *The Economist*. August 11, 2016. https://www.economist.com/news/europe/21704819-even-new-reforms-doubts-remain-about-germanys-energy-transition-its-not-easy-being-green.

Joas, Fabian. "Which Goals Are Driving Energiewende? Making Sense of the German Energy Transformation." *Energy Policy*, vol. 95. August 2016. http://www.sciencedirect.com/science/article/pii/S0301421516301719.

Jorant, Caroline. "The Implications of Fukushima: The European Perspective." *Bulletin of the Atomic Scientists*, vol. 67, no. 4. 2011. http://journals.sagepub.com/doi/pdf/10.1177/0096340211414842.

Jungjohann, Arne and Craig Morris. "The German Coal Conundrum." *Heinrich Boll Foundation*. Washington, D.C. 2014. http://www.indiaenvironmentportal.org.in/files/file/German_Coal_Conundrum.pdf.

Karnitschnig, Matthew. "Germany Revives Putin's Pipeline Dream." *Politico*. December 26, 2017. https://www.politico.eu/article/germany-revives-putins-pipeline-dream/.

Kunzig, Robert. "Germany Could Be a Model for How We'll Get Power in the Future." *National Geographic*. November 2015. https://www.nationalgeographic.com/magazine/2015/11/germany-renewable-energy-revolution/.

Latsch, Gunther, Anne Seith and Gerald Traufetter. "Weak Returns Cripple German Renweables." *Der Spiegel*. January 30, 2014. http://www.spiegel.de/international/business/wind-power-investments-in-germany-proving-riskier-than-thought-a-946367.html.

Lefevre, Benoit and Angela Enriquez. "Transport Sector Key to Closing World's Emissions Gap." *World Resources Institute*. September 19, 2014. http://www.wri.org/blog/2014/09/transport-sector-key-closing-world%E2%80%99s-emissions-gap.

Loughran, Jack. "Germany's Reliance on Coal Continues Despite Renewables Push." *Engineering and Technology*. April 10, 2017. https://eandt.theiet.org/content/articles/2017/08/germany-s-reliance-on-coal-continues-despite-huge-push-towards-renewable-energy/.

Matthews, John. "The Spectacular Success of the German Energiewende – and What Needs to be Done Next." *Energy Post*. October 10, 2017. http://energypost.eu/the-spectacular-success-of-the-german-energiewende-and-what-needs-to-be-done-next/.

Martin, Richard. "Germany Runs Up Against the Limit of Renewables." *MIT Technology Review*. May 24, 2016. https://www.technologyreview.com/s/601514/germany-runs-up-against-the-limits-of-renewables/.

Morris, Craig. "German Renewables Sector Calls for Carbon Tax." *Energy Transition: The Global Energiewende*. February 24, 2017. https://energytransition.org/2017/02/german-renewables-sector-calls-for-carbon-tax/.

Morris, Craig. "New Proposals Would Kill Solar and Wind in the European Union." *Energy Transition: The Global Energiewende*. June 28, 2017. https://energytransition.org/2017/06/new-proposals-would-kill-solar-and-wind-in-eu/.

Morris, Craig. "Renewable Power Curtailment Skyrockets in Germany." *Energy Transition: The Global Energiewende*. November 23, 2015. https://energytransition.org/2015/11/renewable-power-curtailment-in-germany/.

Mudde, Cas. "Europe's Populist Surge." *Foreign Affairs*. November 3, 2016. https://www.researchgate.net/publication/309643775_Europe's_Populist_Surge_A_Long_Time_in_the_Making.

Neslen, Arthur. "Germany Leads Europe in Offshore Wind Energy Growth." *The Guardian*. February 2, 2016. https://www.theguardian.com/environment/2016/feb/02/germany-leads-europe-in-offshore-wind-energy-growth.

Neslen, Arthur. "The End of Coal: EU Energy Companies Pledge No New Plants From 2020." *The Guardian*. April 5, 2017. https://www.theguardian.com/environment/2017/apr/05/the-end-of-coal-eu-energy-companies-pledge-no-new-plants-from-2020.

Neslen, Arthur. “The Rise and Fall of Fracking in Europe.” *The Guardian*. September 29, 2016. https://www.theguardian.com/sustainable-business/2016/sep/29/fracking-shale-gas-europe-opposition-ban.

Noack, Rick. “He Used to Rule Germany. Now, He Oversees Russian Energy Companies and Lashes Out at the U.S.” *The Washington Post*. August 12, 2017. https://www.washingtonpost.com/news/worldviews/wp/2017/08/08/he-used-to-rule-germany-now-he-oversees-russian-energy-companies-and-lashes-out-at-the-u-s/?utm_term=.ec3fc2dd3b98.

Ohlhorst, Dorte. “Germany’s Energy Transition Policy Between National Targets and Decentralized Responsibilities.” *Journal of Integrative Environmental Sciences*, vol. 12, no. 4. November 2015. https://doi.org/10.1080/1943815X.2015.1125373.

Oltermann, Philip. “Germany Takes Steps to Roll Back Renewable Energy Revolution.” *The Guardian*. October 11, 2016. https://www.theguardian.com/environment/2016/oct/11/germany-takes-steps-to-roll-back-renewable-energy-revolution.

“Opposition to Russia’s Nord Stream Pipeline Growing in Eastern Europe.” *Radio Free Europe*. March 9, 2018. https://www.rferl.org/a/opposition-growth-eastern-europe-russia-nord-stream-2-pipeline-germany-baltic-sea-lithuania-estonia-latvia/29087938.html.

“Over 30,000 Poverty-Hit German Homes Have Power Cut off Each Year.” *The Local*. March 2, 2017. https://www.thelocal.de/20170302/over-300000-poverty-hit-german-homes-have-power-cut-off-each-year.

Pescia, Dimitri, Patrick Graichen and David Jacobs. “Understanding the Energiewende.” *Agora Energiewende*. October 2015. https://www.agora-energiewende.de/fileadmin/Projekte/2015/Understanding_the_EW/Agora_Understanding_the_Energiewende.pdf.

“Poland to Generate Nearly 60 Percent of Energy from Coal in 2030.” *Reuters*. July 11, 2017. https://www.reuters.com/article/us-poland-energy-coal/poland-to-generate-nearly-60-percent-of-energy-from-coal-in-2030-official-idUSKBN19W1NE.

Rapier, Robert. “World Sets Record For Fossil Fuel Consumption.” *Forbes.* June 8, 2016. https://www.forbes.com/sites/rrapier/2016/06/08/world-sets-record-for-fossil-fuel-consumption/#d3db608365f7.

Renn, Ortwin. “Coal, Nuclear and Renewable Energy Policies in Germany: From the 1950s to the Energiewende.” *Energy Policy*, vol. 99. December 2016. http://www.sciencedirect.com/science/article/pii/S0301421516302294.

Riley, Alan. "Shale Gas – Central Europe's Most Vital Energy Resource." *Center for European Policy Analysis*. March 1, 2012. http://cepa.org/index/?id=fef873297a8a4a4bc01ca5f2df08eeba.

Saravalle, Edoardo. "Russia's Pipeline Power." *Politico*. June 20, 2017. https://www.politico.eu/article/opinion-russias-pipeline-power/.

Schlandt, Jakob. "Energiewende – Germany is Not Alone." *Clean Energy Wire*. June 24, 2015. https://www.cleanenergywire.org/factsheets/energiewende-germany-not-alone.

Sheppard, David. "Lithuania Becomes First Ex-Soviet State to Buy US Natural Gas." *Financial Times*. August 21, 2017. https://www.ft.com/content/33113758-8680-11e7-8bb1-5ba57d47eff7.

Snowiss, Mark. "Bulgaria Key Battleground in US-Russia Energy War." *VOA News*. February 23, 2015. https://www.voanews.com/a/bulgaria-key-battleground-in-us-russia-energy-war/2655196.html.

St. John, Jeff. "As Germany Curtails Wind and Solar, Billion-Euro Grid Projects Help Bring More Green Power On-Line." *Greentech Media*. April 28, 2016. https://www.greentechmedia.com/articles/read/as-germany-curtails-wind-and-solar-billion-euro-grid-projects-seek-to-bring#gs.3Je0S2E.

Staudenmaier, Rebecca. "Germany's Nuclear Phase-Out Explained." *DW*. June 15, 2017. http://www.dw.com/en/germanys-nuclear-phase-out-explained/a-39171204.

"Success of EU Foreign Policy Hinges on Climate and Energy Security." *Energy Transition: The Global Energiewende*. October 12, 2016. https://energytransition.org/2016/10/success-of-eu-foreign-policy-hinges-on-climate-and-energy-security/.

Szulecki, Kacper. "European Energy Governance and Decarbonization Policy: Learning from the 2020 Strategy." *Climate Policy*, vol 16, 2016. https://doi.org/10.1080/14693062.2016.11811599.

Talbot, David. "The Great German Energy Experiment." *MIT Technology Review*. June 18, 2012. https://www.technologyreview.com/s/428145/the-great-german-energy-experiment/.

Techau, Jan. "Four Predictions on the Future of Europe." *Carnegie Europe*. January 12, 2016. http://carnegieeurope.eu/strategiceurope/62445.

"The Future of Germany's Energiewende." *Energy Transition: The Global Energiewende*. July 24, 2017. https://energytransition.org/2017/07/the-future-of-germanys-energiewende/.

"The History of Energy in Germany." *Planete Energies*. April 29, 2015. https://www.planete-energies.com/en/medias/saga-energies/history-energy-germany.

Trembath, Alex and Matthew Stepp. "Why a Carbon Tax is a Bad Idea." *Energy Post*. November 12, 2013. http://energypost.eu/carbon-tax-bad-idea/.

"Troubled Turn: Germany's Energy Reform." *The Economist*. February 9, 2013. https://www.economist.com/news/europe/21571440-germanys-national-energy-project-becoming-cause-disunion-troubled-turn.

Unnerstall, Thomas. "How Expensive is the German Energy Transition? A Lesson from the German Energiewende." *Energy, Sustainability, and Society.* December 18, 2017. https://doi.org/10.1186/s13705-017-0141-0.

Verseck, Keno. "Nuclear Power on the Rise in Eastern Europe." *DW*. December 23, 2013. http://www.dw.com/en/nuclear-power-on-the-rise-in-eastern-europe/a-17177810.

Wile, Rob. "Solar Power Could Be A Total Game-Changer – But They Still Need to Figure Out One Thing." *Business Insider*. November 18, 2013. http://www.businessinsider.com/renewable-energy-storage-problem-2013-11.

Yack, Austin. "Russia's Financial Support for Anti-Fracking Groups is No Coincidence." *National Review*. July 21, 2017. https://www.nationalreview.com/2017/07/anti-fracking-groups-russia-secret-funding-protects-kremlin-interests/.

Yanofsky, David. "The EU Countries That Depend the Most on Gazprom's Russian Gas." *Quartz*. April 22, 2015. https://qz.com/388148/the-eu-countries-that-depend-the-most-on-gazproms-russian-gas/.

Zha, Weixin and Anna Shiryaevskaya. "Germany is Addicted to Russian Gas." *Bloomberg*. July 4, 2017. https://www.bloomberg.com/news/articles/2017-07-03/german-addiction-to-russia-gas-raises-alarm-in-merkel-s-backyard.

Zha, Weixin, Brian Parkin and Tino Andresen. "How Germany Hammers Down Renewable Energy Costs." *Bloomberg*. February 7, 2017. https://www.bloomberg.com/news/articles/2017-02-07/how-germany-hammers-down-renewable-energy-costs-quicktake-q-a.

Zubrin, Robert. "Germany's Green Power Program Crushes the Poor." *National Review*. May 13, 2015. http://www.nationalreview.com/article/418263/germanys-green-power-program-crushes-poor-robert-zubrin.

"1-Nord Stream to Finish First Gas Pipeline." *Reuters*. May 4, 2011. https://uk.reuters.com/article/europe-gas-pipeline/update-1-nord-stream-to-finish-1st-gas-pipeline-thursday-idUKLDE7431M720110504.

Books

Kalicki, Jan H. and David L. Goldwyn. *Energy and Security: Strategies for a World in Transition*. 2nd ed. Washington, D.C.: Woodrow Wilson Center Press, 2013.

Leal-Arcas, Rafael. *The European Energy Union*. London: Claeys & Casteels, 2016. ISBN: 9789491673450.

Morris, Craig and Martin Pehnt. Ed. Rebecca Bertram, Stefanie Groll, and Kathrin Glastra. *Energy Transition: The German Energiewende*. Heinrich Boll Stiftung: Berlin, 2016.

Pascual, David and Jonathan Elkind. *Energy Security: Economics, Politics, Strategies, and Implications*. Washington, D.C.: Brookings Institute, 2010.

Perloff, Jeffrey M. *Microeconomics*. England: Pearson Education, 2012. Print.

Schneiberg, Marc. "Institutional Theory and Social Movements." In *The Wiley-Blackwell Encyclopedia of Social and Political Movements*. Edited by David A. Snow, Donatella Della Porta, Bert Klandermas, and Doug McAdam. Blackwell Publishing, 2013. https://doi.org/10.1002/9780470674871.

The Routledge Handbook of German Politics and Culture. Edited by Sarah Colvin and Mark Taplin. New York: Routledge, 2015.

Government Documents

"Act on the Development of Renewable Energy Sources: Renewable Energy Sources Act – RES Act 2014." *Federal Ministry for Economic Affairs and Energy*. August 1, 2014. http://www.bmwi.de/Redaktion/EN/Downloads/renewable-energy-sources-act-eeg-2014.pdf?__blob=publicationFile&v=1.

European Commission. *2020 Climate & Energy Package*. Brussels, 2009. https://ec.europa.eu/clima/policies/strategies/2020_en.

European Commission. *2030 Climate & Energy Framework*. Brussels, 2014. https://ec.europa.eu/clima/policies/strategies/2030_en.

European Commission. *Energy Roadmap 2050*. Brussels, December 2011. http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0885&from=EN.

European Commission. *Europe 2020: A Strategy for Smart, Sustainable and Inclusive Growth*. Brussels, 2010. http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:2020:FIN:EN:PDF.

European Commission. *Europe 2020 Strategy: Targets*. Brussels, 2009. https://ec.europa.eu/info/business-economy-euro/economic-and-fiscal-policy-coordination/eu-economic-governance-monitoring-prevention-correction/european-semester/framework/europe-2020-strategy_en.

European Commission. *European Union Global Strategy*. Brussels, June 2016. https://eeas.europa.eu/archives/docs/top_stories/pdf/eugs_review_web.pdf.

European Commission. *Market Legislation*. Brussels, 2013. https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation.

European Commission. *Shale Gas*. Brussels, 2016. https://ec.europa.eu/energy/en/topics/oil-gas-and-coal/shale-gas.

U.S. Department of Energy Office of Electricity Delivery & Energy Reliability. *Grid Modernization and the Smart Grid*. Washington D.C. 2017. https://energy.gov/oe/activities/technology-development/grid-modernization-and-smart-grid.

U.S. Office of the Director of National Intelligence. *Background to "Assessing Russian Activities and Intentions in Recent US Elections:" The Analytic Process and Cyber Incident Attribution*. Washington, D.C. 2017. https://www.dni.gov/files/documents/ICA_2017_01.pdf.

Speeches

Nishkov, Ivan. "Bulgarian Coal Industry." Presentation at the International Energy Raw Materials and Energy Summit. Istanbul. October 1-3, 2015.

Sefcovic, Maros. "Nord Stream II – Energy Union at the Crossroads." Speech at the European Parliament. Brussels. April 6, 2016. http://europa.eu/rapid/press-release_SPEECH-16-1283_en.htm.

Wallstrom, Margot. "On the Road to Copenhagen." Presentation at the Political Implications of Climate Change. Copenhagen. March 8, 2008.

Websites

"A Target Goal for the Energy Transition: From Policy Goals to Specific Measures." *Federal Ministry for Economic Affairs and Energy*. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Artikel/Energy/target-architecture.html.

"Bulgaria." *Euracoal*. Accessed December 18, 2017. https://euracoal.eu/info/country-profiles/bulgaria/.

"EEG Surcharge 2017." *Netztransparenz*. Accessed December 23, 2017. https://www.netztransparenz.de/EEG/EEG-Umlagen-Uebersicht/EEG-Umlage-2017.

"Electricity Production From Renewable Sources, Excluding Hydroelectric (kWh)." *The World Bank*. Accessed December 8, 2017. https://data.worldbank.org/indicator/EG.ELC.RNWX.KH.

"Energy Community." *European Commission*. Accessed August 20, 2017. https://ec.europa.eu/energy/en/topics/international-cooperation/energy-community.

"Energy Concept." *Federal Ministry of Economics and Technology*. Accessed December 23, 2017. https://web.archive.org/web/20161006040920/http://www.bmwi.de/English/Redaktion/Pdf/energy-concept%2Cproperty%3Dpdf%2Cbereich%3Dbmwi%2Csprache%3Den%2Crwb%3Dtrue.pdf.

"Energy Production and Imports." *Eurostat*. Accessed August 20, 2107. http://ec.europa.eu/eurostat/statisticsexplained/index.php/Energy_production_and_imports.

"EU Countries Pro and Against Nuclear." *Association of the Accredited Public Policy Advocates to the European Union*." April 25, 2016. Accessed February 10, 2018. http://www.aalep.eu/eu-countries-pro-and-against-nuclear.

"For a Future of Green Energy." *Federal Ministry for Economic Affairs and Energy*. Accessed August 16, 2017. https://www.bmwi.de/Redaktion/EN/Dossier/renewable-energy.html.

"Fossil Fuels." *Eurostat*. Accessed December 18, 2017. http://ec.europa.eu/eurostat/web/environmental-data-centre-on-natural-resources/natural-resources/energy-resources/fossil-fuels.

"Fukushima Accident." *World Nuclear Association*. Accessed December 20, 2017. http://www.world-nuclear.org/information-library/safety-and-security/safety-of-plants/fukushima-accident.aspx.

"German Climate Action Plan 2050." *Federal Ministry for Economic Affairs and Energy.* November 14, 2016. Accessed August 16, 2017. http://www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Klimaschutz/klimaschutzplan_2050_kurzf_en_bf.pdf.

"German Energy Transition." *Federal Ministry of Education and Research*. Accessed March 6, 2018. https://www.bmbf.de/en/german-energy-transition-2319.html.

"Germany." *Euracoal*. Accessed December 18, 2017. https://euracoal.eu/info/country-profiles/germany/.

"Germany." *Hofstede Insights*. Accessed December 20, 2017. https://geert-hofstede.com/germany/about/culture.upickreviews.html.

"Germany's Energiewende." *World Nuclear Association*. Accessed September 1, 2017. http://www.world-nuclear.org/information-library/energy-and-the-environment/energiewende.aspx.

"Global Energy Transition Needed." *Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety*. November 16, 2016. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Meldung/20161116-weltweite-energiewende-noetig.html.

"Grid Expansion in Germany." *Federal Ministry of Economics and Technology*. Accessed January 16, 2018. https://www.netzausbau.de/SharedDocs/Downloads/EN/WhatyouneedtoknowBrochure.pdf?__blob=publicationFile.

"How Can European Electricity Networks Ease the Distribution Bottleneck?" *New Power*. Accessed December 22, 2017. https://www.newpower.info/2015/12/how-can-european-electricity-networks-ease-the-distribution-bottleneck/.

"Indicator: Greenhouse Gas Emissions." *Federal Environmental Agency*. October 20, 2017. Accessed March 6, 2018. https://www.umweltbundesamt.de/en/indicator-greenhouse-gas-emissions#textpart-3.

"Market Legislation." *European Commission*. Accessed August 20, 2017. https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation.

"National Coal Phase Out Announcements in Europe." *Europe Beyond Coal*. Accessed February 10, 2018. https://beyond-coal.eu/wp-content/uploads/2018/02/Overview-of-national-coal-phase-out-announcements-Europe-Beyond-Coal-Feb-2018.pdf.

"Nuclear Power in Germany." *World Nuclear Association*. Accessed December 20, 2017. http://www.world-nuclear.org/information-library/country-profiles/countries-g-n/germany.aspx.

"Overview of Legislation Governing Germany's Energy Supply System." *Federal Ministry for Economic Affairs and Energy*. January 1, 2017. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Publikationen/gesetzeskarte.html.

"Poland." *Euracoal*. Accessed December 18, 2017. https://euracoal.eu/info/country-profiles/poland/.

"Setting the Course for the Energy Transition: Electricity 2030." *Federal Ministry for Economic Affairs and Energy*. September 16, 2016. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Pressemitteilungen/2016/20160916-weichen-stellen-fuer-die-energiewende.html.

"Structuring of the Targets of the Energy Concept." *Federal Ministry for Economic Affairs and Energy*. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Infografiken/Alt/structuring-of-the-targets-of-the-energy-concept.html.

"The Energy of the Future: First Energy Transition Monitoring Report." *Federal Ministry for Economic Affairs and Energy*. December 3, 2014. Accessed August 16, 2017. http://www.bmwi.de/Navigation/EN/Topic/topic.html?cms_gtp=367762_list%253D6&cl2Categories_LeadKeyword=energiewende&listWithoutIds=-355426+-591218+-516402+-477222+-439888+.

"The Energy of the Future: Fifth 'Energy Transition Monitoring Report." *Federal Ministry for Economic Affairs and Energy*. December 14, 2016. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Publikationen/monitoring-report-2016-summary.html.

"The Energy of the Future: Fourth Energy Transition Monitoring Report." *Federal Ministry for Economic Affairs and Energy*. September 20, 2016. Accessed August 16, 2017. https://web.archive.org/web/20160920202129/https://www.bmwi.de/BMWi/Redaktion/PDF/V/vierter-monitoring-bericht-energie-der-zukunft-englische-kurzfassung%2Cproperty%3Dpdf%2Cbereich%3Dbmwi2012%2Csprache%3Dde%2Crwb%3Dtrue.pdf.

"The Energy of the Future: Second Energy Transition Monitoring Report." *Federal Ministry for Economic Affairs and Energy*. January 3, 2014.

http://www.bmwi.de/Redaktion/EN/Publikationen/zweiter-monitoring-bericht-energie-der-zukunft-kurzfassung.html.

“The German Feed-in Tariff.” *Future Policy*. Accessed December 20, 2017. http://www.futurepolicy.org/climate-stability/renewable-energies/the-german-feed-in-tariff/.

“The Global Energiewende.” *Energy Transition*. Accessed September 2, 2017. https://energytransition.org/.

“The National and European Politics Behind Nord Stream II.” *Vote Watch Europe.* Accessed April 17, 2018. http://www.votewatch.eu/blog/the-national-and-european-politics-behind-nord-stream-ii/.

U.S. Energy Information Administration. *Feed-in Tariff: A Policy Tool Encouraging Deployment of Renewable Electricity Technologies*. Washington, D.C., 2013. https://www.eia.gov/todayinenergy/detail.php?id=11471.

U.S. Energy Information Administration. *How Much US Energy Consumption and Electricity Generation Comes from Renewable Energy Sources? A*ccessed January 16, 2018. https://www.eia.gov/tools/faqs/faq.php?id=92&t=4.

U.S. Energy Information Administration. *Natural Gas Explained*. Accessed December 21, 2017. https://www.eia.gov/energyexplained/index.cfm?page=natural_gas_environment.

U.S. Energy Information Administration. *Short-Term Outlook: Crude Oil.* Washington, D.C. 2018. https://www.eia.gov/outlooks/steo/marketreview/crude.php.

U.S. Library of Congress. Congressional Research Service. *The European Union: Current Challenges and Future Prospects*. R44249 (2017).

“2016 Revision Amending the Renewable Energy Sources Act – Key Points.” *Federal Ministry for Economic Affairs and Energy*. December 8, 2015. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Downloads/eckpunktepapier-eeg-2016.html.

“2017 Revision of the Renewable Energy Sources Act.” *Federal Ministry for Economic Affairs and Energy*. Accessed August 16, 2017. http://www.bmwi.de/Redaktion/EN/Downloads/eeg-novelle-2017-praesentation.pdf?__blob=publicationFile&v=2.