



ISSUE BRIEF

Energiewende

From Germany's Past to Europe's Future?

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A harmonized energy, environment, and labor policy that could only come from within Germany, but which must spread beyond Germany to truly succeed.

The Fascination with Energiewende

Germany's energy policies have long been a source of fascination in the United States. US experts follow the twists and turns of Germany's power sector; they marvel at how Germany's energy policies are striking in their level of ambition. Even more remarkable to outsiders is how those policies have proven resilient despite several challenges that would typically lead to failure in other markets: high costs to consumers, major strains on influential utility companies, and negative impacts on competitiveness in a global economy. Germany's energy transition, or *Energiewende*, is indeed unique. It is difficult to compare to the situation in the United States, which does not have a unifying energy policy at the federal level. Nevertheless, US observers can learn much from the German experience: despite the uncertainties, risks, and costs, the German public remains staunchly supportive of *Energiewende*—arguably because it brings energy, environment, and labor policies together. But for the *Energiewende* to ultimately be successful and durable, Germany must expand the lessons it has learned to the European level, and apply that ambition to achieve environmental sustainability, economic competitiveness, and energy security to the entire European Union (EU).

A German Approach to Energy with Deep Historical Roots

Before renewables proliferated and wholesale electricity prices plummeted in Germany, before the Fukushima Daiichi nuclear disaster in Japan, and before addressing climate change became a global policy imperative, Germany was committed to using clean energy to improve energy security, environmental sustainability, and industrial competitiveness. Indeed, one needs a historical lens to understand the *Energiewende* that Germany is making today. The story of Germany's

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energy path from the 1970s to the present helps illustrate the country's roadmap to a carbon- and nuclear-free future.¹

The strong environmental ethos and Green Party of today's Germany emerged from student-driven social and antiwar movements in West Germany during the Cold War. Many viewed the Berlin Wall and the Fulda Gap as the geographic epicenter of the conflict between the American and Soviet superpowers. Fear of nuclear war and concerns about energy security during the oil crises of the 1970s gave way to concerns about the dangers of accidents at nuclear plants and the need to minimize risks associated with energy dependence on foreign suppliers. The nuclear crisis at Chernobyl in 1986 galvanized opposition to nuclear power and helped link environmental concerns with those about energy choices and create a mindset of sustainability. Reliance on existing nuclear capacity meant that despite the angst associated with them in Germany, nuclear plants remained operational. Nevertheless, the era of new installations ended definitively in the 1980s, and Germany's last nuclear power plant came online in 1988.² Pressure to close them before the end of their useful lives continued: a nuclear phase-out by 2020 was enacted by the German government in 2002,³ but a subsequent government postponed it in 2010 out of concern that climate commitments and energy demand would not otherwise be met.⁴

Alongside the anti-nuclear momentum, questions arose about the long-term viability of coal as an economic engine for West Germany, as did social and environmental concerns about lignite production. West Germany's coal production helped fuel its postwar economy, but lost much of its competitive edge to cheaper imported coal. Germany remains the

world's largest producer of lignite ("brown coal"),⁵ although that distinction has come with social costs on the production side as well as environmental costs on the consumption side; maintaining production has required razing towns to access the resource in parts of Germany.⁶ These experiences help explain the consistency behind the country's bold carbon emissions-reduction targets, which have grown in ambition over time. In 1997, the national target was 21 percent by 2008-2012, in 2007 it was 40 percent by 2020, and in 2012 it was 80-95 percent by 2050 (all from a 1990 baseline).⁷

Meanwhile, Germany's economy has been driven by its unique manufacturing sector known as *Mittelstand*, which is comprised of small businesses that make a small set of highly specialized products used in other products that are manufactured around the world. This sector, which constituted nearly 80 percent of Germany's jobs in 2011 and helps explain Germany's incredible economic power and resilience,⁸ is itself explained not just by a highly effective labor training culture in Germany,⁹ but also by reliable energy supplies, much of which must be imported due to a

1 For an excellent synopsis of the history of the Energiewende, read Paul Hockenos, "Energiewende—The First Four Decades," Clean Energy Wire, June 11, 2015, which served as a resource for this article: <https://www.cleanenergywire.org/dossiers/history-energiewende>.

2 "List of Power Stations in Germany," Wikipedia, en.wikipedia.org/wiki/List_of_power_stations_in_Germany.

3 Jenny Gesley, "Germany: Compensation to Utilities for Acceleration of Nuclear Energy Phase-Out," Global Legal Monitor, Library of Congress, December 21, 2016, <http://www.loc.gov/law/foreign-news/article/germany-compensation-to-utilities-for-acceleration-of-nuclear-energy-phase-out/>.

4 "Merkel Wants to Extend Nuclear Power Plant Lifespans," Spiegel Online, August 30, 2010, <http://www.spiegel.de/international/germany/slowing-the-phase-out-merkel-wants-to-extend-nuclear-power-plant-lifespans-a-714580.html>.

5 "Energy Resources in Germany," Chapter 8 in Energy Materials: Reserves, Resources, and Availability (Hannover, Germany: Federal Institute for Geosciences and Natural Resources, 2009), http://www.bgr.bund.de/DE/Themen/Energie/Downloads/Energi-eroehstoffe_2009_Teil3.pdf?__blob=publicationFile [in German]; "Currently Indispensable for a Reliable Energy Supply," German Ministry for Economy and Energy, www.bmwi.de/DE/Themen/Energie/Konventionelle-Energietraeger/kohle,did=190810.html [in German]; M. Sill, "Coal in Western Europe, 1970-1981," *Geography*, 69(1), January 1984, 66-69; Tim McDonnell, "The Town Almost Swallowed by a Coal Mine," *Slate*, April 29, 2014, http://www.slate.com/articles/health_and_science/climate_desk/2014/04/coal_mines_swallow_towns_in_germany_why_solar_and_wind_haven_t_kicked_the.html; "Germany Coal Imports by Year," Index Mundi, www.indexmundi.com/energy/?country=de&product=coal&graph=imports.

6 McDonnell, "The Town Almost Swallowed by a Coal Mine."

7 "2020 Country Emissions Targets," Center for Climate and Energy Solutions, <http://www.c2es.org/international/history-international-negotiations/2020-targets#ref2>; "Germany Commits 3.3 Billion to Combat Climate Change," *Der Spiegel*, December 5, 2007, <http://www.spiegel.de/international/germany/40-percent-emissions-reductions-germany-commits-3-3-billion-to-combat-climate-change-a-521603.html>.

8 Brian Blackstone and Vanessa Fuhrmans, "The Engines of Growth," *The Wall Street Journal*, June 27, 2011, www.wsj.com/articles/SB1000142052748703509104576329643153915516.

9 Tamar Jacoby, "Why Germany Is So Much Better at Training Its Workers," *The Atlantic*, October 16, 2014, www.theatlantic.com/business/archive/2014/10/why-germany-is-so-much-better-at-training-its-workers/381550/; "The German Vocational Training System," German Federal Ministry of Education and Research, www.bmbf.de/en/the-german-vocational-training-system-2129.html.



An anti-nuclear demonstration at the University of Bonn in West Germany in 1979. *Photo credit: Hans Weingartz.*

lack of domestic natural resources. Part of this energy has come in the form of natural gas, both produced in Europe and imported from the Soviet Union. The rest has come from nuclear power and coal. But with public opinion shifting away from nuclear power, policies emerged in the 1990s to produce sustainable energy that could serve the energy demands of the *Mittelstand*—while also making the energy sector a customer of *Mittelstand* businesses, which would manufacture the sector’s clean energy products.

It is important to note that this historical experience also informs Germany’s current views on energy security vis-à-vis Russia. German energy ties to Russia, now so problematic in the context of developments in Ukraine, were an essential part of West Germany’s Cold War policy of Eastern engagement, or *Ostpolitik*. This approach prioritized building economic linkages to the Soviet Union in the hopes that mutual dependence would prevent further political alienation between

Moscow and the West.¹⁰ As a result of these ties, despite the threats Europe has faced from the East, Germany has never perceived its own energy security to be at risk.

Therefore, the same commitment to German unification after 1989, which was seen as a national priority despite the high economic costs, political challenges, and uncertainties, also imbued the *Energiewende*. The transition to a clean energy future was propelled not by any certainty about how to achieve an outcome of carbon- and nuclear-free power, but by a conviction about the need to change the status quo of energy production in Germany without diminishing its industrial capability. The concept of *Energiewende* also incorporates an assertion that Germany was uniquely able to accomplish this given its geopolitical position, its social fabric, and the role of engineering and manufacturing in its economy.

¹⁰ Daniel Yergin, *The Quest* (London: Penguin Books, 2012), 336.

Implementation Exceeds Expectations

Germany's historical experience informs today's policy approach to the Energiewende: renewables deployment and the phasing out of nuclear generation. Given that history, the high social value of shifting away from nuclear and towards renewables explains the exigency in Germany to never abandon the Energiewende in the face of some very significant perverse policy outcomes, but rather to make iterative course corrections.

West Germany chose the feed-in tariff as the policy mechanism to accelerate the deployment of wind and solar generation. Remarkably, the first feed-in tariff scheme was the very last law passed by West Germany's Parliament under a conservative-liberal government before reunification in 1990; some experts see a direct correlation between the fall of the Berlin Wall and German leadership in renewables and the launch of the global renewables industry.¹¹ The feed-in tariff provided guaranteed rates of return for suppliers of renewable energy that would otherwise be highly unprofitable, and remained the law in a unified Germany. The renewable energy law (the *Erneuerbare-Energien-Gesetz* or EEG), enacted in 2000,¹² established a feed-in tariff scheme guaranteeing absolute rates of return for twenty years for renewable producers and mandated priority grid access for the power they generated. European Union rules to incorporate energy markets into the broader EU common market also facilitated renewables deployment. In the late 1990s and early 2000s, the EU passed directives requiring the liberalization of electricity markets and the unbundling of ownership of vertically integrated companies into separate generation, transmission, and distribution sectors. Germany's implementation of these rules made it possible for new entrants to supply electricity into the German grid that had theretofore been dominated by a small number of big utility companies—in essence, it created a *Mittelstand* in the power generation sector.

The EEG's intention was to implement a guaranteed offtake mechanism for renewable energy. The law exceeded all expectations: the share of renewables in the energy mix grew from around 6 percent in 2000

to 33 percent in 2015.¹³ (In the United States, which provided federal support to renewables in the form of annually reauthorized production tax credits instead of feed-in tariffs with twenty-year guarantees, the share of renewables in energy consumption grew much more slowly, from around 9 to 10 percent in the same timeframe.¹⁴) But the benefit was also the curse: the EEG set forth specific tariffs for types of renewable energy, but did not authorize a regulator to adjust the tariff to market demands. It quickly became clear that the tariff was set too high, and all of that unexpected renewables deployment in Germany also produced unprecedented costs.

Households Bear the Costs—Willingly

Between household electricity prices, increased costs to utility providers, and massive government subsidies, it is unclear just how much the EEG has cost Germany. In a globalized economy, preserving the domestic industry's ability to compete with market players around the world is paramount. In Germany, with its energy-intensive *Mittelstand* manufacturing base, maintaining competitiveness is critical. The EEG funded the aggressive feed-in tariff with surcharges to ratepayers, with the exception of energy-intensive industries, which were exempt. These excluded factories were even able to cover their roofs with solar panels and sell that power to the grid, enjoying the high rates of return without seeing the surcharge reflected in their electricity costs. The costs, therefore, fell mainly on the ordinary ratepayer—households.

Germany requires electricity bills to itemize all costs, and the EEG surcharge accounted for over 22 percent of the bill in late 2016.¹⁵ Household electricity costs in 2015 were double in Germany what they were in the United States. On average, US electricity prices are \$0.1265 per kilowatt hour (/kWh) for households and \$0.1042/kWh for industry.¹⁶ Compare this to €0.2880/

11 Ibid., 541.

12 *Act on Granting Priority to Renewable Energy Sources (Renewable Energy Sources Act)*, (German Federal Ministry for the Environment, Nature Conservation, Building, and Nuclear Safety, March 2000), <http://www.bmub.bund.de/fileadmin/bmu-import/files/pdfs/allgemein/application/pdf/res-act.pdf>.

13 "Information Portal Renewable Energies," German Ministry for Economy and Energy, www.erneuerbare-energien.de/EE/Navigation/DE/Recht-Politik/Das_EEG/DatenFakten/daten-und-fakten.html [in German].

14 "Share of Renewables in Electricity Production (incl. hydro)," Global Energy Statistical Yearbook 2016, Enerdata, www.yearbook.enerdata.net/renewable-in-electricity-production-share-by-region.html.

15 Ellen Thalman, "What German Households Pay for Power," Clean Energy Wire, December 16, 2016, www.cleanenergywire.org/factsheets/what-german-households-pay-power.

16 "2015 Average Monthly Bill - Residential," US Energy Information Administration, www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf; "Average Retail Electricity Prices in the US

kWh for households and €0.1532/kWh for industry in Germany.¹⁷ With the euro and dollar at near-parity these days, German households see costs that are nearly double those in the United States (and industrial costs, even when shielded from the surcharge, are still about 50 percent higher in Germany).

“... German households see costs that are nearly double those in the United States...”

Although there was an outcry about the burden the EEG posed to consumers (reported in 2013 by the German weekly *Der Spiegel*¹⁸ and even the *New York Times*¹⁹), Germany did not abandon the policy. Why did voters remain supportive? One reason for this high threshold of consumer acceptance of a costly policy lies in the country's commitment to achieve denuclearization and promote environmentalism. Another reason could be the longstanding support for the policy—after all, it had been advancing since German reunification. Indeed, although it may appear to outsiders that the German government effectively doubled-down on Energiewende in late 2013, when the Christian Democrats (CDU) and Social Democrats (SPD) joined in a conservative-liberal “grand coalition,” it was just a continuation of a trend. At that time, SPD leader Sigmar Gabriel became vice chancellor under Angela Merkel of the CDU and consolidated responsibility for the energy sector from across the government into one “super-ministry” with Gabriel at the helm.²⁰

from 1990 to 2015 (in cents per kilowatt hour),” Statista, www.statista.com/statistics/183700/us-average-retail-electricity-price-since-1990/.

- 17 *Renewable Energy and the EEG: Figures, Facts, and Graphics (2015)* (Berlin, Germany: German Ministry for Energy and Water Economy, May 11, 2015), [www.bdew.de/internet.nsf/id/20150511-o-energie-info.erneuerbare-energien-und-das-eez-zahlen-fakten-grafiken-2015-de/\\$file/Energie-Info_Erneuerbare_Energien_und_das_EEG_201_11.05.2015_final.pdf](http://www.bdew.de/internet.nsf/id/20150511-o-energie-info.erneuerbare-energien-und-das-eez-zahlen-fakten-grafiken-2015-de/$file/Energie-Info_Erneuerbare_Energien_und_das_EEG_201_11.05.2015_final.pdf) [in German].
- 18 Spiegel Staff, “Germany's Energy Poverty: How Electricity Become a Luxury Good,” *Der Spiegel*, September 4, 2013, www.spiegel.de/international/germany/high-costs-and-errors-of-german-transition-to-renewable-energy-a-920288.html.
- 19 Melissa Eddy and Stanley Reed, “Germany's Effort at Clean Energy Proves Complex,” *New York Times*, September 19, 2013, www.nytimes.com/2013/09/19/world/europe/germanys-effort-at-clean-energy-proves-complex.html?_r=0.
- 20 “New ‘Super Minister’ to Redefine Germany's Energy Transition,” *pv magazine*, December 16, 2013, www.pv-magazine.com/2013/12/16/new-super-minister-to-redefine-germanys-energy-transition_100013733/#axzz43Sfb8P5Z.

Previously, traditional energy responsibilities like grid management were under the ministry of economy, and renewables issues like management of feed-in tariff schemes fell under the ministry of environment. Both Gabriel and Merkel had served as ministers for environment previously in their careers, indicating their understanding of the implications of these reforms for improving the coherence of EEG implementation while also tying Gabriel's political fortunes to the success of the policy.

“... German households are three times more energy efficient than their US counterparts...”

Another key factor that helps explain why high household costs are accepted is the extraordinary energy efficiency that Germany enjoys. Though higher on a kilowatt-hour basis in Germany than in the United States, electricity prices do not have the same bite because German households are three times more energy efficient than their US counterparts, making electricity costs a smaller proportion of overall household spending in Germany compared to the United States.²¹ The divergence in energy efficiency rates between the United States and Germany has been growing for some time: “Over 20 years, German households reduced their power usage by 10 percent, while consumption in the United States increased by 20 percent.”²²

Utilities under Strain; Nuclear Phase-Out Accelerates

Even as it pushed retail prices up, the EEG pulled wholesale prices for electricity down, straining traditional utilities by depriving them of revenues. The feed-in tariff guaranteed that renewables had “dispatch priority,” meaning that grid operators had to

- 21 Melissa C. Lott, “Their Rates Might Be Higher, But Germans Pay Less Than Americans for Electricity,” *Scientific American*, May 30, 2015, www.blogs.scientificamerican.com/plugged-in/report-their-rates-might-be-higher-but-germans-pay-less-than-americans-for-electricity.
- 22 Ellen Thalman, “What German Households Pay for Power,” *Clean Energy Wire*, December 16, 2016, www.cleanenergywire.org/factsheets/what-german-households-pay-power.

use renewable energy at every opportunity regardless of cost or convenience. This upset the traditional merit order that vertically integrated utilities used to dispatch generation assets, using lowest-cost generation (typically nuclear and coal, which provide consistent and predictable “baseload” power) first and then deploying increasingly expensive generation like combined-cycle gas turbines as well as intermittent renewables.

Moreover, two months after the March 2011 Fukushima Daiichi disaster hit Japan, nine of the seventeen nuclear plants still operating in Germany were shuttered for safety reasons. In a decisive action understandable in the context of German sentiments towards nuclear power shaped during the Cold War and Chernobyl, Chancellor Merkel seized the political momentum to mandate a complete shutdown of nuclear power by 2022. Nuclear as a share of the electricity generation mix fell from around 25 percent to 16 percent that year,²³ weakening utilities' revenue stream from nuclear plants and incentivizing the use of cheap, dirty power from coal and lignite. The cost of wholesale energy decreased steadily, hitting a twelve-year low in 2015 as renewables accounted for 28 percent of power generation.²⁴ Wholesale prices even went negative, albeit for very short periods.²⁵

As a result, the profitability of utilities collapsed: they lost millions of euros in revenue and held billions in stranded assets in the form of nuclear plants designed to run for years into the future. (However, energy-intensive industrial companies that purchased electricity off the wholesale market enjoyed a windfall in low energy costs.) Major power companies E.ON and RWE split their companies to separate profitable renewables and electricity services from toxic nuclear and fossil generation assets.²⁶ They also sued the

government to recover some of the losses from those stranded assets.²⁷ Discussion about how to maintain fossil fuel generation capacity—necessary to manage peak demand and baseload but cost-prohibitive in the unfavorable policy environment—included the creation of capacity markets, or funding schemes for utilities to maintain baseload and peaking capabilities on a standby basis. This ignited a new policy debate at the EU level about whether utilities should be subsidized for their polluting assets as well as their clean ones, and if such aid was an unfair distortion in the European common market.²⁸

International Impacts and Perverse Policy Outcomes

Although the exemption from the renewable energy surcharge enjoyed by energy-intensive industries was put into place to maintain those firms' competitiveness on global markets, in 2013 the European Commission announced an investigation to determine if that exemption constituted illegal state aid and thus violated EU competition rules by placing those companies at an unfair advantage over European competitors.²⁹ (That was a serious allegation—at the time, the Commission's only other competition investigation in the energy sector involved alleged anti-competitive practices by Russian gas giant Gazprom.) Meanwhile, the shale revolution in the United States reduced costs dramatically for energy-intensive industries located there, further eroding the competitiveness of German productivity. Some German companies like BASF shifted production to the United States as a result.³⁰

Power,” Bloomberg, December 1, 2015, www.bloomberg.com/news/articles/2015-12-01/rwe-to-spin-off-partly-list-renewables-grids-retail-business.

23 “Nuclear Power in Germany,” World Nuclear Association, October 2016, www.world-nuclear.org/information-library/country-profiles/countries-g-n/germany.aspx.

24 Rachel Morison, “Why Do Germany's Electricity Prices Keep Falling,” Bloomberg, August 25, 2015, www.bloomberg.com/news/articles/2015-08-25/why-do-germany-s-electricity-prices-keep-falling-.

25 Laura Raus, “Deeply Negative Prices Return to Rock German Power Market,” ICIS, May 9, 2016, <http://www.icis.com/resources/news/2016/05/09/9996090/deeply-negative-prices-return-to-rock-german-power-market/>.

26 Rachel Morison and Tino Andresen, “EON Said to Divest Stake in Spinoff Company by 2018,” Bloomberg, March 19, 2015, www.bloomberg.com/news/articles/2015-03-19/eon-said-to-plan-divestment-of-stake-in-spinoff-company-by-2018; Tino Andresen, “RWE's U-Turn on Splitting Forced by Merkel's Love of Green

27 Guy Chazan, “Eon and RWE Sue German Government over Nuclear Shutdown,” *Financial Times*, March 15, 2016, www.ft.com/content/df44d1ee-e792-11e5-bc31-138df2ae9ee6#axzz43N6MQu7n.

28 Aline Robert, “Leaked EU Energy Package Subsidises Fossil Fuels, Undermines Renewables,” Euractiv, November 15, 2016, www.euractiv.com/section/energy/news/leaked-eu-energy-package-subsidises-fossil-fuels-undermines-renewables/.

29 “State Aid: Commission Opens In-Depth Inquiry into Support for Energy-Intensive Companies Benefiting from a Reduced Renewables Surcharge,” Press Release, European Commission, December 18, 2013, www.europe.eu/rapid/press-release_IP-13-1283_en.htm; Frank Dohmen, Christoph Pauly, and Gerald Traufetter, “War on Subsidies: Brussels Questions German Energy Revolution,” *Der Spiegel*, May 29, 2013, www.spiegel.de/international/europe/european-commission-set-to-fight-german-energy-subsidies-a-902269.html.

30 William Boston, “BASF Steps Up Investment in US,” *The Wall Street Journal*, December 17, 2013, www.wsj.com/articles/SB10001424052702303949504579263903951305372.



German Chancellor Angela Merkel poses for the media as she visits a wind turbine park 'WIND-projekt' in northern Germany, August 18, 2010. *Photo credit: Reuters/Fabrizio Bensch.*

With the EU's emissions trading scheme (ETS) largely ineffective as a price signal, the most carbon-intensive fuels like coal and lignite remained the lowest-cost options for power generation.³¹ Gas was squeezed out of the power mix in Germany; new gas-fired plants were mothballed and the lifespans of old, dirty coal plants were extended.³² In the United States, coal consumption decreased in the face of abundant cheap gas, but exports continued, including to Germany.³³

31 "Coal power Is on the Decline, Yet Emissions Have Increased – 2016 Was a Year of Mixed Success," Agora Energiewende, January 6, 2017, <https://www.agora-energiewende.de/en/press/agoranews/news-detail/news/coal-power-is-on-the-decline-yet-emissions-have-increased-2016-was-a-year-of-mixed-success/News/detail/>.

32 Andreas Franke and Jeremy Lovell (ed.), "German Coal-Plant Profitability Recovers as Coal Drops, Natural Gas Suffers," S&P Global, Platts, November 17, 2016, www.platts.com/latest-news/coal/london/german-coal-plant-profitability-recovers-as-coal-26598731.

33 Leonid Bershidsky, "Europe's Hooked on US Coal, But That Can't Last," Bloomberg, December 22, 2015, www.bloomberg.com/view/articles/2015-12-22/europe-s-hooked-on-u-s-coal-but-that-cant-last.

In 2015, year-on-year emissions in Germany actually increased, but fell again in 2016.³⁴

As the profit model for utilities changed irrevocably in Germany, so did the need for an increasingly resilient and flexible grid that could manage the supply fluctuations of wind and solar, which generate electricity only when the sun is shining and the wind is blowing. To deal with demand surges, coal plants that were designed to run at constant rates were used to provide peak power by ramping up and down on short notice, shortening their lifespans.³⁵ The German power grid also lacked

34 "Germany's Energy Transition: Sunny, Windy, Costly and Dirty," *The Economist*, January 18, 2014, www.economist.com/news/europe/21594336-germanys-new-super-minister-energy-and-economy-has-his-work-cut-out-sunny-windy-costly; Megan Darby, "German CO2 Emissions Rise 1% in 2015," Climate Home, March 14, 2016, www.climatechangenews.com/2016/03/14/german-co2-emissions-rise-10-million-tonnes-in-2015/; "Coal power Is on the Decline," Agora Energiewende.

35 John Kemp, "To Survive, Coal Plants Must Become More Flexible," Reuters, November 19, 2013, <http://www.reuters.com/article/coal-power-generation-idU5L5N0J42YG20131119>.

the transmission infrastructure to bring the wind power produced in northern Germany to the industrial consumers in the south. As a result, electricity was pushed into neighboring countries, particularly Poland, the Czech Republic, and the Netherlands, obliging the power grids in those countries to adjust to the influx of power, straining political ties as well as electrical interconnections.³⁶

The aggressive installation of renewables in Germany and other European countries like Spain created massive demand for manufacturing. Electricity consumers and investors in those countries effectively subsidized the fledgling renewables industry—those initial investments in wind and solar, in addition to technological improvements and manufacturing advances, helped them achieve the commercial viability they enjoy today. But German manufacturers did not reap all the benefits of this new demand. By 2010, China manufactured over half of the world's solar panels.³⁷ This helped account for a rapid decline in the costs of solar-powered electricity, but it also undercut the potential for Germany's Mittelstand to provide the core manufacturing base for its renewables sector.

Again, even when the costs exploded alongside deployment in the early 2010s, Germany never abandoned the guarantees from the early, aggressive feed-in tariffs. Contrast this with Spain, where budget deficits from an economic crisis forced the government to take the radical step of walking back the twenty-year guaranteed return on investment.³⁸ Nor did the other unforeseen challenges, including increased coal consumption, the strain on domestic and neighboring infrastructure, and the inability to realize all the employment potential from renewables-related manufacturing, ever translate into a major policy shift.

The Outlook Today

Today, the Energiewende is on better footing as a viable approach to advance renewable energy deployment without endangering economic competitiveness in

Germany. In other words, it is a viable labor policy. The Mittelstand has benefitted: although the EEG was criticized for increasing costs to German small business,³⁹ by 2008, more workers in Germany were employed in renewable energy jobs than in conventional energy.⁴⁰ Furthermore, the European Commission has acted in a way that effectively resolves the legal question about managing competitiveness with two significant decisions. In 2014, the European Commission declared that the exemption from the EEG surcharge enjoyed by energy-intensive industries did not violate EU rules, in effect sanctioning the German approach to preserving industrial competitiveness by shielding that sector from the costs of renewable energy.⁴¹

However, the main reason the Energiewende is on a more balanced footing now—adjustment of the tariff—has paradoxically weakened the economic case for new renewable deployment in Germany. Reforms to the EEG have replaced the automatic feed-in tariff with an auction system for utility-scale projects, so that only a predetermined amount of new renewables capacity will qualify for the most favorable incentives, and the feed-in tariff for rooftop solar is vastly lower than it used to be.⁴² The future of the big utilities is still in question, although recent legal decisions indicate the German government is likely to bail them out,⁴³ and insufficient transmission capacity inside Germany continues to force curtailment or export of wind generation in the north of the country.⁴⁴

36 Weixin Zha and Marek Stzrelecki, "German Wind and Solar Power Overwhelming Neighboring Grids," *Renewable Energy World*, July 8, 2015, <http://www.renewableenergyworld.com/news/2015/07/german-wind-and-solar-power-overwhelming-neighbor-country-s-grids.html>.

37 Kevin Bullis, "The Chinese Solar Machine," *MIT Technology Review*, December 19, 2011, www.technologyreview.com/s/426393/the-chinese-solar-machine/.

38 Nikolaj Nielsen, "Spain Solar Power Clouded by Government U-turn," *EU Observer*, October 27, 2015, euobserver.com/re-gions/130408.

39 Sheenagh Matthews, "German Green Energy Push Bites Hand That Feeds Economy," *Bloomberg*, January 27, 2013, <https://www.bloomberg.com/news/articles/2013-01-27/german-green-energy-push-bites-mittelstand-hand-that-feeds-gdp>.

40 Kate Gordon, Julian L. Wong, and JT McLain, *Out of the Running? How Germany, Spain, and China Are Seizing the Energy Opportunity and Why the United States Risks Getting Left Behind* (Washington, DC: Center for American Progress, 2010), https://cdn.americanprogress.org/wp-content/uploads/issues/2010/03/pdf/out_of_running.pdf.

41 "State Aid: Commission Approves German Aid Scheme for Renewable Energy (EEG 2012); Orders Partial Recovery," *Press Release*, European Commission, November 25, 2014, www.europa.eu/rapid/press-release_IP-14-2122_en.htm.

42 Amy Gahran, "Germany's Course Correction on Solar Growth," *Greentech Media*, November 3, 2016, <https://www.greentech-media.com/articles/read/germanys-course-correction-on-solar-growth>.

43 Zeke Turner, "German Government Must Compensate Utilities for Nuclear Law, Court Rules," *The Wall Street Journal*, December 6, 2016, www.wsj.com/articles/german-government-must-compensate-utilities-for-nuclear-law-court-rules-1481023375.

44 Amy Gahran, "Germany's Course Correction on Solar Growth."

Nordstream II in the Energiewende Context

The argument for improved gas sector integration is also an argument that the Energiewende would benefit if the German government were to take a position on a seemingly unrelated issue: formal opposition to the controversial Nordstream II project, a proposed gas pipeline that would double the transmission capacity of direct imports of Russian gas to Germany via the Baltic Sea. If built, the pipeline would reduce the need for Gazprom to ship gas through Ukraine to meet its obligations with European buyers and undermine gas supply diversification efforts in Southeast and Central Europe.

Nordstream II has placed the German government in the crosswinds of conflicting responsibilities—on one hand, to not obstruct the legal actions of European companies to work with Gazprom on a project that could lower their energy costs, and on the other, to promote the deepening integration of the EU energy market and to strengthen energy security throughout Europe. Although there may be debate about the commercial benefits of the pipeline and its impact on the broader European gas market on the technical level, there is no question that the pipeline is controversial at the political level.¹ The German government has avoided taking a formal position on Nordstream II. Nevertheless, it has not been able to avoid the negative publicity that surrounds the project, which demonstrates how commercial issues still have major geopolitical impacts that governments must confront. Contrast the German government's approach to Nordstream II with its very hands-on approach—all the way to the level of chancellor and vice chancellor—to leading the Energiewende in the face of remarkable criticism from German utilities, EU competition authorities, and the international media.

1 Thomas Cunningham, "Brexit + Energy Union = ?," *New Atlanticist*, June 30, 2016, <http://www.atlanticcouncil.org/blogs/new-atlanticist/brexit-european-energy-union>.

An EU decision has also resolved the question of the legality of state aid for Germany's need for a capacity market. In July 2016, Germany established a policy for a "strategic reserve" to ensure sufficient electricity generation capacity for at least four years, when renewables deployment and overall grid resilience is expected to obviate the need for reserve generation capacity.⁴⁵ In December 2016, the European Commission approved the strategic reserve as compliant with EU state aid rules, citing the need to preserve security of electricity supply in a market that is increasingly, but not yet securely, reliant on renewables generation.⁴⁶

Europeanization of the Energiewende: A Call for Proactive German Energy Diplomacy at the EU-Level

The December 2016 European Commission ruling, which came on the heels of its release of a major

legislative package on electricity market design, offers another taste of what will be necessary for the long-term viability of the Energiewende—full integration into a single EU electricity market. The strategic reserve was approved on the basis of its temporary nature, which incentivizes Germany's utilities and policy makers to work together with their counterparts in neighboring countries to achieve a seamless and robust grid. Note that it remains unanswered if and when the German grid will be able to function without its unprofitable nuclear- and fossil-powered assets, which provide critical baseload and peak load services. The fact that German policy has made them obsolete without finding a substitute to provide those capacity services implies that more seamless grid integration beyond German borders will become even more important in the future. But the leaders of Germany's power companies do not seem to see European energy integration as a priority. Johannes Teysen, chief executive officer of major German utility E.ON, has been critical of the Energy Union vision for an EU-wide electricity market; having led the divestment of E.ON's coal and nuclear assets into a separate company, he stresses it is more important to focus on distribution

45 *Law for the Further Development of the Electricity Market (Electricity Market Legislation)*, (Berlin, Germany: Bundestag, July 26, 2016), www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl&jumpTo=bgbl116s1786.pdf [in German].

46 "Commission Clears German Network Reserve for Ensuring Security of Electricity Supply," Press Release, European Commission, December 20, 2016, www.europa.eu/rapid/press-release_IP-16-4472_en.htm.

than on transmission, and on deploying renewables and providing new electricity services to customers.⁴⁷

In addition to continued need for baseload capacity and transmission improvements, peak power services will also be important for some time to come. Natural gas, which is a more effective fuel than coal for providing peak services, will need to play a more significant role in the generation mix in Germany and throughout Europe.⁴⁸ The reforms of the EU ETS that are expected to advance in early 2017 should clarify the market signal about increased costs for carbon-intensive energy production, which will disincentivize coal and make room for natural gas to return to the mix.⁴⁹ But maximizing the cost-effectiveness of natural gas across the EU also requires advancing a more diversified, transparent, and liquid gas market across the EU.

Germany's history helped shape the country's commitment to a power sector transition that holistically integrates geopolitical factors, societal values, and economic requirements. Germany's experience with implementation to date shows the policy's resilience in the face of unanticipated consequences. Going forward, Europeanization of the Energiewende will be critical. Addressing the interrelated goals of maximizing energy security, economic competitiveness, and environmental sustainability requires an approach that will be increasingly holistic. Given the need for maximum integrity of the EU common market to achieve real efficiencies in each of these three categories, German competitiveness on a global level will be effective over the long term only if energy costs are made level across the European Union. To put it another way, European energy policy will need to be optimized to ensure overall EU industrial competitiveness in the face of low energy costs in North America and low labor costs in Asia.

And while other countries in the EU have vastly different visions for their energy mixes (consider the examples of France and Germany, which champion nuclear and coal power, respectively), those differences will need to be reconciled, not ignored. Germany has not been a vocal supporter of the European Commission's Energy Union strategy,⁵⁰ perhaps to avoid the policy contradictions that arise from it. But Germany's experience with its Energiewende shows that contradictions are unavoidable and can be embraced. Germany has unsurpassed economic and political clout with which to lead this effort.

Germany's historical experience explains how the Energiewende came about, and largely explains the resilience of the policies to abandon nuclear power and to scale-up renewables in the face of the challenges they have posed to Germany's consumers, utilities, and international competitiveness. But the success of the Energiewende so far comes from the way it takes a unifying approach to energy, environment, and labor policies. Its ultimate success will require bringing them to an EU-wide scale. Particularly in the context of a new US administration and the uncertainty about the future role of US energy diplomacy in Europe and US climate leadership globally, the stage is set for Germany's government and industry to step forward to advance the vision at the European level of a harmonized energy, labor, and environmental policy, which has made such significant progress at the national level in spite of remarkable obstacles.

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47 S. Van Renssen, "In-Depth Interview: The New EON, the New Johannes Teysse: 'The future is State-Led Renewables, Stop Dreaming of Perfect Energy Union and Emission Trading System,'" *Energy Post Weekly*, September 30, 2016, <http://energy-postweekly.eu/september-30-2016-brussels/>.

48 Carlo Carraro, Massimo Tavoni, Thomas Longden, and Giacomo Marangoni, *The Optimal Energy Mix in Power Generation and the Contribution from Natural Gas in Reducing Carbon Emissions to 2030 and Beyond* (Cambridge, MA: The Harvard Project on Climate Agreements, January 2014), www.belfercenter.ksg.harvard.edu/files/dp63_carraro-et-al.pdf.

49 "Major Parties Agree More Robust ETS Reform," *Argus Media*, December 15, 2016, www.argusmedia.com/news/article/?id=1368428.

50 Kerstine Appunn, "Germany Views European Energy Union Proposals through Energiewende Lens," *Clean Energy Wire*, February 25, 2015, www.cleanenergywire.org/news/germany-views-european-energy-union-proposals-through-energiewende-lens.

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