

The Energiewende — A Success Story at a Crossroads

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Germany is a world leader in renewable energy deployment. The Renewables 2016 Global Status Report ranks Germany as third (after China and the U.S.) in absolute and second (behind Denmark) in per capita installed renewable energy capacity.¹ Driven by a long-term renewable energy policy that dates back decades and a phase-out of its nuclear power, the country is spearheading a transition to renewables commonly known as the Energiewende (“energy transition”). This article explores Germany’s key motivations for embarking on the Energiewende. It explains the uniqueness of the energy transition and investigates critical junctures in the country’s policymaking in the last 20 years. As Germany’s Energiewende continues to evolve, it faces many challenges ahead. However, there are real lessons to be learned from Germany as other states embark on their own energy transitions and explore the potential of renewables.

Five Motivations for the Energiewende

A number of evolving socioeconomic, security and environmental arguments have propelled the Energiewende over the last two decades. To some extent, they help explain the Energiewende’s unique character as a bottom-up movement driven by citizens, which differs substantially from energy transitions in other countries such as the United Kingdom.²

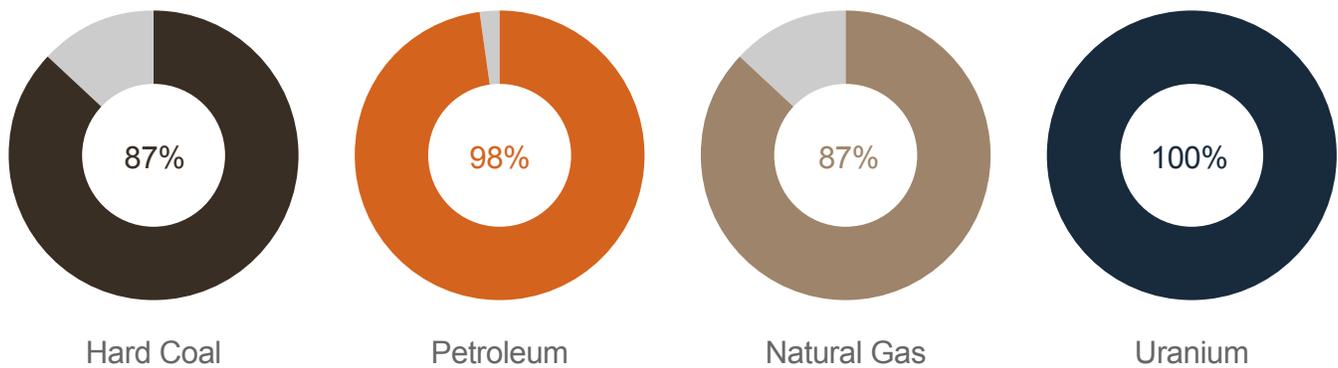
Fighting Climate Change

The Earth is warming at a faster rate than expected and 2016 is on track to be the hottest year on record, according to a report by the World Meteorological Organization (WMO).³ A major motivation for Germany to transition to a renewable

energy-based economy is its goal to fight climate change. A 2015 Pew Research Center survey found that 84 percent of Germans believe climate change is already harming or will harm people around the world (compared to 69 percent of Americans).⁴ The same study looked at the partisan divide on the issue and found 57 percent of German conservative voters agree that global climate change is a serious problem (compared to only 30 percent of Republicans in the United States). In fact, there is no debate among German citizens or lawmakers whether climate change is real: There is a broad consensus that climate change is happening, is caused by human activity, and must be addressed by reducing carbon emissions and cutting energy waste. The German public feels a responsibility to act. They understand that Germany is among the countries that have most contributed to carbon emissions over the past century.

Based on its domestic performance and international engagement, Germany is perceived as a climate leader. Between 1990 and the end of 2015, the country reduced its carbon emissions by 27.2 percent. Germany aims to go further, with an 80 to 95 percent reduction by 2050. However, meeting the 2020 target to cut emissions by 40 percent is unlikely, due to high levels of coal generation and lack of progress in cutting emissions in the heating and transportation sectors.⁵ Reducing Energy Imports, Strengthening Energy Security

Another motivation for the energy transition is the idea that increasing use of renewables can strengthen Germany’s energy security. Since the country does not have a lot of natural resources, aside from lignite (a poor and dirty form of

Figure 1: Share of Imports of Conventional Energy Sources in Germany

Source: BMWi

coal) and relatively expensive hard coal, Germany imports two-thirds of its energy, including uranium. This dependency on energy imports makes the country vulnerable to fluctuating prices for fossil fuels and political influence from abroad. This vulnerability is particularly clear in the case of Russia. Germany is by far the largest importer of natural gas from the Russian Federation. Furthermore, Germany only produces roughly 15 percent of its own natural gas, importing about 40 percent from Russia.

In 2013, Germany spent roughly 90 billion euros on energy imports, which made up 11 percent of its total spending on imports. Developing renewable energy, hand in hand with increasing energy efficiency, can help cut the country's energy imports and thus save money. The government estimates that renewable energy offset 9.1 billion euros in energy imports in 2013 alone, most of that in electricity and heat.⁶

Reducing and Eliminating the Risks of Nuclear Power

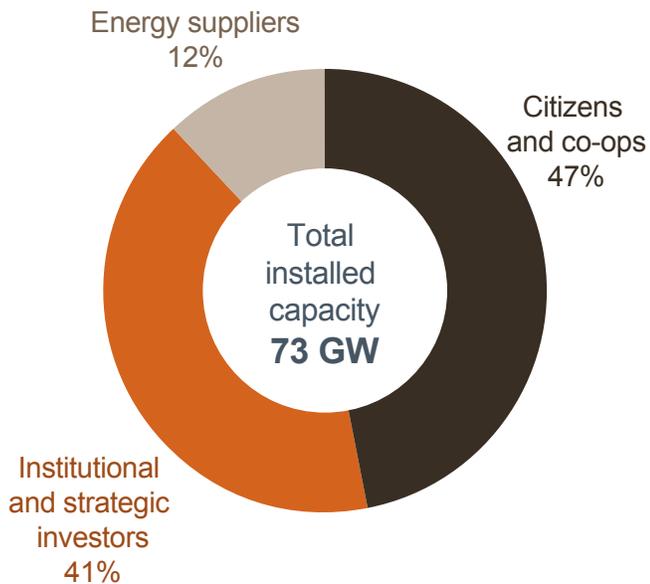
A third motivation for the energy transition is Germany's planned phasing out of nuclear power. In fact, the Energiewende movement began as a popular protest against the construction of nuclear reactors in the 1970s, long before climate change became a common concern. Among German politicians there is a broad consensus that nuclear power has no role in a sustainable energy future. If a large-scale accident like Japan's 2011 nuclear disaster at Fukushima were to occur at one of Germany's 20 nuclear reactors, it would cause disastrous environmental and economic damage and likely require millions of people to resettle. Most Germans are convinced that renewables are a safer alternative to nuclear. Furthermore, most energy experts agree that since large baseload power plants (those running 24/7 like nuclear ones) produce energy at a more constant rate, they are

incompatible with wind and solar power. Renewables require flexible backup power plants that can ramp up and down quickly to complement the fluctuating electricity generation from wind turbines and solar panels. This might also explain why most Germans think that fighting climate change and phasing out nuclear power are two sides of the same coin.⁷ Furthermore, building nuclear power infrastructure is considered to be overly costly while a solution for nuclear waste has yet to be found. Also, with international terrorism on the rise, the risk of nuclear proliferation (e.g., plutonium from nuclear plants to build dirty bombs) is a growing concern.

Economic Benefits for a Green Innovator

For a highly industrialized and export-oriented country such as Germany, the energy transition offers tremendous opportunities. The country is positioning itself as an innovator in green technology such as renewables and efficiency. The German Solar Energy Association, the interest group of the German solar industry, estimates that exports made up 65 percent of German photovoltaic (solar) production in 2013, up from 55 percent in 2011 and 14 percent in 2004. The target for 2020 is 80 percent. The German Wind Energy Association (BWE) puts the wind industry's current export ratio at 65 to 70 percent. Germany has built a strong domestic renewables market, not only for its own power supply, but also enabling manufacturing companies to position themselves competitively in the global market.

However, the economic benefits go beyond the manufacturing of wind turbines and solar panels. Deploying and operating renewables is labor-intensive. Those jobs cannot be outsourced. In 2014, roughly 355,000 people worked in the renewables sector in Germany (down from a high of 380,000 in 2011, due mainly to layoffs in the solar sector). This is more than in the coal and nuclear sectors combined. In 2015,

Figure 2: Ownership in Renewables in 2012

Source: AEE, www.unendlich-viel-energie.de

the German government estimated that renewables would create 100,000 net jobs by the year 2030 and 230,000 by 2050.⁸

Energy Democracy

In most countries, the energy sector has long been in the hands of big utilities, which operate large power plants. In contrast, renewables offer the opportunity to switch to a number of smaller generators. One notable feature of the German solar landscape is that neither big investors nor utility companies play a major role. The traditional energy suppliers invested relatively little in renewables. Rather, German farmers and homeowners own 60 percent of the country's capacity.⁹ Though most countries do not collect data on this, it seems safe to say that Germany has a comparably high level of citizen involvement in energy production. This is one central factor that differentiates the *Energiewende* from energy transitions in other countries. One in every 60 Germans is now an energy producer. Germans can even sell power at a modest profit thanks to the feed-in tariff policy. This policy guarantees priority access to the grid for renewables. It requires utilities to buy power from independent energy producers (like a person with a solar panel on their roof). Those producers receive a set price for each kilowatt-hour of electricity they feed into the grid, generally for 20 years. This price, differentiated by technology and the size of the installation, is decided by regulators to ensure a modest return on investment (e.g., buying, installing and operating that solar panel). By 2012, almost

half of all installed renewable energy power in Germany was co-owned by citizens and cooperatives. The German energy transition is a democratic movement that opens up formerly closed markets to new investors, thus increasing competition.

Over the last decade, roughly 900 energy cooperatives have been established to make it easier for citizens to participate in renewable energy projects. Overall, energy cooperatives leveraged an estimated 1.67 billion euros in investments from more than 130,000 private citizens in 2014. The high level of citizen engagement and community ownership accelerates the energy transition: By triggering more private capital to transform the energy sector and reducing NIMBYism (a term that characterizes opposition to new development, "Not In My Back Yard"), acceptance levels for renewables have increased.¹⁰

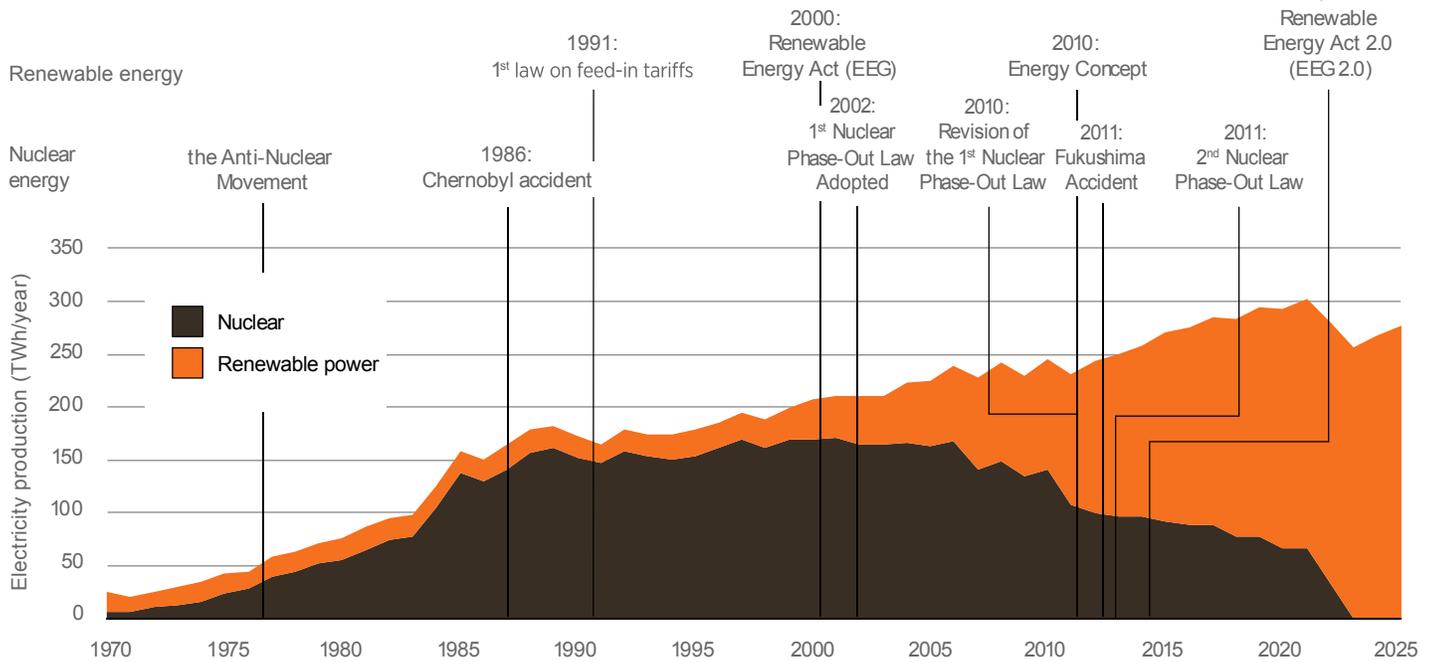
Critical Junctures in *Energiewende* Policymaking

Germany's renewable energy law is seen as a cutting-edge policy and has steered the country's rapid shift to renewables.¹¹ However, crafting and passing the legislation was not without its challenges. Like in other countries, German industry and utilities frequently lobby for legislation that benefits their interests and often manage to leave their mark on legislation. This helps explain why the original nuclear phase-out from 2002 came more slowly and with more uncertainties than anti-nuclear campaigners had hoped. Another difficulty was the emissions trading system: The industry successfully lobbied for free CO₂ allowances, resulting in generous wind-fall profits for polluters.

With their own large power plants, German utilities were hostile to the idea of promoting distributed renewable energy. Assuming they wield a great deal of leverage on bureaucrats and policymakers to shape legislation to their benefit—why would the German utility companies not prevent the growth of small-scale, citizen-owned renewable energy that erodes their business model? Why did they not see what was coming at them and just block new legislation or prevent the worst as they did with emissions trading and the nuclear phaseout? Looking back, there were three critical turning points that enabled the change to occur:

- First, the original feed-in tariff law was drafted in the summer of 1990 by a handful of politicians who realized that the federal government, especially the Ministry of Economics, would not advance their cause. As a result, an unlikely coalition of parliamentary backbenchers across party lines drafted the bill without government agency support. Matthias Engelsberger, a conservative politician, pushed for the bill so farmers in his district in Bavaria could continue operating their small hydropower plants. Herman Scheer, the Social Democrat, ensured that his party did not

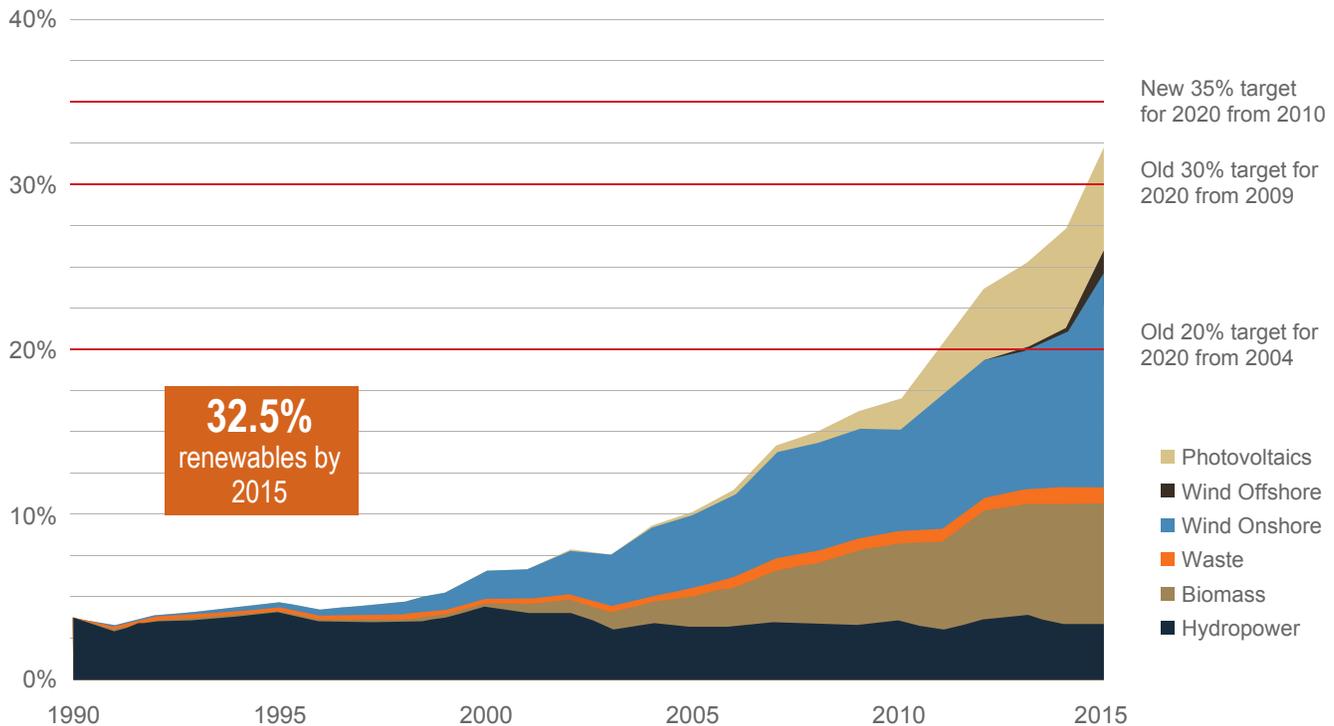
Figure 3: Nuclear and Renewable Electricity Generation and Major Events (1970-2025)



Source: IRENA, "Renewable Energy Prospects: Germany," REmap 2030 analysis, Nov. 2015, International Renewable Energy Agency (IRENA), Abu Dhabi, page 15.

- oppose the bill. Finally, Wolfgang Daniels from the Green Party co-authored the legislation. However, he ultimately removed his name from the bill so that it would not be voted down for political reasons. In addition, 1990 was the year after the fall of the Berlin Wall, an extraordinary and busy time for policymakers and stakeholders, who were preparing for reunification across all sectors. The coalition made use of a short window of opportunity in which the anti-renewable camp, led by utility companies, was preoccupied with taking over the East German energy sector.¹²
- In the year 2000, the Red-Green alliance (a coalition between Social Democrats and the Green Party) disrupted the traditionally strong ties between utilities and the government by passing the Renewable Energy Act. The Ministry of Economics, the government agency in charge of energy, was not interested in extending incentives for renewable energy. Backed by the big utilities, it blocked the requests of parliamentarians from the Social Democrats and the Green Party to draft legislation. Like their predecessors a decade earlier, the politicians—in particular Herman Scheer of the Social Democrats, and Michael Hustedt and Hans-Josef Fell of the Green Party—realized they would have to circumvent their own government. Again the utility companies were distracted with arguably

- bigger issues, including the nuclear phase-out and the ecological tax reform that were being negotiated in parallel. To close the deal and overcome opposition from the pro-coal camp within the Social Democratic Party, electricity generation from mine gas (which escapes coal mines) was included in the law.
- The nuclear accident in Fukushima, Japan, in March 2011 was a decisive moment for the *Energiewende*. It coincided with a heated debate on nuclear policy in Germany. The year prior, the center-right coalition of Christian Democrats and Free Democrats passed an energy package, which included the lifetime extension of Germany's nuclear plants. However, the majority of Germans and many small and municipal utilities opposed the extension. The deal energized the anti-nuclear community and mobilized large demonstrations. When Chancellor Angela Merkel saw the explosions in Fukushima, she knew her nuclear policy could not stand. With the public overwhelmingly supporting a phase-out more than ever before, and with important state elections coming up, she decided to reverse her party's long-held position on nuclear power overnight. When the phase-out law from the coalition came to a vote in parliament, it received nearly unanimous support. The vote sealed the nuclear phase-out over the next decade. From

Figure 4: Renewable Share of German Gross Electricity Consumption by Source (1990–2015)

Source: AGE

that moment, it was clear that the nuclear industry would end its business in Germany for good.

These three junctures are crucial to understanding how the Energiewende came to be implemented. These moments were unique in the sense that a small window of opportunity opened to enact change in an otherwise stable system with influential incumbents. Traditional interest groups and their allies in parliament and government, such as the German utilities and the Ministry for Economics, were unable to prevent progressive legislation. Of course, three single decisions over 20 years do not make for a comprehensive policy framework. The success of the Energiewende is due to the hard work of many over a long period of time. Without political leadership, skillful maneuvering within the policy arena, a bit of luck and the right timing, the Energiewende legislation would not have progressed to where it is today.

The Energiewende at a Crossroads

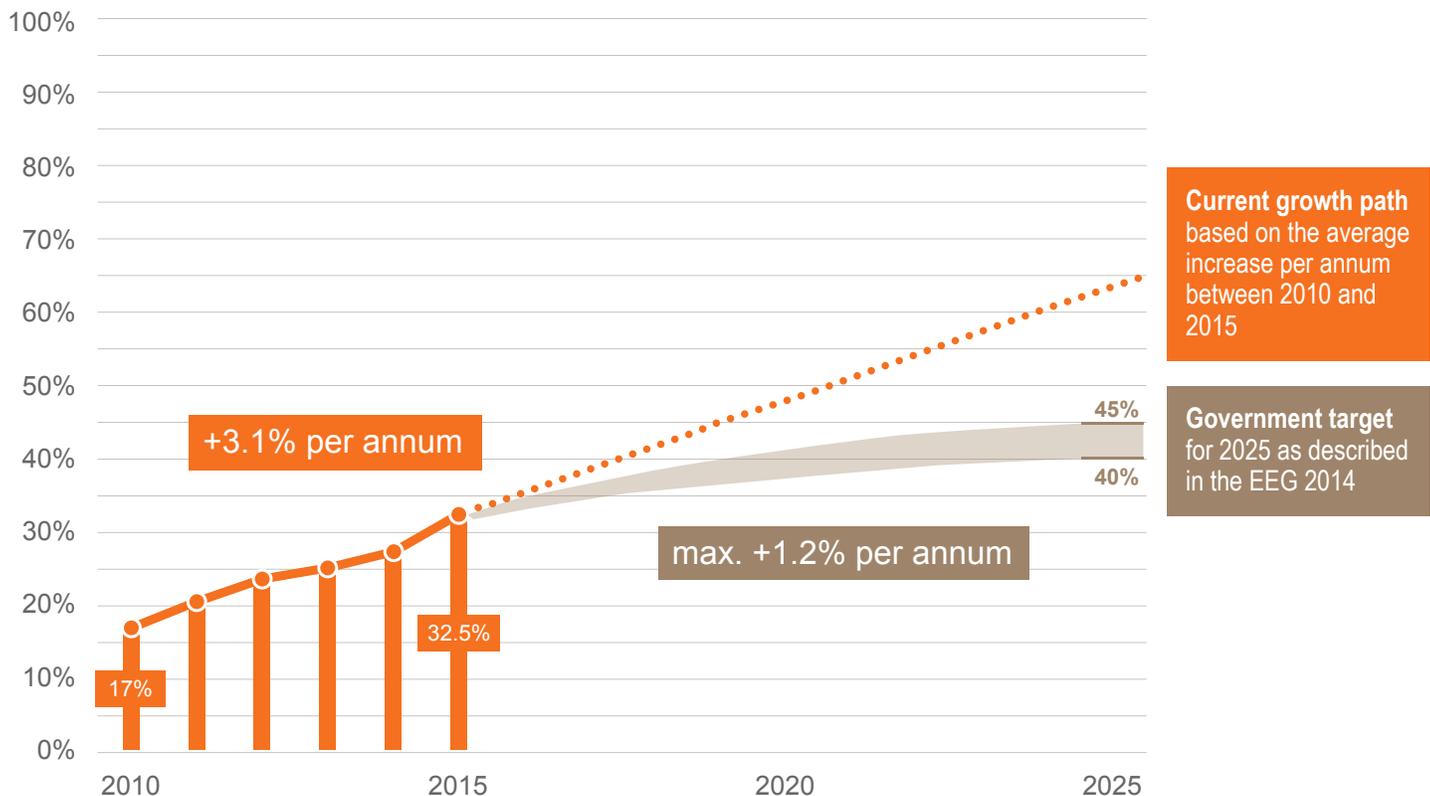
For many years, Germany's policy instrument of choice was the feed-in tariff. It guaranteed a fixed payment for 20 years (in most cases) and priority grid access for renewables. The policy provided high investment certainty and triggered tremendous growth in renewable power generation capacity. When the initial law was introduced in 1990, the role of

renewables in Germany's power mix was negligible. By 2015, renewable electricity made up 32 percent of consumption and had grown at a speed that exceeded all expectations. The government repeatedly had to upgrade its targets to keep up with renewables growth.

However, in the spring of 2016, the German government put forward plans to overhaul the Energiewende's flagship policy. The reform of the Renewable Energy Sources Act includes a switch from feed-in tariffs to auctions: Instead of automatically receiving guaranteed payments, renewable energy installations will now have to compete on the open market in an auction bid for subsidies. Sigmar Gabriel, minister for economic affairs and energy and the party leader of the Social Democrats, hails the reform as a paradigm shift in the way renewables are funded: "More competition, continuous growth with effective steering, restrictions on costs, stakeholder diversity and dovetailing with grid expansion—these are the coordinates for the next phase of the energy transition."¹⁴ With the reform, the government reiterates previously set goals to increase the share of renewable electricity to 40 to 45 percent in 2025, to 55 to 60 percent in 2035, and to at least 80 percent by 2050.

To keep a steady hand on the increase in renewable power, a "deployment corridor" will set limits to how much renewables

Figure 5: Share of Renewable Electricity in Domestic Demand and Government Targets



Source: AGEB, EEG 2014

capacity may be added per year. These limits are set per technology, such as onshore and offshore wind, solar power and biomass. Small renewables installations like rooftop solar will continue to receive feed-in tariffs. The government believes this will ensure that citizen cooperatives and project developers remain active in operating small renewables plants. It argues that the reforms are making renewables deployment more predictable, thereby facilitating grid expansion and improving planning security for Germany's neighbors and the energy industry. After all, Merkel promised the *Energiewende* would not destroy German utilities.¹⁵

Critics argue that the government is putting the brakes on the *Energiewende*. Green campaigners see the new limits for onshore wind power, the most cost-competitive renewable technology, as a sign that the government is trying to slow the rapid growth of renewables. In light of past growth rates, this concern seems justified. Since 2010, Germany has increased the share of renewables in electricity demand by 3.1 percent per year, on average. If this growth trajectory continued, the share would rise to 60 percent by 2025.¹⁶ With the new proposal for reform, however, the government seeks

to ensure that renewables growth does not exceed its 2025 target of 40 to 45 percent.

Critics expect that these changes will not only fundamentally threaten Germany's leadership in energy and climate policy, but also lead to significant job losses and reduce business opportunities for entrepreneurs. Anna Leidreiter, a climate policy expert at the World Future Council, a nonprofit that advocates for policy to enable sustainable development, argues that the switch from feed-in tariffs to auctions, in particular, would weaken investment opportunities for small investors, energy cooperatives, farmers and enterprises.¹⁷

The parliamentary majority of the Christian Democrats and the Social Democrats passed the law despite this opposition. However, in a last-minute change, special rules for citizen energy projects were included. They have to participate in the auction system, but also enjoy certain benefits. For example, they will automatically receive the highest feed-in tariff accepted in the tender, rather than their own (possibly) lower bid.¹⁸ The *Energiewende* is at a crossroads. So far, citizens, communities and new investors have been the driving force

behind the energy transition. This is likely to change with the reforms coming into effect in early 2017. The introduction of caps and the switch from feed-in tariffs to auctions will most likely result in big investors and large corporations dominating the market. The reforms threaten to exclude many potential investors, including ordinary citizens, whose billions of euros could be used to finance the transformation to a low-carbon economy. An analysis by the Climate Policy Initiative concludes that more than 30 billion euros per year could be available for investment in the expansion of renewable energy capacity in Germany if the country shifts policy effectively to deal with the next phase of the energy transition and keeps investment open.¹⁹

Future Challenges

So far, the implementation of renewables has gone smoothly. Despite the high share of renewables, Germany enjoys one of the most reliable grids in the world. However, generating 50 percent or more of electricity from variable renewable sources will require some serious changes in the power system, because it will no longer be dominated by baseload power plants. This includes flexibility measures such as better cross-border exchange with other countries, demand-side management such as smart grids and smart metering, and linking the power sector to the heat and transportation sectors. This sector coupling—basically meaning that excess electricity from renewables can be used in the heat and transportation sectors—is particularly important to harness all renewable energy potential and to reduce costlier options such as curtailment or battery storage.²⁰

In addition to these technical challenges, German policymakers will have to address the future costs of the energy transition. So far, domestic manufacturers have kept their competitive edge, backed by strong exports, despite concerns about rising electricity prices. Some of the most energy-thirsty companies are actually benefitting from the lowest wholesale prices in Europe. Many are exempted from the taxes and levies that fund the Energiewende. As consumers shoulder the bulk of these costs and some firms do not qualify for such benefits, the topic of competitiveness is likely to persist as the Energiewende progresses.²¹

What does progress look like in the long run? The Fraunhofer Institute for Solar Energy Systems (ISE) calculated what it would cost to cut emissions by at least 85 percent by mid-century. The study concludes that once carbon is priced and increasing fossil fuel prices are included in cost calculations, the transition to renewables is cheaper than just keeping the current system going.²²

Finally, Germany still relies heavily on coal power. Those who think nuclear should be part of a low-carbon future have criticized Germany for the 2011 nuclear phase-out and argue

that coal is filling the gap. Indeed, Germany went through a temporary uptick in coal power in 2012-2013 and reported rising greenhouse gas emissions. However, analysis shows that the reduction of electricity generation from nuclear power is fully offset by an increase in renewable energy. The coal uptick mainly happened due to greater power exports and a gas-to-coal switch in the power sector, driven by higher prices for natural gas.²³

However, Germany's continued reliance on coal remains the Energiewende's Achilles heel. Mary Robinson, the former president of Ireland and UN special envoy on climate change, sharply criticized the government's recent decision to pay new subsidies for the closure of old coal plants, and rightly so.²⁴ Without a real commitment to shift away from coal in a certain time frame, the German government will face a credibility problem.

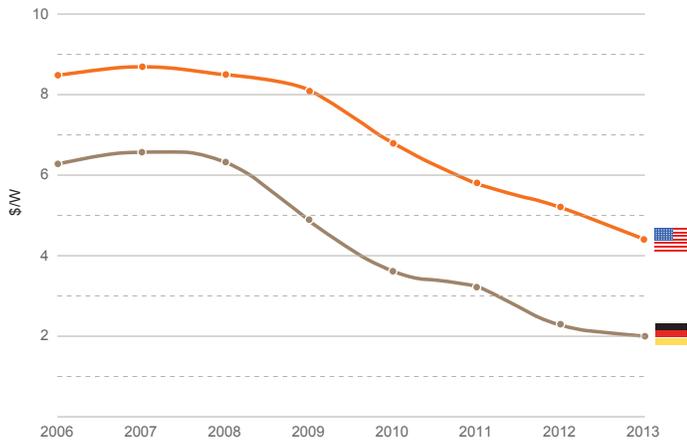
Global Problem, Global Solution

No country is the same and what works in one place might be a dead end in another. Still, the German case offers some pointers for other states interested in addressing the renewable energy issue. Overall, Germany's Energiewende shows that there are no perfect solutions. On the contrary, it takes societal and political will, flexibility and endurance to transition. Three central lessons can be learned from Germany's experience:

1. **There is no silver bullet.** Policies should be coordinated across sectors and levels of government to achieve maximum effectiveness. Despite the high public visibility of flagship projects such as the Renewable Energy Act or the Nuclear Phase-Out Law, no policy alone has proven to be the single cause of success. For the Energiewende, many individual policies were integrated into a larger policy framework. This framework is comprehensive and oriented toward the future, including binding long-term targets guiding implementation efforts and the compulsory review of policies at regular intervals.²⁵ What is remarkable in international comparisons—and a contrast to the “all-of-the-above” approach favored by many in the United States—is that German policies set clear priorities (for renewables, against nuclear, and likely soon against coal) for its energy mix.

2. **Germany is an economic showcase for the energy transition.** The Energiewende demonstrates the feasibility of an energy transition and provides an illustration of the economic benefits that come with it. The German case shows how countries can create a secure business model and necessary framework conditions for significant investment in renewables.²⁶ Together with long-term policy goals backed by cross-partisan support, this framework generated a high investment certainty for industrial manufacturers, which helped drive down costs of renewables even further. Some

Figure 6: The Cost of Fully Installed Photovoltaic Arrays in Germany and the US (10 kW - 100 kW)



Source: RMI, Fraunhofer ISE

stress the need for more research and development before renewable technologies can play a bigger role. However, the Energiewende has shown that both innovation and cost reductions have often come from deployment, not from waiting for breakthroughs. Germany embarked on the transition when renewables were still expensive. By cutting red tape and providing easy access to financing, Germany managed to make it easier for homeowners to invest in solar panels. In return, the market grew and costs declined. Comparisons show that installing a 100kw solar panel on the roof of a family house in Germany cost roughly \$2,000 in 2013, while American homeowners would have to pay more than \$4,000 for a comparably sized model.²⁷ In a nutshell, the German government made it easy for its citizens to go solar. Germany does not enjoy particularly favorable conditions for wind and solar resources, so for other states, the economic benefits could be even higher.

3. The energy transition represents a one-time window of opportunity to democratize the energy sector. Global investments in wind and solar soared to roughly \$265 billion in 2015 alone. After China, the United States is the world's biggest investor in renewable power capacity with an estimated \$44 billion, an increase of 19 percent from the previous year.²⁸ These numbers show that the energy transition is already underway. Once utilities have built giant wind and solar farms, the market will be closed to citizens and communities. Without energy democracy, corporations, which view citizens as consumers, will handle the transition. The Energiewende shows that it pays to expand the discussion about the energy transition beyond affordability and greenhouse gas emissions. These are, no doubt, important criteria to consider, but so are basic civil rights in the energy sector.

This involves including citizens and providing them not only the choice to buy, but also to produce clean power and sell it at a fair price. An active role for citizens in the energy transition would strengthen communities, increase its acceptance and accelerate the transition.²⁹ Germany will continue with its transition to a renewable energy-based economy. It remains to be seen if important milestones (such as cutting greenhouse gas emissions by 40 percent by 2020) can be met. Future Energiewende reform plans are on hold until the 2017 election. Germany's next government will have to address the challenge of a coal phase-out and decide how to expand the Energiewende to the heat and transportation sectors.

ABOUT THE AUTHOR

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