

Wind-Power Development in Germany and the U.S.:  
Multiple Streams, Advocacy Coalitions, and Turning Points

Chapter 5 in Andreas Duit, ed.,  
The Politics of Ecology:  
The Comparative Study of Environmental Politics and Policy.  
[tentative title]  
Cambridge, Mass.: MIT Press, forthcoming in 2013.

Roger Karapin  
Department of Political Science  
Hunter College and the CUNY Graduate Center  
New York, USA  
Email: rkarapin@panix.com

May 2012 draft

## **Introduction**

Renewable energy is seen as a solution to problems of anthropogenic climate change, air pollution, resource scarcity, and dependence on energy imports (Vasi 2009; IPCC 2012). Of the various forms of renewable energy, wind-generated electricity has a unique set of advantages, which make its potential impacts on fossil-fuel consumption, greenhouse-gas emissions, and other air pollution especially large. Wind power produces relatively low levels of environmental damage over its life cycle (like solar),<sup>1</sup> relies on relatively mature technology, and has a relatively large current share of energy production (like hydro and biomass). It is also based on a potentially enormous natural resource and has been growing rapidly in many industrialized and developing countries (Greene, et al. 2010). Global installed capacity of wind power rose an average of 26% a year from 2001 to 2010, to a total of about 197,000 megawatts (WWEA 2010, 5; author's calculations).

---

<sup>1</sup> Sovacool 2009, 712. However, critics have emphasized its damage to the aesthetic value of landscapes, noise pollution, and harm to bird and bat populations (Sovacool 2008, 185-86).

Although common experiences with the oil crises of the 1970s and more recent concerns about global warming have motivated most industrialized countries to adopt wind-power development policies, they vary greatly in the extent to which they have successfully developed this renewable-energy source. The key measure used in this chapter for description and explanation is the share of electricity consumption or generation that is produced from wind, since this describes the extent of wind-power development while controlling for the size of a country's economy and energy sector.<sup>2</sup> By focusing on an outcome measure, this chapter concerns environmental performance; by choosing a specialized outcome measure that is directly linked to improvements in environmental quality, it avoids the problems with aggregated indices noted by Meadowcroft in his chapter in this volume. In terms of the share of electricity generated from wind in 2008, the leading countries in the world were Denmark (19%), Spain (12%), Portugal (11%), Ireland (9%), and Germany (7%). Laggards in wind-power development according to this metric include Italy, the U.S., Sweden, the U.K., Australia, Canada, and Japan, all with wind shares below 2% of electricity demand (IEA 2009, 10).

The central question that this chapter addresses is whether political actors in countries that lag in wind-power development might have used government policy to achieve more than they have, or whether the structural constraints under which they operate made their relative failure inevitable. Of course, this question lends itself to a comparative approach, in order to use the contrasting experiences of different countries as a basis for explanation and theory

---

<sup>2</sup> Using wind-generated electricity as a percentage of total electricity consumed or generated has an advantage over using measures based on installed capacity, since the former adjusts for differences in the capacity factors of the wind turbines, which can vary significantly across countries. Unlike installed capacity, generation shares may vary from year to year because of weather conditions; however, this is of little importance given the time frames and scales that pertain here.

development. A *cross-national* comparison is appropriate because wind-power policies are largely made by national governments, although laggard European countries (not included here) may be affected by the EU's renewable-energy policies, such as its 2001 directive setting national targets. At the same time, the role of subnational governments in federal systems must be taken into account where it is of major significance for a country's wind-power development.

In this chapter, I will focus on two country cases in order to examine a large number of process variables, which are difficult to include in large-N studies because of the unavailability of reliable, comparable information on those variables across many cases. Thus I aim to correct for the bias of large-N studies toward structural factors (cf. Karapin 2012). A small-N approach also facilitates undertaking a longitudinal analysis, and the comparative analyses in this chapter extend to include cross-temporal comparisons within countries as well as comparison between them. To aid in theory development, I will also assess multiple theories, rather than merely providing support for one approach. This method helps guard against assuming that one's favorite theory is correct and makes it possible to discover where different theories are each applicable (Sabatier 2007, 330; Zahariadis 2007, 86-87).

In choosing cases, it was evident that Germany and the U.S. comprise a useful comparison for addressing this chapter's central question and for building theory, for several reasons. They currently represent a leading and a laggard country, respectively, in terms of wind-power development as a share of electricity consumption, and hence provide a clear contrast to be explained, even though this does not mean that their relative positions are fixed, as I will explain below. More generally, the two countries represent the first and third worlds

of the environmental state, in Jahn's terms, occupying extreme positions in that typology (see his chapter in this volume, esp. Figure 4.2). At the same time, in absolute terms, both the U.S. and Germany are very significant wind-power producers in the global context. Because of the large size of its energy sector, the U.S.'s small share of wind power still translates into a large absolute volume. Therefore, in terms of absolute wind-power capacity, the U.S. is in second place globally, while Germany is in third; China leads in total capacity, although its wind sector currently provides only 1.2% of national electricity generation (IEA 2011, 5). Together, the U.S. and Germany account for about 35% of global capacity, so explaining these two country cases is of inherent importance in understanding the politics of wind power worldwide.

There is another, perhaps more important reason for including these two countries. Strong structural explanations have been advanced to explain the differences between their wind sectors, so comparing them provides a good test of the structural theories. Given the structural differences between the two countries, was it inevitable that Germany would increase its wind share so much more than the U.S.? Or did political and other processes, which could have unfolded differently, play a significant role? If so, under what conditions do actors have more scope for influencing outcomes?

The following section describes two contrasting theoretical perspectives, one based on socioeconomic structures and political institutions and the other on the interaction between problem and political streams and advocacy coalitions. Next, I briefly describe wind-power outcomes and policies in Germany and the U.S. The rest of the chapter then explains the gap between the two countries in a series of analyses. These go beyond a static comparison by

distinguishing three phases: U.S. leadership (1980-92); Germany's surge into a growing leadership role (1993-2003); and the beginning of catch-up by the U.S. (2004-present). The phases are marked by turning points, which are explained by analyses that triangulate between structural and process explanations. The conclusions consider the implications for theories of environmental outcomes and for multiple-streams theory.

### **Theoretical Perspectives**

Implicit in many causal analyses of environmental policies and outcomes is the question of how much difference actors such as government officials, environmental organizations, political parties, or coalitions of actors have made and could make in the future. To bring this question into sharp relief, it is useful to contrast a structural theory of environmental performance with the multiple-streams theory of policy-making.<sup>3</sup>

#### A structural approach: socioeconomic structures and political institutions

Major works on environmental outcomes and on climate or energy policies (e.g., Kitschelt 1986; Jänicke, Mönch, and Binder 1996; Jahn 1998; Neumayer 2003; Paterson 1996; Scruggs 2003) argue for the importance of structural features, as do some studies of renewable energy (e.g., Huang 2007; Keller 2010; Toke, Breukers, and Wolsink 2008).

These literatures examine a wide range of structural factors such as wind resources, fossil-fuel endowments, export dependence, the openness of policy-making institutions, electoral systems,

---

<sup>3</sup> While the former aims to explain outcomes and the latter to explain agenda setting, here they will both be applied to explain policy-making and implementation. This is reasonable because wind-power outcomes depend strongly, though not exclusively, on renewable-energy policies. Also, the causal factors in multiple-streams theory often bear directly on decision making and implementation as well as agenda setting (cf. Zahariadis 2007, 80), and I will supplement them with advocacy-coalitions theory to more fully address policy making.

the strength of implementation institutions, planning systems, wind-turbine ownership patterns, and the strength of landscape protection organizations. Of course, these are too numerous to treat adequately in this chapter. To provide the best test of the structural theory, here I will describe four factors that seem best able to explain U.S.-Germany differences (Keller 2010). While these factors may change over time, the rate of change is very slow, so they can be seen as structures with basically stable effects on these two countries from the 1970s to the present.

First, countries' energy policies are influenced by their fossil-fuel endowments. Those with less domestic production of fossil fuels, and therefore greater dependence on energy imports, are more likely to develop policies that promote renewable energy at the expense of fossil fuels. Their fossil-fuel-sector lobbies are relatively weak, and thus less able to block renewable-energy policies. Moreover, such countries have a national interest in developing domestic energy sources in order to reduce dependence on oil and natural-gas imports, which have been subject to price volatility and supply insecurity (Paterson 1996, 80; Keller 2010, 4741). Second, countries dependent on manufacturing and on exports have an interest in promoting industries that would create new manufacturing jobs to meet domestic and international demand, which also helps drive economic growth that in turn boosts government revenue. Since wind power is a much more labor-intensive form of energy production than coal or natural gas, it is in such countries' interests to promote it over fossil fuels (Gipe 1991, 763).

Third, the nature of the electoral system affects a political system's openness to innovations in environmental and energy policy. In countries with proportional representation, ecological or left-libertarian political parties were more likely to become established by the

early 1990s than in countries where electoral rules strongly favor major parties at the expense of minor parties, such as the U.S. (Willey 1998). Green parties have been strong advocates of renewable-energy policies and may influence policy through participation in government, by exerting competitive pressure on other parties, and by playing crucial roles in advocacy coalitions (Neumayer 2003; Karapin 2012).

Fourth, the nature of the interest-group system is also held to bear on environmental policies, including renewable energy. Pluralist interest-group systems are marked by fragmentation of business interests, an adversarial relationship between business and government, and hence relatively uncertain or unstable environmental policies. Neocorporatist systems are characterized by a relatively centralized and concentrated representation of interests, cooperative relations between business and government, and more stable policies that are more smoothly implemented by economic actors (Crepaz 1995; Jahn 1998; Scruggs 2003).

#### A process approach: policy windows and advocacy coalitions

By contrast, most of the cross-national literature on wind power, as well as some key works on Germany and on the U.S., argues for the importance of short-term, relatively steerable processes. These include the positions and strategies of economic, non-governmental, and state actors, mobilization by environmental movements, advocacy-coalition formation, issue framing, policy feedback, market formation, election results, and policy design features (e.g., Bird, et al. 2005; Gan, et al. 2007; Jacobsson and Lauber 2006; Kraft and Axelrod 1984; Laird and Stefes 2009; Portman, et al. 2009; Sovacool 2008; Stenzel and Frenzel 2008; Swisher and Porter 2006; Szarka 2007; Vasi 2009; Walz 2007). The multiple-

streams theory of agenda setting and policy making can subsume many of these variables into a coherent framework (Kingdon 2003; Zahariadis 2007). In this theory, an issue is most likely to reach the decision-making agenda when intense problem perception, viable policy solutions, and strong political commitment converge. Each of these is affected both favorably and adversely by streams of events and other processes, which are partly but not completely independent of each other. When problem and politics streams converge to produce the perception of a severe problem and also strong political commitment to address it, a policy window is created. The window may be exploited by policy entrepreneurs who promote particular policy solutions, which already have been generated and tested in their own complex, slow-moving stream (Kingdon 2003, 15-18, 203). Similar to theories of critical junctures (Collier and Collier 1991) and of punctuated equilibrium (Baumgartner and Jones 1993), the theory of multiple streams attempts to locate and explain moments of unusual openness, when policies that are usually fairly stable may rapidly change.

Here I will focus on the problem and politics streams. Doing so will simplify the comparative analysis and provide a somewhat tougher test of this process theory, since policy streams are those most amenable to influence by political actors. Problem streams concern which problems are seen as most important and hence worth putting on policy makers' decision-making agendas. A problem stream is altered significantly through extraordinary focusing events (such as environmental disasters), dramatic information about indicators of environmental conditions, and/or strong feedback from existing policies (Kingdon 2003, 197-98). The politics stream concerns who holds power, their ideological or value-based commitments, and the political constraints they anticipate. This stream is affected by election

results, changes in governmental leadership positions, shifts in public opinion, and mobilization by organized groups that affect their balance of power (Kingdon 2003, 198).

One element in the multiple-streams theory, the balance of power aspect of the politics stream, requires further elaboration, partly to capture more fully the influences on decision making as opposed to agenda setting. The advocacy-coalition framework, which is largely consistent with and complementary to multiple-streams theory,<sup>4</sup> is helpful here. Advocacy-coalitions theory centers on the balance of power between a coalition of advocates for a policy direction and a coalition of their opponents (Sabatier 1988; Sabatier and Weible 2007). Both kinds of coalition can draw on specialists in a variety of governmental and private organizations, including government agencies, parties, parliaments, interest groups, non-profit organizations, social-movement organizations, research institutions, and media outlets (Jänicke 2005, 138; Jost and Jacob 2004; Watanabe 2009). The composition, political resources, and constraints of advocacy coalitions can be influenced by elements of the problems and politics streams, such as environmental crises, other socioeconomic developments, shifts in public opinion, changes in the governing coalition, or policies in other subsystems (Sabatier and Weible 2007, 202).

The combination of these two theories offers to explain innovations in renewable-energy policy. When problem and policy streams converge, they open a policy window. At such times, if the advocacy coalition is more powerful and mobilizes more energetically than the opposition coalition, stronger policy will result. In addition, problem streams play another

---

<sup>4</sup> Although they are sometimes seen as rivals and have different emphases, the two theories have much in common and few real points of disagreement. Both hold that the usual inertia in policy-making can be overcome when sharp changes in perceived problems and in political alignments create openings for political actors to press successfully for major policy changes.

role in a theory of environmental outcomes. Besides affecting policy-making, they may affect outcomes more directly, by influencing economic actors and policy implementation.

### Testing and relating structural and process theories

Although structural and process theories often appear as rivals in explanations of environmental outcomes, in fact they can be complementary theories. Few studies of renewable energy examine both structures and processes,<sup>5</sup> and fewer still analyze the relative weights of these causes or how they relate to each other.<sup>6</sup> Most studies examine either only structural features or only processes. Perhaps without intending to, the former imply that structural causes comprise a sufficient explanation, while the latter imply that the processes studied are not much affected by structures.

In the rest of this chapter, I will try to contribute to our understanding of the relative causal weights of structures and processes and how they fit together in producing environmental outcomes. The structural theory described above will be tested for congruence between the putative causes and the outcomes. The multiple-streams theory will be tested through process tracing to try to produce causal chains of mechanisms that stretch from processes that generate the problem and politics streams, to the creation of policy windows, to policies and outcomes. There are several ways to test these theories against each other, which will be employed below. Are the stable outcomes predicted by the structural theory are

---

<sup>5</sup> Among those that do, Reiche and Bechberger (2004) and Gan, et al. (2005) assess a wide range of factors without distinguishing relative weights, and Snyder and Kaiser (2009) and Bohn and Lant (2009) come down largely on the side of the processes that they consider.

<sup>6</sup> Exceptions include Laird and Stefes (2009) and Stefes (2010), which examine the roles of historical contingency and path dependence, and Breukers (2006), which relates structures and processes in a theory of institutional capacity building.

actually produced, or do the outcomes vary over time in line with process variables? Do the mechanisms identified by the process theory flow simply from the structures alone, or do they depend on extraneous and contingent factors? Are the structural features themselves influenced by the processes? By using one theory to critique the other, I aim to improve our understanding of the scope and limits of each.

## **Wind-Power Outcomes and Policies**

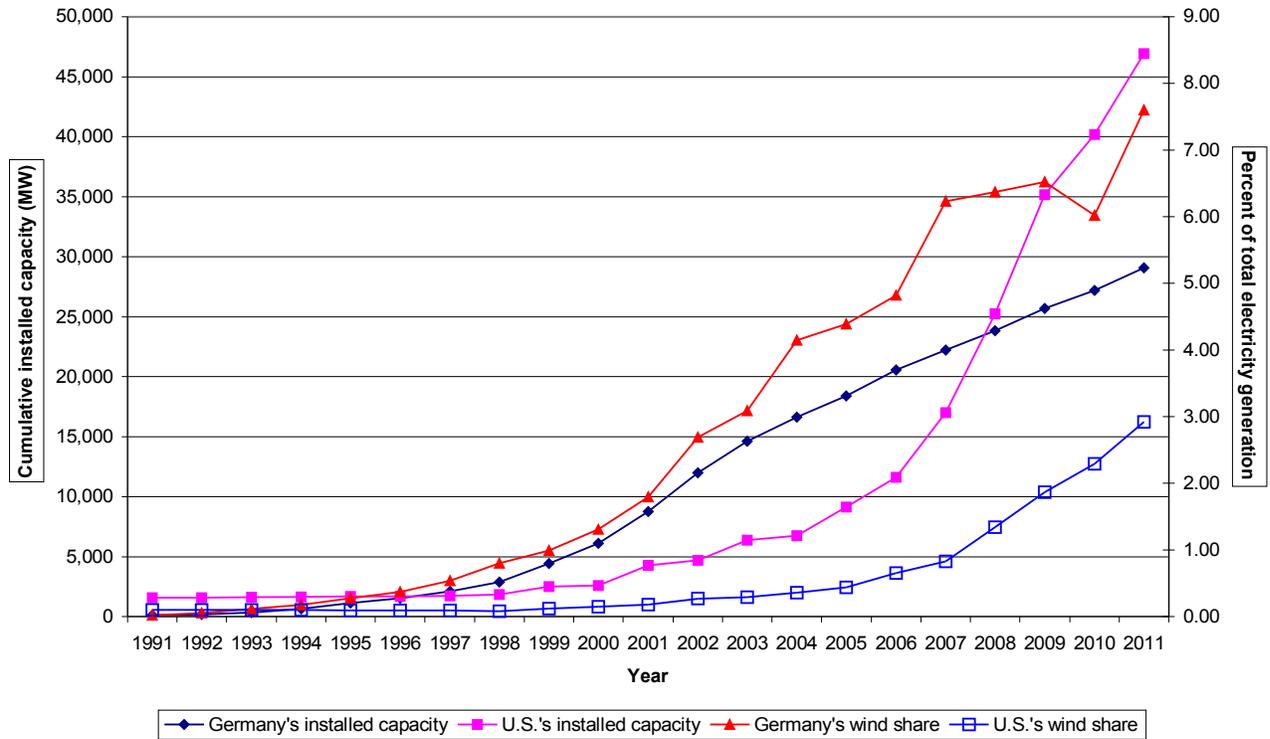
### Outcomes

Both Germany and the U.S. recently have experienced rapid growth in wind power, but the takeoff was delayed in the U.S. and hence its wind share of electricity generation is still less than 40% of Germany's. In Germany, wind power began to grow rapidly in 1991, with installed capacity rising from 106 MW in 1991 to 16,623 MW in 2004, an average growth rate of 48% per year, and although growth has slowed markedly, it still averaged 8% per year during the 2004-11 period (see Figure 1).<sup>7</sup> In 2011, wind power accounted for 46,500 Gigawatthours (GWh), or 7.6% of electricity consumption in Germany. By contrast, in the U.S., growth in wind power was very slow before 1998, with installed capacity rising only 3% per year from 1989 to 1998. Rapid growth began the next year, eight years later than in Germany, and installed capacity then grew at a 28% annual rate in the 1998-2011 period. Because of its relatively late start, wind power still made up only 1.8% of the U.S.'s electricity generation in 2009, though it had risen to 2.9% in 2011.

---

<sup>7</sup> Data for Figure 1 from BMU 2012, 11-12; AGEBA 2010, 22; Dismukes, et al. 2007, 778; AWEA 2010, 2; USEIA 1996, Table A1; 2012, Tables 1.1, 1.1.A.

**Figure 1: Growth of Cumulative Installed Wind Power Capacity and Wind Shares of Electricity Generation in Germany and the U.S., 1991-2011**



## Policies

It is clear that the state, including the national state, has been crucial for the growth of wind power. The development of wind power requires government support for research and development, financial supports in order to at least partially level the playing field with energy sources possessing large environmental externalities and their own government subsidies, and regulatory support to break into (semi)-monopolistic markets (Walz 2007). Not surprisingly, the leading countries seem to have stronger wind-power development policies than the laggards (Szarka 2007, 68-86).

Two main differences in their policies toward wind energy go a long way toward explaining the different outcomes in Germany and the U.S. First, financial incentives have been larger in Germany, although exact comparisons are difficult (Walz 2007, 78). In Germany, wind-energy producers were guaranteed 90% of the retail price of electricity from 1991 to 2000, and since then about 8-9 Euro cents (currently about 11-12 U.S. cents) per KWh (Lauber and Mez 2006, 113). In the U.S., the federal production tax credit has provided a subsidy of about 2 cents/KWh since 1992, which is around 20% of the retail electricity price. The incentives from state-level renewable portfolio standards (RPSs) currently add between 0.5 and 5.5 cents/KWh, depending on the state, and green-power choice programs add another 1.5 cents/KWh, which applies to about 30% of wind-generated electricity (Stern and Wobus 2008, 16, 20; Bird, Kreycik, and Friedman 2008, 10). Hence, total U.S. subsidies for wind power are highly variable across states, ranging from 2.5 to 8.5 U.S. cents/KWh, compared to about 11 U.S. cents/KWh offered everywhere in Germany.

Second, policies and the policy context have been much more stable in Germany than in the U.S., which has created a more secure climate for investors. In Germany, the 1990 Electricity Feed-In Law guaranteed prices to producers beginning in 1991, and the only major political challenge to those rates was defeated in 1997. Three years later, the Renewable Energy Sources Act guaranteed feed-in tariffs for 20 years and distributed the costs of the subsidies equally across all utilities and their customers, which reduced political opposition. Moreover, the overall policy context for renewable-energy development has been more favorable and stable in Germany, as it has included prominent, ambitious greenhouse-gas reduction targets since 1990 and renewable-energy targets since 2000 (12.5% of electricity by

2010, later raised to 30% by 2020) (Bechberger and Reiche 2004, 50; Mez 2009, 386-87; Lauber and Mez 2006, 110; Walz 2007, 69; Vasi 2009, 328). By contrast, in the U.S., tax credits for wind power have often been allowed to expire or have been renewed only at the last minute. National targets for renewable energy and greenhouse-gas emissions also have been lacking, along with any sustained federal government interest in binding international commitments concerning the latter, which signals a lack of political commitment in those areas. Altogether, this has created much uncertainty for investors, insurers, and employees (Wiser 2007, 5; Sovacool 2008, 156-57).

Explaining these differences in policies and outcomes is the topic of the next section.

## **Explanation of the Germany-U.S. Differences**

### Structural explanations

Germany and the U.S. differ in a number of structural and institutional features that have been advanced to explain differences in environmental outcomes (Jahn 1998; Scruggs 2003), in energy and climate policies (Paterson 1996), and specifically in wind-power development (Keller 2010). These might explain why Germany has developed wind power much more intensively than the U.S.

However, some of these possible explanations have little support. For example, wind resource has been advanced as an explanation in several cross-national and cross-state studies (Menz and Vachon 2006; Toke, Breukers, and Wolsink 2008, 1133; Bird, et al. 2005; Vasi 2009). But the U.S. does not lag Germany because the U.S. lacks adequate wind resource.

The most recent estimate of the wind potential in the U.S. is 36,900,000 GWh/year, which is 934% of current electricity consumption and over 500 times the current generation from wind (NREL 2010).

Another possible explanation is that the U.S. lags in wind power because it had already developed other renewables to a greater degree than Germany. This would reduce the pressure -- coming from any domestic environmental or energy-security interests or international climate-policy commitments -- to develop wind power more aggressively. However, Germany leads the U.S. in almost every areas of "new renewable energy," including biomass, solar, wind, and all non-hydro renewables combined (11.6% vs. 3.6%); the U.S. leads Germany only in geothermal energy (data from BMU 2009, 16; USEIA 2010a, 5).

Several other structural explanations are more plausible. First, Germany has smaller fossil-fuel endowments and greater dependence on energy imports, as well as on manufacturing and manufacturing exports, than the U.S. Germany's energy imports totaled about 75% of total consumption in 2008, compared with about 26% for the U.S. (USEIA 2009, xix; *Der Spiegel* 2007). Also, among major industrial countries, Germany has ranked at or near the top in the share of manufacturing jobs in the economy since 1970, while the U.S. has ranked near the bottom. In 1995, 23% of German jobs were in manufacturing, compared with 13% in the U.S. (Pilat 2006, 6). Germany also depends much more on exports than the U.S. does; exports made up 30% of Germany's GDP in 2002, compared with only 7% in the U.S.<sup>8</sup> As a result, Germany arguably has a stronger national interest than the U.S. in developing renewable energy. Indeed, renewable-energy policy in Germany has been justified

---

<sup>8</sup> [CIA World Factbook](#), 2003 data via [www.nationmaster.com](http://www.nationmaster.com), accessed 14 May 2010.

partly by reference to the 280,000 jobs the government estimates it to have created (BMU 2009, 31).

Second, proportional representation allowed the Green party to become a national force in Germany, while the plurality winner-takes-all electoral system of the U.S. has protected the Democrats and Republicans against potential third parties. Hence, green parties have been insignificant in the U.S., which reduces pressure for innovation in energy policy. Third, the competitive, pluralist interest-group system in the U.S. is accompanied by an adversarial relationship between government and business, while Germany has a neocorporatist system and more cooperative business-government relations (Scruggs 2003, 227-28, 233). Hence, business opposition to environmental policy is usually more muted in Germany than in the U.S., where radical environmental deregulation was pushed by business interests and largely carried out by the Reagan administration in the 1980s, with lasting effects.

#### Some problems with the structural accounts

Together, these structural factors offer a plausible explanation of why Germany took a leadership role in wind-power development. However, the structural explanations are problematic in several ways. First, the U.S.'s structures do not present only disadvantages. It has greater wind resources than Germany, and its institutions favor innovation in energy policy in at least two ways. The U.S.'s pluralist interest-group system and weak political parties make it more open to new interests and ideas than Germany, with its moderately strong neocorporatist arrangements and programmatic parties (Kitschelt 1986, 66, 81). Also, while both countries have federalist institutions, state governments in the U.S. have more autonomy

in energy and environmental policy than those in Germany (Kraft 2004, 89; Keller 2010).

This provides another avenue for innovation in the U.S. system, since states are relatively free to experiment with renewable-energy policies, and if they have success, it may be imitated in other states and the national government may come under pressure to make policy more uniform. Indeed, the state level has been an important source of renewable-energy policy change in the U.S.

It is possible that these advantages for the U.S. operate at the same time that the disadvantages do. Since the U.S. lags Germany in wind power and other new renewables, one could defend the structural theory by arguing that the U.S.'s structural disadvantages outweigh the advantages when it comes to renewable-energy policy and outcomes. But in theoretical terms, it is not clear why some structural features would be more important than others. A theoretically more fruitful line of analysis starts with the fact that the two sets of structural factors tend to cancel out or balance each other to an extent. This creates scope for other causal factors, such as political and socioeconomic processes, to contribute to the outcomes.

Another, larger problem for the structural explanation of Germany's leadership over the U.S. is that the outcomes fit the explanation only for the period since the early 1990s. In fact, the same structural explanation would be completely wrong for the 1970s and '80s, when the U.S. led Germany in wind power, and it has been losing force since 2004, when the U.S. has been catching up. The U.S. began the commercial use of modern wind power almost ten years before Germany did, in California (Dismukes, et al. 2007). Hence, the U.S. led Germany in absolute wind-power capacity from 1982 until 1997. As late as 1992, the U.S. had over 60% of the world's wind-power capacity and nine times Germany's, and the U.S.

still led Germany in terms of its share of wind power in total electricity generation.<sup>9</sup> Also, since 2004, the U.S. has been catching up to Germany in terms of its wind-power share, due to rapid recent growth in capacity in the U.S. (32%/year) and a slowdown in Germany's growth (to 9%/year).

In short, the relative positions of German and U.S. wind power comprise a variable, not a fixture. Although the U.S. now lags Germany's share of wind power, this was not always the case, and it may not be the case a decade from now. Indeed, if their respective post-2004 growth rates were to continue for the five years from 2012 to 2016, the U.S. would begin to exceed Germany's share of wind power in electricity generation in 2016.<sup>10</sup> The variability in their relationship can be seen in Figure 2,<sup>11</sup> which shows the ratio between the German and the U.S. share of wind power in total electricity generation. The ratio rose from less than parity in the 1981-92 period to a peak of almost 12:1 in 2004. Since then it has declined, reaching less than 3:1 in 2011.

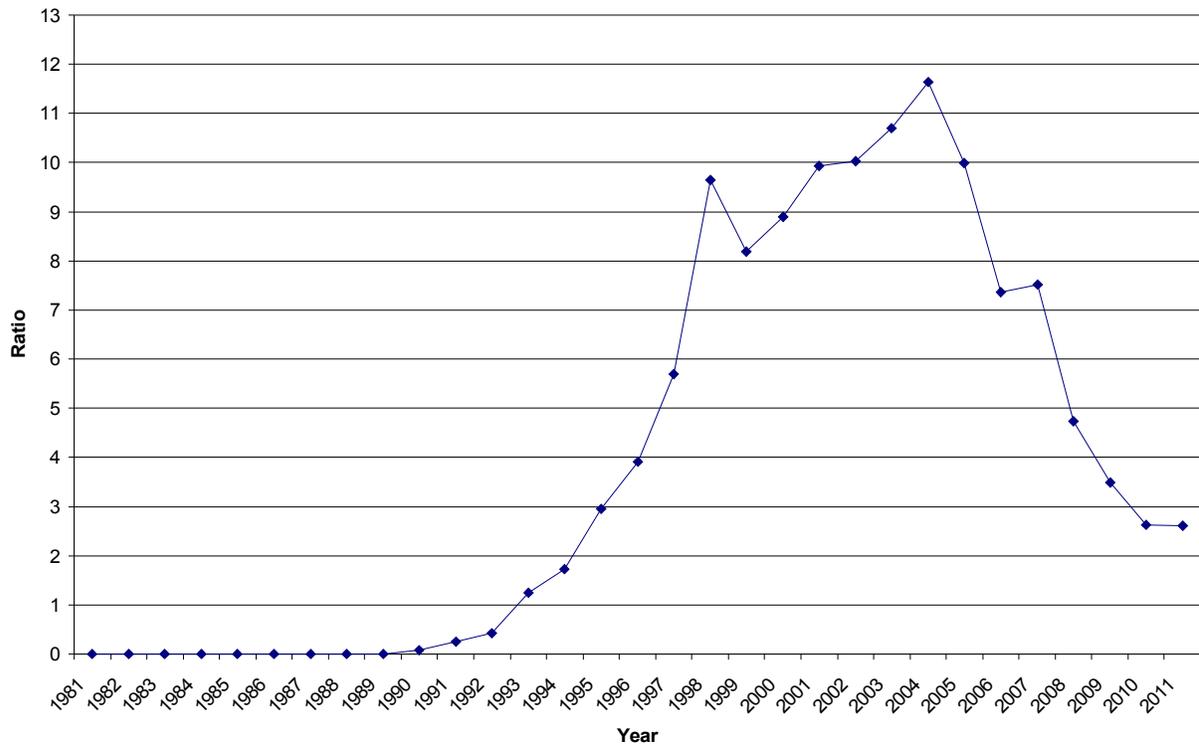
---

<sup>9</sup> Dismukes, et al. 2007, 778; author's calculations from the data cited for Figure 1.

<sup>10</sup> Based on 2004-11 annual growth rates in both countries; data from BMU 2012; USEIA 2012. However, the sharp decline in U.S. natural-gas prices since 2008 is a potential problem for the U.S. wind industry.

<sup>11</sup> Data for Figure 2 are calculated from BMU 2012, 11-12; AGEBA data; USEIA 1996, Table A1; 2012, Table 1.1. The U.S. wind shares for 1981-94 are my estimates based on installed capacity and average capacity factors.

Figure 2: Ratio of Germany's to the U.S.'s Wind Share of Electricity Generation, 1981-2011



Therefore, rather than a simple story of German dominance, it is more accurate to say that the relative positions of the two countries have gone through three phases: U.S. leadership (1975-92), U.S. stagnation and growing German leadership (1992-2004), and the beginning of catch-up by the U.S. (2004-present). Hence, there are three turning points in the relative positions of Germany and the U.S. to explain, which the next section does in terms of the convergence of problem and political processes.

## Multiple streams, policy windows, and advocacy coalitions

### *The U.S. takes the lead*

In the 1970s, problem and politics streams converged to produce a window for innovations in energy policy in the U.S., both at the federal level and in some states. The 1973 oil crisis presented large, unexpected problems, which included a quadrupling of oil prices, a five-month embargo of the U.S. by OPEC, and gasoline rationing. Unusually strong political commitment came after the election of Jimmy Carter, who won the 1976 presidential election by only a 50-48% margin. Carter had a strong interest in energy policy and advocated the creation of the Department of Energy during the presidential campaign (Laird 2001, 90). He and his administration (1977-81) sharply increased R & D spending for wind power, which peaked in 1980, and created the cabinet-level Department of Energy and within it an office for renewable energy with its own assistant secretary (Cox, Blumstein, and Gilbert 1991, 353; Walz 2007, 67; Nemet and Kammen 2007, 750; Laird and Stepes 2009, 2620). Carter also proposed major energy legislation, and one part that survived the congressional process in 1978 was PURPA, a bundle of utility reforms. This gave independent power producers grid access and opened the door for state governments to set high purchase prices for renewable-sourced electricity if they chose to interpret the "avoided costs" of generation under generous assumptions concerning future fossil-fuel prices (Swisher and Porter 2006, 186). Wind projects were eligible for a 15% investment tax credit adopted in 1978, and for accelerated depreciation starting in 1981 (Cox, Blumstein, and Gilbert 1991, 354). These aggressive national Carter-era policies set the stage for the 1980s boom in wind power in California.

California's structural advantages were also necessary conditions of the boom there. The state had abundant land, some with excellent wind resources (in mountain passes), as well as many rich individuals potentially interested in investing in wind projects. That latter was important since utilities were not eligible for important federal tax credits, a feature that also encouraged the growth of independent power producers (Gipe 1995, 30).

But the wind boom in California would not have occurred without strong state-level political support for wind and solar power. This occurred through a key development in the politics stream: the election of Jerry Brown as governor of California, who served from 1975 to 1983. In his 1974 election campaign, Brown ran on the slogan "serve the people, protect the earth, explore the universe" and advanced a strong environmental agenda. Although Brown was elected only narrowly (by 50-47%), his victory helped create a policy window for renewable energy in the state. Advised by renewable-energy advocates such as Amory Lovins, Brown revived the California Electricity Commission and created an Office of Alternative Technology, both of which pressed for a strong renewable-energy policy (van Est 1999, 34-35). Staffers in the latter agency helped ensure that a 1978 solar tax-credit law would also apply to wind power. The same year, the state legislature passed the Mello Act, which set ambitious targets for renewable-sourced electricity (1% by 1987, 10% by 2000) (Righter 1996, 204-6).

Encouraged by this political support, the California Public Utilities Commission, all of whose members were Brown appointees after January 1979, went on the offensive against utility companies. In 1979 and 1983, it levied multi-million-dollar fines against two large utilities for failing to pursue alternative energy, conservation, and cogeneration (Harris and

Navarro 1999, 12-13). The fines spurred the utilities to negotiate with independent power producers and the public utilities commission, which led to contracts with high purchase prices for wind power (Gipe 1995, 30). The commission also began mapping wind resources in 1977, providing crucial data that was not available in other states (Righter 1996, 204-6).

The convergence of federal and state politics streams led to a very generous combination of financial incentives for wind power at this time: a 15% federal investment tax credit for certain energy properties enacted in 1978, a generic federal investment tax credit of 10%, accelerated depreciation from the federal government, and the California tax credit for wind power of 25% (Cox, Blumstein, and Gilbert 1991, 354). On top of all these financial incentives, the California Public Utilities Commission guaranteed wind-power operators a price of about 7 cents/KWh in contracts lasting at least 10 years (Righter 1996, 203-4; Harris and Navarro 1999, 14). As a result, 50,000 individual investors provided \$2 billion in capital, and companies rushed to build wind farms in California, mainly in three mountainous areas. Companies installed 1141 MW of capacity by 1985, and California generated 87% of the world's wind power that year (Harris and Navarro 1999, 14; Cox, Blumstein, and Gilbert 1991, 356).

### *Germany surges ahead*

After 1992, Germany exceeded the U.S.'s wind share of electricity generated, because wind power stagnated in the U.S. from 1985 to 1998 while it took off in Germany after 1990. In the first place, the U.S. boom in wind energy turned to a bust because its problem and politics streams simultaneously reversed direction and created a different kind of policy

window, one that conservatives used to undermine renewable energy. One reason the problem stream shifted is because the top-down approach taken in the 1970s set the stage for technological failures in the 1980s; wind power became seen as a problem more than a solution. U.S.-made wind turbines broke down in field conditions in California in the early 1980s, since aerospace firms failed to anticipate problems such as insects and ice, and extremely high subsidies led to shoddy construction (Cox, Blumstein, and Gilbert 1991, 349). By 1985, only 38% of the U.S. turbines were working reliably, compared with 98% of the Danish turbines, and hence Danish turbines came to dominate the U.S. market (Heymann 1998, 646).

The second reason the problem stream reversed was the decline in fossil-fuel prices during the 1980s. After peaking in 1980, crude oil prices fell continuously for the next six years, declining by a total of 70%, and coal and natural-gas prices also fell sharply during the 1980s. The low prices sharply reduced political interest in alternative energy and made the aggressive renewable-energy strategy of states like California difficult to sustain (Sovacool 2008, 150-54).

Around the same time, the politics stream presented a reversal of fortunes for environmental policy, including renewable-energy policy. Nationally, the election of Ronald Reagan as president in 1980 inaugurated a sharp shift toward environmental deregulation, which drastically curtailed national support for renewable energy (Kraft and Axelrod 1984, 319; Kraft 2004, 115). Congress largely went along with Reagan's proposed cuts to wind and other renewable-energy programs. R & D spending for wind power fell by 50% from 1981 to 1984 and kept declining through the early 1990s. Spending for renewable energy and energy

conservation fell by about 90% during the 1980s (Nemet and Kammen 2007, 750; Kraft 2004, 174). Federal tax credits and accelerated depreciation for wind power were allowed to expire in 1985, dealing a severe blow to the industry (Gipe 1991, 758).

California also saw a political reversal, after the Republican George Deukmejian was elected governor in 1982. He attacked the state's renewable-energy tax credits, and although the legislature initially resisted him (van Est 1999, 55), the combination of changes in the problem and politics streams was irresistible. California stopped signing preferential contracts for wind power in 1985, gave operators with existing contracts only five years to get their projects online, and let its tax credit for wind projects expire (Swisher and Porter 2006, 187; Harris and Navarro 1999, 16). Some wind and solar companies went bankrupt, many skilled and experienced people left the industries, and wind and solar became saddled with a stigma of ineffectiveness and financial failure (Sovacool 2008, 154-55; 2009, 4502).

The problem and politics streams continued to be unfavorable for national renewable-energy policy into the 2000s. Oil prices remained at or below their 1986 level until 2003, and Republicans controlled either the White House or the House of Representatives for all but two years until 2009. However, a 1990 spike in oil prices, the 1990-91 Persian Gulf war, and President George H.W. Bush's rebranding as an environmentalist helped lead to the National Energy Policy Act in 1992. A broad coalition including the natural-gas and renewable-energy industries as well as energy-efficiency advocates helped get a national production tax credit for wind power into that legislation (Eikeland 1993, 65-68).

Nonetheless, these forces were too small and short-lived, and the 1992 Act was too weak, to have much effect on wind-power development. The production tax credit's low level

of subsidy combined with low fossil-fuel prices meant that wind power did not become competitive with natural gas until about 2000. Moreover, providing the incentive as a tax credit made it difficult for wind-power operators to claim it, since their long-term tax liabilities were not large and predictable enough. This promoted the sale of wind-generation facilities to large corporations and hindered the development of a new set of economic actors with a strong interest in technological development and political advocacy (Swisher and Porter 2006, 188). Furthermore, Congress gave low priority to the renewal of the production tax credit, allowing it to expire for periods of several months in 1999, 2002, and 2004. The expirations in some years, and uncertainties about the credit's extension in others, created insecurity for investors and led to a boom-bust cycle in the construction of new wind projects, which reduced the long-term growth of the industry (Wiser 2007).

By contrast, in Germany, commercialization of wind power did not really begin until after 1990. But Germany quickly passed the U.S. in the wind-power share of electricity (in 1993) and in absolute wind-power generation (in 1997). The extremely rapid growth in Germany was largely due to the 1990 passage of the Feed-In Law, its defense in the late 1990s, and its strengthening in 2000. And that legislative history, in turn, was due to the convergence of politics and problem streams in the late 1980s that created an extraordinarily large window for energy and climate policy.

The politics stream included the emergence of a broad strong, advocacy coalition. The coalition eventually included the Greens, environmental organizations, research institutes, unions, religious organizations, hydroelectric producers, key elements of the Christian-Democratic and Social-Democratic parties, the Environment Ministry, and the Federal

Environmental Agency. The environmental movement and its legacies contributed crucially to the advocacy coalition, in several ways. The West German environmental movement was stronger than in most industrialized countries, with a major focus on opposition to nuclear power during the 1970s (Koopmans 1995). The movement spawned organizations such as the Eco-Institute and solar associations, which in the late 1980s began to develop feed-in tariff proposals for renewable energy (Jacobsson and Lauber 2006, 263). Environmentalists also helped to found green parties, initially at local and regional levels, in alliance with leftist activists. The environmental movement influenced public opinion on nuclear power and climate change in the long term (Vasi 2009, 328). Moreover, once the Greens gained Bundestag seats in 1983, the new party strongly influenced the established parties toward environmental positions. The Christian Democratic federal government began to regulate SOX emissions to prevent forest dieback, and the Social Democrats backed away from their support for nuclear energy (Papadakis 1989; Schreurs 1997, 153; Weidner 2002, 154).

These political developments linked to the environmental movement were peaking at the same time that a series of external events created major changes in the perception of environmental problems in the 1985-86 period. The rise of ozone depletion as an international issue in 1985 was followed in January 1986 by a report from the respected German Physical Society warning of climate change and rising sea levels, which sparked much anxious media coverage and public attention (Beuermann 2000, 100; Kords 1996, 204; Der Spiegel 1986). Then, in April, the Chernobyl nuclear disaster focused attention on environmental problems in West Germany, which was one of the West European countries receiving the greatest amount of radioactive fallout (Peplow 2006, 983).

These events drove changes in the politics stream, creating a window of opportunity for elites who promoted climate protection and renewable energy. Public support in Germany for environmental protection reached a peak in the late 1980s (Bang 2003, 217). The federal government created the Federal Environment Ministry in June 1986 and a parliamentary inquiry commission on ozone and climate issues that October (Watanabe and Mez 2004, 112). The commission, which created and expressed a consensus across all the parliamentary parties, called for Germany to reduce CO<sub>2</sub> and methane emissions by 30% compared with 1987 rates and to adopt an electricity feed-in-law to assist renewable energy (Lauber and Mez 2006, 105-6).

Bound up with these political changes was the formation of a broad advocacy coalition. In 1989, Green and Christian Democratic deputies created a highly unusual alliance to support a feed-in law for renewable-energy sources, including wind, solar, small biomass, and small hydroelectric projects. The law was resisted by the utilities, the Federal Economics Ministry, and party leaders, but gained support from deputies in all parliamentary parties. Its unanimous passage was aided by two additional contingent events. In 1987, the electricity utilities announced that they had reached their limits in making payments for small hydroelectric producers, which drove those producers into the advocacy coalition. In fact, the Christian Democratic deputy who led the push for the feed-in law was head of the hydroelectric power producers association and the operator of a hydroelectric plant (Reiche 2004, 146). Also, as German unification unfolded rapidly in 1989-90, the utilities became distracted by the restructuring of the former East German electricity sector, so they did not anticipate the Feed-In Law's likely effects on new renewables and did not strongly oppose it (Bechberger 2000, 4-

5; Lauber and Mez 2006, 106; Jacobsson and Lauber 2006, 264).

Although the principle of government mandating the price at which utilities would purchase renewable-sourced electricity was similar to that used in the U.S.'s PURPA as well as in Denmark's renewable energy policies, there is no evidence that the policy idea diffused from either of those countries to Germany. Rather, similar what happened to Denmark, a feed-in tariff for renewable-sourced electricity had existed in Germany since 1979 in the form of a voluntary agreement among trade associations, before the 1990 Feed-In Law converted it to a regulatory measure on terms much more generous to wind power producers (Reiche 2004, 146).

The 1990 law strengthened the advocacy coalition for renewable energy by creating a market for wind turbines and solar photovoltaic cells and hence reducing their costs, and by spurring interest-group formation and mobilization. Hence, when large utilities and the federal government tried to reduce the feed-in subsidies in 1997, a coalition of wind turbine suppliers and operators, solar energy producers, metalworkers, farmers, environmental and religious organizations, and the large Equipment and Machinery Producers Association drew 4000 people to a demonstration in Bonn. Their mobilization helped defeat the proposed cuts in a Bundestag committee (Jacobsson and Lauber 2006, 265; Michaelowa 2005, 195; Watanabe 2009, 151-52, 160, 166, 179, 184).

The advocacy coalition reached a new level of influence after the 1998 parliamentary elections, in which the Greens received 6.7% of the vote and joined in a national coalition government with the Social Democrats for the first time (Jänicke 2005, 138; Weidner 2002, 182). Under that government, a series of major climate policies were enacted, including a

100,000 roofs program for solar photovoltaics and the 2000 Renewable Energy Sources Act (Bechberger and Reiche 2004, 50). The advocacy coalition grew to include one of the large utilities and officials in the environment ministry. It overcame strong opposition from the Federation of German Industry and most large utilities to help pass the 2000 law and the 2004 amendments to it (Jacobsson and Lauber 2006, 267; Wüstenhagen and Bilharz 2006, 1688).

*The U.S. begins to catch up*

The next turning point occurred around 2003, when new wind installations grew rapidly in the U.S. and began to slow slightly in Germany (see Figure 1 above). The slowdown in Germany may be due in part to gradually declining feed-in tariffs for new onshore wind turbines after 2001 (Lauber and Mez 2006, 111) and the declining availability of suitable new onshore sites. The growth in the U.S., which began in 1999 and accelerated in 2005, was caused by a convergence of factors in the problem and politics streams which opened policy windows in a large number of states.

First, fossil-fuel price increases made the problem of finding an alternative to fossil fuels more acute, and wind power appeared to be an increasingly viable solution. In particular, natural-gas prices at the wellhead rose sharply beginning in 2000, rising from about \$2 per thousand cubic feet in the 1986-99 period to a peak of \$6-8 in the 2005-08 period, before falling to about \$4 in the next three years (USEIA data). Hence the operating costs of fossil-fuel electricity plants rose from about 2.0 cents/KWh in 1998 to 3.6 cents in 2008 (data from USEIA 2010c, Table 8.2). At the same time, the cost of wind-power generation fell continuously, by about 1.1 cents/KWh from 1998 to 2006 (Wiser and Bolinger 2008, 23-25).

Given its subsidies, wind power became commercially competitive with natural-gas fired electricity generation in the U.S. around 2000, when the price of natural gas passed \$3.50/thousand cubic feet (Bird, et al. 2003, 5). Since 2003, wind power has on average sold for about 4 cents/KWh, which is cheaper than gas-fired generation but still more expensive than coal-fired generation (Wiser and Bolinger 2008, 18-19).

However, economic drivers by themselves were not enough to produce a surge in wind power, because competitiveness also depends on state and federal subsidies. The approximately 4 cents/KWh charged by wind-power producers is supplemented by a 2 cent subsidy from the federal production credit, RPS subsidies that range from 0.5 to 5 cents/KWh, and up to 1.5 cents from retail customers through green-power purchasing agreements (Stern and Wobus 2008, 16, 20; Bird, Kreycik, and Friedman 2008, 10). Subsidies and a high natural-gas price are both necessary for wind power to be competitive.

Since national subsidies have not grown in inflation-adjusted terms since 1992, the surge in supportive-state level policies was crucial. The most effective state policies have been renewable portfolio standards and programs promoting green-power choice (Menz and Vachon 2006), which began in the late 1990s. By 2008, RPSs had been adopted in 28 states, over half of all electricity customers had an option to buy "green power," and 2% did so (Sovacool 2008, 158; Bird, Kreycik, and Friedman 2008, 1). Although already in 1978 the PURPA law had included a feed-in tariff, RPSs have remained the most important instrument for states in the last three decades. Despite the success of feed-in-tariffs in Germany, Denmark, and Spain, this policy instrument has largely failed to diffuse to the United States, where it is limited to a few recent local and state experiments (Rickerson, Bennhold, and Bradbury 2008; Gipe 2009).

Why did some states move strongly in favor of wind and other renewable energy? The answer does not lie in partisanship; the legislatures of states with RPSs were roughly divided between Democratic and Republican control, and 16 of the first 22 states with RPSs had Republican governors, even though Democrats are stronger advocates for renewable energy on the national level (Rabe 2006, 6). However, one structural factor does facilitate state action in the U.S. Historically, state governments have regulated energy and areas related to it, such as economic development, land-use planning, and disaster planning. Hence, in the 1990s many states already possessed strong administrative capacity to regulate energy production, and their citizens accepted and even expected state action in this area. This constellation reduced the power of energy lobbies at the state level (Byrne, et al. 2007, 4567). While this may have been a necessary condition, it was not sufficient, as shown by the lack of action by all but a few states before the late 1990s.

At that time, a conjunction of changes in the problem and politics streams created policy windows for policy entrepreneurs in many states (Rabe 2004). First, the delayed effects of the 1992 Energy Policy Act created problems and opportunities for state-level energy policy. Spurred by the planning reviews required by the federal act, states began to open their electricity markets beginning in 1996, by promoting new kinds of power producers and retail choice for customers. The reforms also led to a lull in the construction of new power plants, which resulted in a need for new capacity by the late 1990s. Second, natural-gas prices increased sharply and became volatile beginning in June 2000, which prompted state-level concerns about energy security and diversification (Martinot, Wisser, and Hamrin 2005, 5, 19).

At the same time, two political changes occurred that also favored renewable-energy

advocates. First, the UNFCCC process and the adoption of the Kyoto Protocol in December 1997 spurred some states to develop climate policies, notwithstanding the federal inaction signaled by the U.S. Senate's symbolic 95-0 vote in July that year rejecting the protocol (Rabe 2004). Moreover, policy entrepreneurs saw an opportunity to link climate policy with other important state goals, i.e., economic development, the creation of in-state manufacturing jobs, increased energy security, and compliance with the Clean Air Act (Byrne, et al. 2007, 4567; Rabe 2006, 6-7; Peterson and Rose 2006). Second, renewable energy also became very popular with the public. Ninety percent supported alternative and renewable energy development in a 2001 survey, and in 2006, 77% said it should be the top priority for energy policy in the U.S. (Byrne, et al. 2007, 4566).

How states responded to these pressures and opportunities depended on their particular circumstances and processes. Texas is a key example, since, if it were an independent country, it would be the world's seventh largest greenhouse-gas emitter. It would also rank sixth in absolute wind-power capacity, with 10377 MW in 2011, which was 22% of the U.S. total (AWEA 2012, 2, 5). Its share of wind-generated electricity was 6.9% that year, about the same as Germany's. The growth of wind power in Texas has been largely the result of an aggressive RPS adopted in 1999, while George W. Bush was governor. The RPS initially required for-profit electricity retailers to install 2000 MW in new renewable capacity within ten years; it was amended in 2005 to require a total of 5880 MW by 2015. A strength in the law is the fact that non-compliance triggers automatic penalties (Rabe 2004, 50-1; 2006, 10-12; Schmalensee 2009, 26).

This remarkable Texas policy was adopted because of a convergence of problem and

political processes in the state. State officials undertook a restructuring of the electricity market, aiming to deregulate markets and diversify electricity supplies, partly because Texas is in an isolated position in the U.S. electricity grid and the energy-inefficient, oil- and gas-producing state actually had become a net importer of energy in 1992. The RPS was a small component of this reform, written on only one of the bill's 61 pages, and neither the bill nor its supporters mentioned the contentious issue of climate change. It probably would not have been adopted were it not for a previous, unusual use of "deliberative polling" that brought customers, utility representatives, and regulators into discussions in the 1996-98 period. The polling showed that customers wanted renewable-sourced electricity and were willing to pay a dollar a month for it. Surprised by these results, officials started a pilot project that cost consumer 25 cents a month, and this project helped build political support for the 1999 RPS (Bird, et al. 2003, 8-9; Rabe 2004, 56-59).

### **Summary and Conclusions**

This comparative analysis has three main theoretical implications. First, structural theories of environmental outcomes have serious limitations in explaining renewable-energy development. They cannot account for change over time within a country case, such as the boom (1980-85), bust (1985-98), and boom (2003-present) in the U.S., and hence cannot explain the changing relative positions of Germany and the U.S. In addition, the growing governmental support for wind power in both countries, which helps make them both increasingly "environmental states" (cf. Duit's concluding chapter in this volume), cannot be explained by reference to structural differences.

Second, a combination of structural and multiple-streams theories is most effective in explaining environmental performance. Although structures matter, their effects are not stable over time. Rather, which structures matter and when they do depend on processes that drive the opening of policy windows and hence the turning points between periods. Those processes consist of convergent developments in problems and in politics, which are contingent on external events and accidents of timing and hence cannot be readily derived from any set of structural features. If structures and processes are used together as competing explanations or rival hypotheses, the resulting analysis can help clarify how much scope actors have, and under what conditions.

The interplay of structural factors and stream convergence can be seen in three periods in this comparison. During the period of U.S. leadership (1980-92), the institutional autonomy of state-level actors in U.S.-style federalism mattered greatly, as did other structural advantages that California enjoyed, such as strong wind resources in an area with low-intensity land use and an innovative investment climate. But those structural factors mattered only because Jimmy Carter and Jerry Brown were elected in the mid-1970s (both quite narrowly) and their administrations then were committed to the aggressive promotion of renewable energy in response to the oil crisis.

Next, in Germany's period of expanding leadership (1992-2003), its proportional-representation electoral system and cooperative business-government relations were crucial underlying causes. Without them, the Greens would not have become national-level actors capable of sparking and later extending the Feed-In Law, and the Kohl government's (1982-1998) neoliberal intentions might have been extended to environmental deregulation, as

occurred with the Reagan administration in the U.S. (cf. Weidner 2002). But those institutional features came into play and helped produce the Feed-In Law only because politics and problem streams converged in the mid- and late 1980s. These included the growth of a strong (West) German environmental movement, the establishment of the Greens, their cooperation with conservatives, and the Chernobyl accident and other external events that coincided in the 1985-86 period.

Moreover, political processes helped change the structures that shaped renewable-energy policy, in two key ways. The combination of the proportional electoral system and the environmental movement, not either factor by itself, led to a structural change in the West German party system with the addition of the Greens in 1983 (cf. Kitschelt 1986). Also, the environmental movement of the 1970s and '80s ultimately helped to reshape the neocorporatist system regarding environmental policy, as new economic interest groups and environmental organizations became political players (Jänicke 1997) and the protest demonstration became an acceptable method of participation.

The decline of new wind installations in the U.S. after 1987 also was shaped by a combination of structures and processes. The decline revealed certain structural weaknesses of the U.S. for renewable-energy policy: the winner-take-all electoral system (hence no party strongly promoted renewable energy) and the adversarial relationship between business and government on environmental policy (hence a strong business backlash against environmental regulations in the late 1970s) (Kraft 2002, 36-37; Prasad 2006, 181-84). But wind power might have continued to grow rapidly in the 1980s and '90s were it not a convergence of developments in the problem and politics streams that were unfavorable to renewable energy:

the economic recession and Iranian hostage crisis that allowed Reagan to win the 1980 presidential election, the 1980s drop in oil prices, and the technical failures of many U.S.-made wind turbines in the field.

Finally, since the late 1990s, the U.S. has begun to catch up with Germany, because of a potent combination of structures and processes. Substantial state autonomy and capacities in energy policy made possible the adoption of RPSs, green-power choice programs, and other supports for renewable energy. But these would not have been adopted without a conjuncture of problem and political processes favorable to the renewable sector, especially rising and volatile natural-gas prices, declining wind-power costs, climate-change concerns raised by the Kyoto process, and the successful promotion of green consumerism by environmentalists. The supportive state policies that resulted were not simply determined by natural-gas prices, since those began to rise only in June 2000, after the trend to RPSs and green-power options was underway in many states (Price 2002, 40).

In short, while the U.S. has structural disadvantages for renewable energy, both country-cases show that there is more scope for actors to make a difference when certain aspects of problem and politics streams converge, for whatever reasons. This is most likely when external shocks focus elite and public attention on environmental problems, fossil-fuel prices rise, environmental movements build public support, and environmentally oriented parties or candidates do well at the polls. These processes do not only counteract structural forces; they shift the political terrain in ways that makes certain structures more or less relevant.

The third implication of these case comparisons is that multiple-streams theory needs to

be developed in certain ways. The relation of the different streams to each other requires more theoretical attention (cf. Zahariadis 2007, 81-82). Problem and politics streams are often independent, in which case their convergence to produce policy windows is largely coincidental. But sometimes the two streams are both driven by outside forces, are manipulated by actors, or influence each other through positive feedback. The cases examined here illustrate some of these possibilities. The periods of strong U.S. growth were largely due to coincidental processes, although international developments (the 1970s oil crisis, the Kyoto protocol) affected politics as well as problem perception to some extent. By contrast, in Germany, a coincidence of domestic political factors and internationally-driven problem factors in the mid- and late 1980s triggered two decades of positive feedback that produced strong, consistent policies for renewable energy. The positive feedback involved the broadening and mobilization of an advocacy coalition, the strengthening of renewable-energy policies and targets, the development of administrative institutions, and perceptions of growing technical and economic feasibility (Weidner and Eberlein 2009; Laird and Stefes 2009; Jacobsson and Lauber 2006). The weakness of positive feedback so far in the U.S. has made the progress on renewable-energy there more fragile.

## Acknowledgements

I would like to thank Katerina Eckerberg, Andreas Duit, Christine Ingebritsen, Detlef Jahn, Krister Andersson, and the other participants at the Workshop on the Politics of Ecology in Stockholm, Sweden, 28-29 June 2010, as well as the anonymous reviewers for MIT Press, for their comments and suggestions on earlier versions of this chapter.

## References

AGEB [Arbeitsgemeinschaft Energiebilanzen], Energieverbrauch in Deutschland, 2009. Berlin: idem., March 2010.

AWEA [American Wind Energy Association], Year End 2009 Market Report, January 2010.

AWEA [American Wind Energy Association], U.S. Wind Industry Fourth Quarter 2011 Market Report, January 2012.

Bang, Guri, Sources of Influence in Climate Change Policymaking. Dr. Polit. thesis submitted to the Department of Political Science, University of Oslo, June 2003.

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

Bechberger, Mischa, "Das Erneuerbare-Energien-Gesetz (EEG)," FFU-report 00-06, Environmental Policy Research Centre, Free University of Berlin, 2000.

Bechberger, Mischa and Danyel Reiche, "Renewable Energy Policy in Germany," Energy for Sustainable Development 8 (2004), 47-57.

Beuermann, Christiane, "Germany," in William Lafferty and James Meadowcroft, Implementing Sustainable Development. New York: Oxford University Press, 2000, 85-111.

Bird, Lori, Claire Kreycik, and Barry Friedman, Green Power Marketing in the United States (11th edition), National Renewable Energy Laboratory Technical Report, October 2008.

Bird, Lori, et al., Policies and Market Factors Driving Wind Power Development in the United States, National Renewable Energy Laboratory Technical Report, July 2003.

Bird, Lori, et al., "Policies and Market Factors Driving Wind Power Development in the United States," Energy Policy 33 (2005), 1397-1407.

BMU [Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit], Erneuerbare Energien in Zahlen. Berlin: idem., June 2009.

BMU [Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit], Entwicklung der erneuerbaren Energien in Deutschland im Jahr 2011. Berlin: idem., March 2012.

Bohn, Christiane and Lant, Christopher, "Welcoming the Wind?" The Professional Geographer 61 (2009), 87-100.

Breukers, Sylvia, Changing Institutional Landscapes for Wind Power. Amsterdam: Amsterdam University Press, 2006.

Byrne, John, et al., "American Policy Conflict in the Greenhouse," Energy Policy 35 (2007), 4555-73.

Collier, Ruth and David Collier, Shaping the Political Arena. Princeton, N.J.: Princeton University Press, 1991.

Cox, Alan, Carl Blumstein, and Richard Gilbert, "Wind Power in California," in Gilbert, Regulatory Choices. Berkeley, Calif.: University of California Press, 1991, 347-74.

Crepaz, Markus, "Explaining National Variations of Air Pollution Levels," Environmental Politics 4 (1995), 391-414.

Der Spiegel, "Die Klima-Katastrophe - Ozon-Loch, Pol-Schmelze, Treibhaus-Effekt: Forscher warnen," Der Spiegel 1986/33, 11 August 1986.

Der Spiegel, "Deutschland erzeugt nur ein viertel der Energie selbst," Der Spiegel (10 January 2007), accessed online at <http://www.spiegel.de/wirtschaft/0,1518,458934,00.html>, 7 May 2012.

Dismukes, John, et al., "Wind Energy Electrical Power Generation," PICMET Proceedings, Portland, Oregon, 5-9 August 2007.

Eikeland, Per Ove, "US Energy Policy in the Greenhouse," EED Report 1993/1, Fridtjof Nansen Institute, Lysaker, Norway.

Gan, Lin, et al., "Green Electricity Market Development," Center for International Climate and Environmental Research, Oslo, Norway, June 2005.

Gan, Lin, et al., "Green Electricity Market Development," Energy Policy 35 (2007), 144-55.

Gipe, Paul, "Wind Energy Comes of Age," Energy Policy 19 (1991), 756-67.

Gipe, Paul, Wind Energy Comes of Age. New York: John Wiley, 1995.

Gipe, Paul, "Vermont feed-in tariffs become law," Grist.org, 29 May 2009, accessed 7 May 2012 at <http://grist.org/politics/2009-05-29-vermont-feed-in-tariffs>.

Greene, D.L., et al., "The Importance of Advancing Technology to America's Energy Goals," Energy Policy 38 (2010), 3886-90.

Harris, Frank and Peter Navarro, "Policy Options for Promoting Wind Energy Development in California," Graduate School of Management, University of California at Irvine, November 1999.

Heymann, Matthias, "Signs of Hubris," Technology and Culture 39 (1998), 641-70.

Huang, Ming-Yuan, et al., "Is the Choice of Renewable Portfolio Standards Random?" Energy Policy 35 (2007), 5571-75.

IEA [International Energy Agency], IEA Wind Energy Annual Report 2008. n.p.: idem., July 2009.

IEA [International Energy Agency], IEA Wind Energy Annual Report 2010. n.p.: idem., July 2011.

IPCC [Intergovernmental Panel on Climate Change], Renewable Energy Sources and Climate Change Mitigation. New York: Cambridge University Press, 2012.

Jacobsson, Staffan and Volkmar Lauber, "The Politics and Policy of Energy System Transformation," Energy Policy 34 (2006), 256-76.

Jahn, Detlef, "Environmental Performance and Policy Regimes," Policy Sciences 31 (1998), 107-31.

Jänicke, Martin, "The Political System's Capacity for Environmental Policy," in idem. and Helmut Weidner, eds., National Environmental Policies. New York: Springer, 1997, 1-24.

Jänicke, Martin, "Trend Setters in Environmental Policy," European Environment 15 (2005), 129-42.

Jänicke, Martin, Harald Mönch and Manfred Binder, "Umweltindikatorenprofile im Industrieländervergleich," in Jänicke, ed., Umweltpolitik der Industrielaender. Berlin: edition sigma, 1996, 113-31.

Jost, Gesine and Klaus Jacob, "The Climate Change Policy Network in Germany," European Environment 14 (2004), 1-15.

Karapın, Roger, "Explaining Success and Failure in Climate Policies: Developing Theory through German Case Studies," Comparative Politics 45 (October 2012), forthcoming.

Keller, Sarina, "Sources of Difference," Energy Policy 38 (2010), 4741-42.

Kingdon, John, Agendas, Alternatives, and Public Policies, second ed. New York: Longman, 2003.

Kitschelt, Herbert, "Political Opportunity Structures and Political Protest," British Journal of Political Science 16 (1986), 57-85.

Koopmans, Ruud, Democracy from Below. Boulder, Colo.: Westview Press, 1995.

Kords, Udo, "Tätigkeit und Handlungsempfehlungen der beiden Klima-Enquete-Kommissionen des Deutschen Bundestages (1987-1994)," in Hans Günther Brauch, ed., Klimapolitik. Berlin: Springer, 1996, 203-14.

Kraft, Michael, "Environmental Policy and Politics in the United States," in Uday Desai, ed., Environmental Politics and Policy in Industrialized Countries. Cambridge, Mass.: MIT Press, 2002, 29-70.

Kraft, Michael and Regina Axelrod, "Political Constraints on Development of Alternative Energy Sources," Policy Studies Journal 13 (1984), 319-30.

Kraft, Michael, Environmental Policy and Politics, third ed. New York: Pearson/Longman, 2004.

Laird, Frank, Solar Energy, Technology Policy, and Institutional Values. New York: Cambridge University Press, 2001.

Laird, Frank and Christoph Stefes, "The Diverging Paths of German and United States Policies for Renewable Energy," Energy Policy 37 (2009), 2619-29.

Lauber, Volkmar and Lutz Mez, "Renewable Electricity Policy in Germany, 1974 to 2005," Bulletin of Science, Technology and Society 26 (2006) 105-20.

Martinot, Eric, Ryan Wiser, and Jan Hamrin, "Renewable Energy Policies and Markets in the United States," Center for Resource Solutions, San Francisco, n.d. [2005]. accessed at [www.martinot.info](http://www.martinot.info), 31 May 2010.

Menz, Fredric and Stephan Vachon, "The Effectiveness of Different Policy Regimes for Promoting Wind Power," Energy Policy 34 (2006), 1786-96.

Mez, Lutz, "Renewables in Electricity Generation," in Burkhard Eberlein and Bruce Doern, eds., Governing the Energy Challenge. Toronto: University of Toronto Press, 2009, 373-95.

Michaelowa, Axel, "The German Wind Energy Lobby," European Environment 15 (2005), 192-99.

Nemet, Gregory and Daniel Kammen, "U.S. Energy Research and Development," Energy Policy 35 (2007), 746-55.

Neumayer, Eric, "Are Left-wing Party Strength and Corporatism Good for the Environment?" Ecological Economics 45 (2003), 203-20.

NREL [National Renewable Energy Laboratory], "Estimates of Windy Land Area and Wind Energy Potential by State," February 4, 2010; downloaded from [www.windpoweringamerica.gov](http://www.windpoweringamerica.gov), 31 May 2010.

Papadakis, Elim, "Green Issues and Other Parties," in Eva Kolinsky, ed., The Greens in West Germany. New York: Berg, 1989, 61-86.

Paterson, Mathew, Global Warming and Global Politics. New York: Routledge, 1996.

Peplow, Mark, "Counting the Dead," Nature 440 (2006), 982-83.

Peterson, Thomas and Adam Rose, "Reducing Conflicts between Climate Policy and Energy Policy in the US," Energy Policy 34 (2006), 619-31.

Pilat, Dirk, "The Changing Nature of Manufacturing in OECD Economies," STI Working Paper 2006/9, OECD Directorate for Science, Technology and Industry, 27 October 2006.

Portman, Michelle, et al., "Offshore Wind Energy Development in the Exclusive Economic Zone," Energy Policy 37 (2009), 3596-607.

Prasad, Monica, The Politics of Free Markets. Chicago: University of Chicago Press, 2006.

Price, Jeff, "The Production Tax Credit," Public Utilities Fortnightly, 15 May 2002, 38-41.

Rabe, Barry, "Race to the Top," prepared for the Pew Center on Global Climate Change, June 2006.

Rabe, Barry, Statehouse and Greenhouse. Washington, D.C.: Brookings Institution Press, 2004.

Reiche, Danyel, Rahmenbedingungen für erneuerbare Energien in Deutschland. New York: Peter Lang, 2004.

Reiche, Danyel and Mischa Bechberger, "Policy Differences in the Promotion of Renewable Energies in the EU Member States," Energy Policy 32 (2004), 843-49.

Rickerson, Wilson, Florian Bennhold, and James Bradbury, Feed-in Tariffs and Renewable Energy in the USA: A Policy Update. Washington, D.C.: Heinrich Böll Foundation, May 2008.

Righter, Robert, Wind Energy in America. Norman, Okla.: University of Oklahoma Press, 1996.

Sabatier, Paul, "An Advocacy Coalition Framework of Policy Change and the Role of Policy-Oriented Learning therein," Policy Sciences 21 (1988), 129-68.

Sabatier, Paul, "Fostering the Development of Policy Theory," in idem., ed., Theories of the Policy Process, 2nd ed. Boulder, Colo.: Westview Press, 2007, 321-36.

Sabatier, Paul and Christopher Weible, "The Advocacy Coalition Framework," in Sabatier, ed., Theories of the Policy Process, 2nd ed. Boulder, Colo.: Westview Press, 2007, 189-220.

Schmalensee, Richard, "Renewable Electricity Generation in the United States," Center for Energy and Environmental Policy Research, MIT, November 2009.

Schreurs, Miranda, "Domestic Institutions and International Environmental Agendas in Japan and Germany," in Schreurs and Elizabeth Economy, eds., The Internationalization of Environmental Protection. New York: Cambridge University Press, 1997, 134-61.

Scruggs, Lyle, Sustaining Abundance. New York: Cambridge University Press, 2003.

Snyder, Brian and Mark Kaiser, "A Comparison of Offshore Wind Power Development in Europe and the US," Applied Energy 86 (2009), 1845-56

Sovacool, Benjamin, The Dirty Energy Dilemma. Westport, Conn.: Praeger, 2008.

Sovacool, Benjamin, "Exploring and Contextualizing Public Opposition to Renewable Electricity in the United States," Sustainability 1 (2009), 702-21.

Stefes, Christoph, "Bypassing Germany's Reformstau," German Politics 19 (2010), 148-63.

Stenzel, Till and Alexander Frenzel, "Regulating Technological Change," Energy Policy 36 (2008), 2645-57.

Stern, Frank and Nicole Wobus, "Renewable Energy Credit Prices," prepared for the New York State Energy Research and Development Authority by Summit Blue Consulting, 14 November 2008.

Swisher, Randall and Kevin Porter, "Renewable Policy Lessons from the US," in Karl Mallon, Renewable Energy Policy and Politics. Sterling, Va.: Earthscan, 2006, 185-98.

Szarka, Joseph, Wind Power in Europe. New York: Palgrave, 2007.

Toke, David, Sylvia Breukers, and Maarten Wolsink, "Wind Power Deployment Outcomes," Renewable and Sustainable Energy Reviews 12 (2008) 1129-47.

USEIA [U.S. Energy Information Administration], Short-Term Energy Outlook, February 1996.

USEIA [U.S. Energy Information Administration], Annual Energy Review 2008 (June 2009).

USEIA [U.S. Energy Information Administration], Electric Power Monthly, March 2010a.

USEIA [U.S. Energy Information Administration], Electric Power Annual, January 2010c.

USEIA [U.S. Energy Information Administration], Electric Power Monthly, March 2012.

van Est, Rinie, Winds of Change. Utrecht, Netherlands: International Books, 1999.

Vasi, Ion, "Social Movements and Industry Development," Mobilization 14 (2009), 315-36.

Walz, Rainer, "The Role of Regulation for Sustainable Infrastructure Innovations," International Journal of Public Policy 2 (2007), 57-88.

Watanabe, Rie, A Comparative Analysis on Climate Policy Change Processes Between Germany and Japan. Ph.D. dissertation, Free University of Berlin, 2009.

Watanabe, Rie and Lutz Mez, "The Development of Climate Change Policy in Germany," International Review for Environmental Strategies 5 (2004), 109-26.

Weidner, Helmut, "Environmental Policy and Politics in Germany," in Uday Desai, ed., Environmental Politics and Policy in Industrialized Countries. MIT Press, 2002, 149-202.

Weidner, Helmut and Burkard Eberlein, "Still Walking the Talk? German Climate Change Policy and Performance," in Eberlein and Bruce Doern, eds., Governing the Energy Challenge. Toronto: University of Toronto Press, 2009, 314-43.

Willey, Joseph, "Institutional Arrangements and the Success of New Parties in Old Democracies," Political Studies 66 (1998), 651-68.

Wiser, Ryan, "Wind Power and the Production Tax Credit," testimony prepared for a Hearing on "Clean Energy: From the Margins to the Mainstream," U.S. Senate Finance Committee, 29 March 2007.

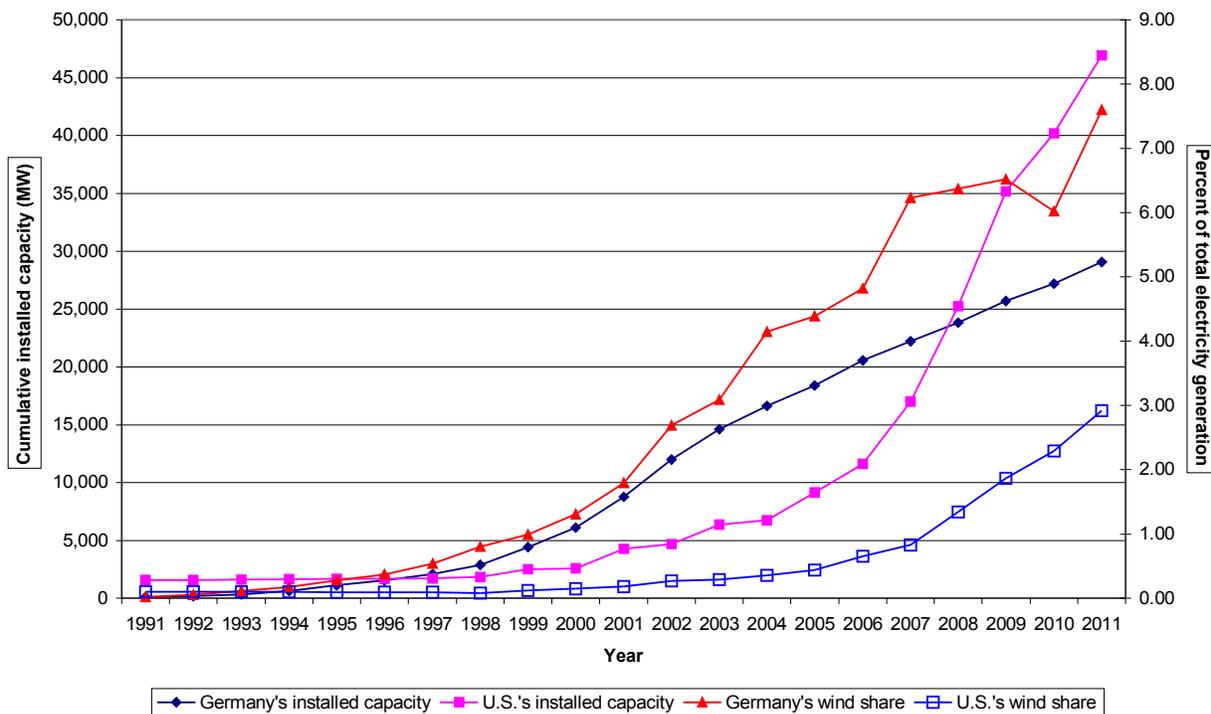
Wiser, Ryan and Mark Bolinger, Annual Report on U.S. Wind Power Installation, Cost, and Performance Trends, 2007. Washington, D.C.: U.S. Department of Energy, May 2008.

World Wind Energy Association [WWEA], World Wind Energy Report 2010. Bonn, Germany: WWEA, April 2011.

Wüstenhagen, Rolf and Michael Bilharz, "Green Energy Market Development in Germany," Energy Policy 34 (2006), 1681-96.

Zahariadis, Nikolaos, "The Multiple Streams Framework," in Paul Sabatier, ed., Theories of the Policy Process, 2nd ed. Boulder, Colo.: Westview Press, 2007, 65-92.

**Figure 1: Growth of Cumulative Installed Wind Power Capacity and Wind Shares of Electricity Generation in Germany and the U.S., 1991-2011**



**Figure 2: Ratio of Germany's to the U.S.'s Wind Share of Electricity Generation, 1981-2011**